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PREVENTION OF THROMBUS FORMATION AFTER ENDOPROSTHESIS IN AMBULATORY PRACTICE OF ORTHOPEDIC TRAUMATOLOGISTS

PREVENCIJA STVARANJA TROMBA NAKON ENDOPROTETIČKIH ZAHVATA U AMBULANTNIM USLOVIMA ORTOPEDSKE TRAUMATOLOGIJE

Sergey FIRSOV ANATOLYEVICH

Summary

Introduction. For the first time in the Russian clinical practice, an analysis of safety and efficacy of oral anticoagulants available in the pharmaceutical market, was performed in patients after endoprosthesis of large joints, in the outpatient stage. **Material and Methods.** The study included 5.025 patients after total knee joint replacement, and 5.216 patients – after hip joint surgery. **Results.** All patients were divided into three groups based on the prescribed anticoagulant (dabigatran, rivaroxaban and apixaban). The duration of anticoagulant therapy after endoprosthesis of the hip and knee joints lasted 35 and 45 days from the time of surgery, respectively. All patients underwent ultrasound examination of the lower extremity veins 3 and 6 months after being discharged from the hospital. In the group of the patients taking dabigatran, the incidence of clinically significant deep vein thrombosis was lower than among the patients receiving rivaroxaban and apixaban, accounting for 5% versus 7.7% and 16%, respectively. The incidence of non-fatal pulmonary thromboembolism was comparable. The occurrence of rethrombosis (recurrent deep vein thrombosis) was noted only in the rivaroxaban group. **Conclusion.** An assumption was put forward that extended treatment for prevention of thrombus formation after surgery of large vessels is expedient, but it requires conduct of large scale studies.

Key words: Venous Thrombosis; Pulmonary Embolism; Anticoagulants; Joint Prosthesis; Postoperative Complications; Primary Prevention; Ultrasnography, Doppler

Sažetak

Uvod. Prvi put u ruskoj kliničkoj praksi urađena je analiza bezbednosti i efikasnosti oralnih antikoagulantnih lekova, dostupnih na farmaceutskom tržištu, kod pacijenata nakon endoprotetike velikih zglobova, u ambulantnoj fazi lečenja. **Materijal i metode.** Studija je obuhvatila 5 025 pacijenata posle totalne zamene zgloba kolena i 5 216 pacijenata posle operacije zgloba kuka. **Rezultati.** Svi pacijenti su bili podeljeni u tri grupe na osnovu propisanih antikoagulantnih lekova (dabigatran, rivaroksaban i apiksaban). Antikoagulantna terapija nakon ugradnje endoproteze kuka i kolena trajala je 35 i 45 dana posle operacije, respektivno. Kod svih pacijenata obavljen je ultrazvučni pregled vena donjih ekstremiteta, tri i šest meseci nakon otpuštanja iz bolnice. U grupi pacijenata koji su uzimali dabigatran, incidencija klinički značajne duboke venske tromboze bila je niža nego kod pacijenata koji su primali rivaroksaban i apiksaban (5% u odnosu na 7,7% i 16%, respektivno). Incidencija nefatalne plućne tromboembolije je slična. Pojava retromboze (rekurentne duboke venske tromboze) zabeležena je samo u grupi koja je primala rivaroksaban. **Zaključak.** Pretpostavka je da je produženi tretman prevencije stvaranja tromba posle operacije velikih krvnih sudova svrsishodan, ali zahteva sprovođenje studija velikih razmera.

Ključne reči: venska tromboza; plućna embolija; antikoagulansi; zglobna proteza; postoperativne komplikacije; primarna prevencija; Dopler ultrasonografija

Introduction

The problem of venous thrombosis and thromboembolism in traumatology and orthopedics, especially in outpatients who had undergone surgical interventions, is still topical. Most clinical recommendations suggest anticoagulant therapy during hospital stay, but physicians in the ambulatory care also encounter a fairly great number of complications in respect to the hemopoietic system [1–3].

Numerous studies have shown that primary prevention significantly decreases the incidence of deep vein thrombosis (DVT) and pulmonary thromboembolism (PTE) [1–5]. According to the statistical models, the number of fatal outcomes after venous thromboembolism reaches 900.000 cases a year. In the period from 1966 to 1990, 250.000 cases were reported with fatal outcome associated with venous thromboembolism per year [6].

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Abbreviations

DVT – deep vein thrombosis
PTE – pulmonary thromboembolism
TKJEP – total knee joint endoprosthesis
THJEP – total hip joint endoprosthesis
CI – confidence interval
SD – standard deviation
M – mean deviation
VTE – venous thromboembolism

Endoprosthetic replacement of the knee and hip joints is associated with high risk for the development of thrombosis and thromboembolism, and without anticoagulant therapy their incidence may reach 57% and 85%, respectively [7–10]. PTE is a severe complication, and the probability of its development accounts for 28% [11, 12]. With the use of anticoagulants, the complication rate decreases dozens of times.

At present, oral anticoagulant therapy, intended for prevention of venous thromboembolic complications, is used not only during the hospital stay, but also during the outpatient treatment period [1, 4, 5, 13]. In the North America, warfarin is frequently used for prevention of venous thrombolytic complications after extensive orthopedic operations during the outpatient period [14, 15]. There are a number of limitations for the use of this drug, including the narrow therapeutic index, regular control of therapy, and frequent dose adjustment [15, 16]. In Europe, low molecular heparins are predominantly used for thrombosis prevention. However, they require parenteral administration, that is not always convenient for patients, particularly if it is necessary to continue the therapy after being discharged from the hospital [11, 12, 17]. Novel oral anticoagulants, which do not require therapy control, may be administered in fixed doses and the use of which is not accompanied by the risk of drug interactions or interactions with foodstuffs, may evidently have practical advantages [7, 9, 12, 13, 18]. Nevertheless, it is necessary to determine their efficacy and safety in orthopedic practice, especially in prolonged use during the outpatient treatment [19–21].

It has earlier been shown that the efficacy and safety of prevention of thrombus formation does not significantly depend on the time of initiation of therapy [12, 13, 17]. Furthermore, these studies do not cover the outpatient period of treatment, especially long-term results, whereas complications do not frequently develop as soon as the patient is discharged from hospital [16].

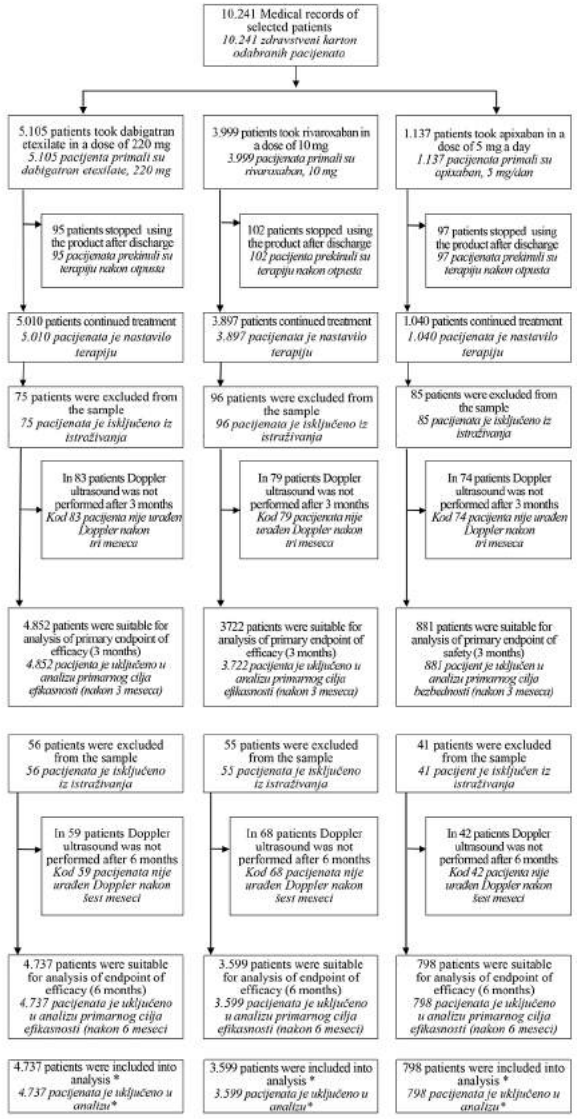
The purpose of the study was to evaluate the efficacy and safety of oral anticoagulants available in the Russian pharmaceutical market in outpatients who underwent endoprosthesis of the hip and knee joints.

Material and Methods

The retrospective analysis included medical records of outpatients who underwent total hip and knee joint replacement in the period from 2009 - 2015 at the leading Russian clinics and who received oral anticoagulants for prevention of thrombus formation. The exclusion criteria were: any hemorrhagic diathesis, acute intracranial pathology or hemorrhagic stroke in medical history, uncontrolled arterial hypertension or myocardial infarction in the previous 3 months, exacerbated peptic ulcer in the previous 6 months, severe liver disease, and severe kidney failure.

The number of patients after total knee joint endoprosthesis (TKJEP) was 5.025, and after total hip joint endoprosthesis (THJEP) – 5.216 **(Graph 1)**. The mean age of patients was 55.4 years; 95% confidence interval (CI), range 35 – 74 years.

All patients were divided into groups depending on the prescribed oral anticoagulant. Dabigatran etexila-



* – the main reasons for premature cessation of analysis were refusal of using the products, and occurrence of exclusion criteria.

Graph 1. Algorithm of patient selection
Grafikon 1. *Algoritam odabira pacijenata*

te was administered in a dose of 220 mg once a day, rivaroxaban – 10 mg once a day, apixaban (used since 2013) – 2.5 mg twice a day. The therapy lasted for 35 days, from the day of surgical intervention in patients after THJEP, and for 45 days – after TKJEP. In accordance with the clinical recommendations, the use of dabigatran was initiated 4 h after the end of surgery, rivaroxaban – after 10 h, apixaban – after 12 h.

In accordance with the requirements of local clinical practice, 3 and 6 months after discharge from the hospital all patients underwent Doppler ultrasound examination of veins of the lower extremities.

The ultrasound examination was performed using different ultrasound devices according to the generally accepted technique [22]. At the time of discharge, no patients presented with DVT. In the first 3 months after the discharge, all patients were recommended to wear compression stockings.

The efficacy of the anticoagulants was evaluated by the incidence of clinically significant DVT of the lower extremities, and safety – by the incidence of DVT recurrences.

The statistical processing of the data was performed by means of the software EpiInfo 3.4.1 and SPSS 17.0 for Windows. The quantitative data are presented as mean (M) and standard deviation (SD). The nominal data are presented as relative frequencies and their 95% CI. The differences at $p<0.05$ were regarded as statistically significant.

Results

Among the outpatients who underwent THJEP, at the control examination 3 months after the discharge, asymptomatic DVT of the lower extremities was most rarely diagnosed in the group receiving dabigatran – in 215 (8%) cases; out of these, proximal thrombosis was found in 16 (0.7%) cases, distal thrombosis in 199 cases (7.3%) **(Table 1)**. The highest number was found in the apixaban group, in 75 (18%) cases. Symptomatic DVT was also most rarely found in the dabigatran group, in 5% of patients, in the rivaroxaban group this adverse event developed in 7.7% of operated patients ($p<0.05$), and in the apixaban group, in 16% ($p<0.05$). Fatal PTE occurred only in the dabigatran group, however the difference with the other groups in regard to this parameter was not statistically significant. The incidence of nonfatal PTE in all three groups turned out to be comparable **(Table 1)**. According to the data of ultrasound investigation 6 months after surgery, asymptomatic venous thrombosis was recorded with approximately equal incidence in the dabigatran and rivaroxaban groups – 1.5 and 3.3%, respectively. However, in the rivaroxaban group, 3.11% of patients presented with rethrombosis (DVT recurrence), and it was not established in the dabigatran and apixaban groups. Asymptomatic venous thrombosis was nearly 1.5 times higher in the apixaban group, though no statistically significant difference was revealed due to the small size sample **(Table 2)**.

In patients with prevention of thrombus formation after TKJEP, a similar tendency was found 3 months later, at control examination **(Table 3)**. Thus, in the dabigatran group, asymptomatic DVT was diagnosed in 8.5% of cases, in the rivaroxaban group – in 10.8% ($p<0.05$), and in the apixaban group – in 13%. Symptomatic DVT was statistically significantly ($p<0.01$) more rarely found in the group of patients receiving dabigatran – 4.7% versus 6.0 and 10.7% in the rivaroxaban and apixaban groups, respectively. PTE, with fatal outcome, was recorded in the dabigatran group in 2 (0.09%) cases, and in the apixaban group – in 1 (0.2%) case.

Table 1. Incidence of thrombotic complications in patients who underwent THJEP, at control examination 3 months after discharge
Tabela 1*. Incidencija trombotskih komplikacija kod pacijenata nakon totalne endoproteze kuka na kontrolnom pregledu tri meseca nakon otpusta iz bolnice*

Parameter/*Parametar*	Dabigatran etexilate (*n*=2646)	Rivaroxaban (*n*=1825)	Apixaban (*n*=425)
Asymptomatic DVT *Asimptomatska DVT*	215 (8%, 95% CI 7.1–8.9)	239* (13%, 95% CI 11.9–14.1)	75 (18%, 95% CI 16.8–19.2)
Proximal/*Proksimalna*	16 (0.7%, 95% CI 0.4–1.0)	24 (2%, 95% CI 1,7–2,3)	23 (6%, 95% CI 5,3–6,7)
Only distal/*Samo distalna*	199 (7.3%, 95% CI 6.6–8.0)	215* (11%, 95% CI 10.1 – 11.9)	52 (12%, 95%CI 11.4 – 12.6)
Symptomatic DVT *Simptomatska DVT*	122 (5%, 95% CI 4.1–5.9)	141** (7.7%, 95% CI 7.1–8.3)	69 (16%, 95% CI 14.9–17.1)
Symptomatic PTE *Simptomatska PTE*	5 (0,1%, 95% CI 0,06–0,14)	2 (0,1%, 95% CI 0,07–0,13)	3 (0,7%, 95% CI 0,4–1,0)
Death/*Smrt*	1 (0.03%, 95% CI 0.01–0.05)	–	–
Severe VTE/fatal outcomes related to VTE *Teška VTE/letalni ishod uzrokovan VTE*	9/1 (0.3/0.03%, 95% CI 0.1–0.5)	12/1 (0.7/0.05%, 95% CI 0.3–0.9)	4/0 (0.9%, 95% CI 0.6–1.2)

Legend. In tables 4 – 6 significance of differences compared to dabigatran group: * –$p<0.05$, ** –$p<0.01$
Legenda. *U tabelama 4– 6 značajnost razlika u odnosu na grupu koja je dobijala dabigatran: * -p < 0,05, ** -p < 0,01*
DVT - duboka venska tromboza, PTE - plućna tromboembolija, VTE - venska tromboembolija

Table 2. Incidence of thrombotic complications in patients who underwent THJEP, at control examination 6 months after discharge
Tabela 2. *Incidencija trombotskih komplikacija kod pacijenata nakon totalne endoproteze kuka na kontrolnom pregledu šest meseci nakon otpusta iz bolnice*

Parameter/*Parametar*	Dabigatran etexilate (*n*=2596)	Rivaroxaban (*n*=1772)	Apixaban (*n*=384)
Asymptomatic DVT *Asimptomatska DVT*	38 (1.5%, 95% CI 1.2–1.8)	59 **(3.3%. 95% CI 2.8–3.8)	16 (4.2%, 95% CI 3.7–4.7)
Proximal *Proksimalna*	6 (0.3%, 95% CI 0.16–0.44)	4 (0.2%. 95% CI 0.09 –0.31)	3 (0.2%. 95% CI 0.08–0.32)
Only distal *Samo distalna*	32 (1.2%, 95% CI 0.8–1.6)	55* (out of these - 32 rethromboses) (3.11%. 95% CI 2.84–3.38)	13 (4%, 95% CI 3.7–4.3)
Symptomatic DVT *Simptomatska DVT*	19 (0.7%, 95% CI 0.5–0.9)	27 (1.5%, 95% CI 1.3–1.7)	16 (4.2%, 95% CI 3.9–4.5)
Symptomatic PTE *Simptomatska PTE*	–	1 (0.05%, 95% CI 0.03–0.07)	–
Death/*Smrt*		–	–
Severe VTE/fatal outcomes related to VTE/*Teška VTE/letalni ishod uzrokovan VTE*	5/0 (0.2%, 95% CI 0.08–0.32)	7/0 (0.4%, 95% CI 0.2–0.6)	2/0 (0.5%, 95% CI 0.29–0.71)

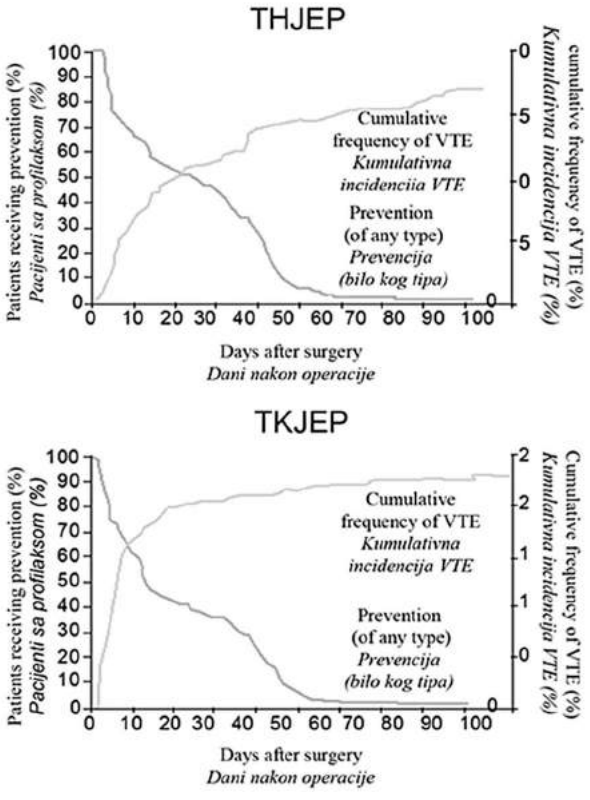
Six months after surgery, asymptomatic venous thrombosis was determined with approximately equal incidence in the dabigatran and rivaroxaban groups – 2.5 and 3.4%, respectively. However, in the rivaroxaban group, rethrombosis was also recorded (2.9% of patients), but not in other groups. In the apixaban group, asymptomatic venous thrombosis was diagnosed 2 times more frequently, though no statistically significant differences were revealed due to the small size sample **(Table 4)**. In the group of patients taking dabigatran, 1 (0.04%) fatal outcome was reported.

Discussion

At present, new oral anticoagulants need to provide high efficacy, low risk of bleeding, simple usage (oral administration, no dose adjustment, and no special monitoring), safety and convenience for use in practice, not only in hospital, but also in outpatient settings [2, 3, 5, 11, 18, 23, 24].

Dabigatran etexilate, rivaroxaban and apixaban are current oral anticoagulants which are widely used in orthopedics for prevention of thromboembolic complications in patients undergoing endoprosthesis of hip and knee joints [6, 9, 19, 20, 25, 26]. These anticoagulants are considered to be effective, convenient and safe by the manufacturers and many investigators [10, 27]. Their best characteristic is that they do not require, in contrast to warfarin, constant laboratory monitoring and dose titration. In contrast to heparin, their prolonged administration does not induce thrombocytopenia [28]. Despite already proven advantages of oral anticoagulants, clinical studies evaluating their safety and efficacy in traumatology and orthopedics are still ongoing [9]. However, studies on oral anticoagulants practically do not cover the time after discharge from the hospital, especially during the long follow-up period [16, 29].

In 2007, D. Warwick et al. presented data on the incidence of thromboembolic complications after discharge from hospital [16]. They showed that, on the average, thromboembolic complications developed 21.5 days after surgery, and their incidence



Graph 2. Total number of thromboembolic complications after surgical interventions
Grafikon 2. *Ukupan broj tromboembolijskih komplikacija nakon hirurških intervencija*

Table 3. Incidence of thrombotic complications in patients who underwent TKJEP, at control examination 3 months after discharge
Tabela 3. *Incidencija trombotskih komplikacija kod pacijenata nakon totalne endoproteze kolena na kontrolnom pregledu tri meseca nakon otpusta iz bolnice*

Parameter/*Parametar*	Dabigatran etexilate (n=2206)	Rivaroxaban (n=1897)	Apixaban (n=456)
Asymptomatic DVT *Asimptomatska DVT**	189 (8.5%, 95% CI 8.2–8.8)	205** (10.8%, 95% CI (9.9–11.7)	59 (13%, 95% CI (12.5–13.5)
Proximal/*Proksimalna*	11 (0.6%, 95% CI 0.3–0.9)	13 (1.8%, 95% CI 1.5–2.1)	9 (4%, 95% CI 3.2–4.8)
Only distal *Samo distalna*	178 (7.9%, 95% CI 7.3–8.5)	192 (9%, 95% CI 8.2–9.8)	50 (9%, 95% CI 8.5–9.5)
Symptomatic DVT *Simptomatska DVT*	104 (4.7%, 95% CI 4.2–5.2)	114* (6%. 95% CI 5.6–6.4)	49 (10.7%, 95% CI 10.3–11.1)
Symptomatic PTE *Simptomatska PTE**	2 (0.09%, 95% CI 0.06–0.12)	4 (0.2%, 95% CI 0.1–0.3)	1 (0.2%, 95% CI 0.09–0.31)
Death/*Smrt*	2 (0.09%, 95% CI 0.05–0.11)	–	1 (0.2%, 95% CI 0.08–0.32)
Severe VTE/fatal outcomes related to VTE/*Teška VTE/letalni ishod uzrokovan VTE*	8/1 (0.4/0.04%, 95% CI 0.25–0.55)	6/0 (0.3%, 95% CI 0.2–0.4)	5/1 (1.1/0.2%, 95% CI 0.1–1.9)

*DVT - *duboka venska tromboza*, PTE - *plućna tromboembolija*, VTE - venous thromboembolism/*venska tromboembolija*

reached 2.3% **(Graph 2)**. They also showed that the incidence of complications after a median time since discharge from the hospital may reach 75%.

In 2008, data of the unprecedented clinical trial "ENDORSE", which included 68.183 patients, were published [13]. This study published summarized results of prevention of thromboembolic complications in the world, including Russia. According to the presented data, in Russia, prevention was carried out only in 23.8% of cases, prevention of venous thromboembolic complications in fractures of the femoral bone was carried out in 42.9% of cases, and in extensive injuries – in 4.9%.

The fact that most patients are admitted unprepared for the previously arranged orthopedic treatment, deserves to be mentioned separately. Recently, the leading western orthopedists began giving more attention to the use of oral anticoagulants before the planned orthopedic treatment at the hospital. In 2015, M. Dietrich et al. [8] published a study including 668 patients receiving oral anticoagulants before the planned surgical intervention. It showed that such an approach greatly decreased the incidence of thromboembolic complications and mortality.

In many Russian and foreign medical institutions, even at present, prevention of thromboembolic complications is conducted by using drugs such as warfarin and aspirin. It is well known that the anticoagulation effect of warfarin significantly varies due to difference in absorption and metabolism of

Table 4. Incidence of thrombotic complications in patients who underwent TKJEP, at control examination 6 months after discharge
Tabela 4. *Incidencija trombotskih komplikacija kod pacijenata nakon totalne endoproteze kolena na kontrolnom pregledu šest meseci nakon otpusta iz bolnice*

Parameter/*Parametar*	Dabigatran etexilate (*n*=2141)	Rivaroxaban (*n*=1827)	Apixaban (*n*=414)
Asymptomatic DVT *Asimptomatska DVT*	46 (2.5%, 95% CI 2.2–2.8)	63 (3.4%. 95% CI 2.9–3.9)	28 (6.8%, 95% CI 6.2–7.4)
Proximal/*Proksimalna*	8 (0.6%, 95% CI 0.3–0.9)	10 (0.5%, 95% CI 0.2–0.8)	6 (2.8%, 95% CI 2.5–3.1)
Only distal *Samo distalna*	38 (1.9%, 95% CI 1.5–2.3)	53* (out of these – 16 ret-hromboses) (2.9%, 95% CI 2.4–3.4)	22 (4%, 95% CI 3.7–4.3)
Symptomatic DVT *Simptomatska DVT*	24 (1.1%, 95% CI 0.8–1.4)	31** (1.7%, 95% CI 1.3–2.1)	18 (4.3%, 95% CI 3.8–4.8)
Symptomatic PTE *Simptomatska PTE*	–	–	–
Death/*Smrt*	1 (0.04%, 95% CI 0.02–0.06)	–	–
Severe VTE/fatal outcomes related to VTE/*Teška VTE/ letalni ishod uzrokovan VTE*	2/0 (0.09, 95% CI 0.02–1.1)	3/0 (0.2%, 95% CI 0.18–0.22)	2/0 (0.5%, 95% CI 0.28–0.72)

DVT - *duboka venska tromboza*, PTE - *plućna tromboembolija*, VTE - venous thromboembolism/*venska tromboembolija*

the drug and its interactions with medications [15]. At the same time, in addition to its low efficacy, aspirin possesses the property of producing formation of heterotopic ossificates after endoprosthesis of the hip, that was convincingly demonstrated by R. Cohn in 2010, and G. Pavlou in 2012 [30–32].

The present study showed that the greatest efficacy in regard to the prevention of clinically significant DVT of the lower extremities in outpatient settings was demonstrated by dabigatran etexilate both after THJEP (5% versus 7.7 and 16% in the groups of rivaroxaban and apixaban, respectively, and after TKJEP (4.7% versus 6 and 10.7%, respectively). Also, patients receiving rivaroxaban presented with rethrombosis, that was not observed in the dabigatran and apixaban groups.

Conclusion

The data obtained in the present study suggest that current oral anticoagulants are efficacious and safe in prevention of thrombosis in orthopedic and trauma patients. Our 6-year experience of using these drugs and the data of international studies indicate that rivaroxaban demonstrates lower efficacy in long-term prevention of thrombosis. Dabigatran etexilate, which demonstrated the best results in long-term use in patients after hip and knee endoprosthesis, should be considered the drug with the greatest efficacy and the best safety profile.

A rather high incidence of thromboembolic complications after the use of oral anticoagulants comes under notice. In our opinion, the administration of anticoagulants should not be limited to 35 days after surgery, but continued for up to 6 months. However, this opinion requires confirmation within the framework of large scale clinical studies which should evaluate the safety and efficacy of such a long-term use of oral anticoagulants.

We believe that preoperative preparation of orthopedic patients with the use of oral anticoagulants should be a separate topic of discussion. Up to date, no significant studies on this topic have been conducted and the safety and expediency of these pharmacological preparations have not been studied.

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MEDIAL PATELLOFEMORAL LIGAMENT RECONSTRUCTION

REKONSTRUKCIJA UNUTRAŠNJE ČAŠIČNO-BUTNE VEZE

Vladimir RISTIĆ[1], Mirsad MALJANOVIĆ[1] and Vukadin MILANKOV[2]

Summary

Introduction. There is no standard surgical procedure for patellar dislocation. The purpose of this study was to present surgical techniques and evaluate the clinical efficacy of medial patellofemoral ligament reconstruction. **Material and Methods**. The surgical procedures were performed in 15 patients using gracilis or quadriceps tendon grafts. Eleven patients were female, the average age was 18 years (range, 13 – 24 years). The average follow-up period was 14 months (12 – 16 months). The patients were evaluated using preoperative and postoperative physical and radiographic examinations, including clinical tests for patellar instability and Lysholm score. **Results**. None of the patients experienced recurrent postoperative episodes of dislocation or subluxation. By the final follow-up, patellar apprehension had disappeared in all patients. Our clinical results showed a significant Lysholm score improvement (from 71.0 ± 10 preoperatively to 95.5 ± 4.5 postoperatively, $p < 0.0001$). **Conclusion.** Medial patellofemoral ligament reconstruction techniques provide acceptable short-term results in the treatment of recurrent patellar dislocation.

Key words: Patellofemoral Joint; Patellar Dislocation; Tendons; Lysholm Knee Score; Reconstructive Surgical Procedures; Treatment Outcome

Sažetak

Uvod. Ne postoji standardna hirurška procedura u lečenju iščašenja čašice, pa je cilj ove studije da prikaže operativne tehnike i kliničku efikasnost rekonstrukcija unutrašnje čašično-butne veze. **Materijal i metode**. Izvršili smo navedene rekonstrukcije uz pomoć kalema tetiva vitkog i četvoroglavog mišića buta kod 15 pacijenata. Jedanaest od njih bili su ženskog pola. Prosečna starost iznosila je 18 godina (13–24). Pacijente smo pratili prosečno 14 meseci (12–16) preoperativnom i postoperativnom kliničkom i radiografskom dijagnostikom, koje je uključivalo kliničke testove za nestabilnost čašice i Lišolmovu bodovnu skalu. **Rezultati.** Nismo zabeležili niti jedan slučaj postoperativnog iščašenja. Na poslednjoj kontroli svim pacijentima je test straha od iščašenja bio negativan. Zabeležili smo značajno poboljšanje vrednosti Lišolmove skale aktivnosti (od preoperativnih 71 ± 10 poena do 95,5 ± 4,5 postoperativnih, $p < 0,0001$). **Zaključak.** Rekonstrukcije unutrašnje čašično-butne veze obezbeđuju zadovoljavajuće rezultate u kratkoročnom praćenju učestalih iščašenja čašice.

Ključne reči: patelofemoralni ligament; dislokacija patele; tetive; Lisholm skala; rekonstruktivne hirurške procedure; ishod lečenja

Introduction

Patellar dislocation is a complete displacement of the patella from the trochlear groove of the femur. It nearly always involves a lateral displacement and commonly occurs during sports [1, 2]. The incidence is roughly 6 per 100.000, although it is considerably higher in children and adolescents aged between 10 and 19 years with an incidence of 31 per 100.000 [1–3]. At this age, females have a 33% increased prevalence compared to males [3, 4]. Patellar instability typically occurs in patients with several anatomic risk factors, including both soft-tissue and osseous abnormalities [3–5].

Despite being a common pathology, relatively easy to diagnose, with well known risk factors, and over 100 operative techniques, patellar dislocations were mainly treated nonoperatively till the last 15 years [5–7]. Traditionally, patients were treated nonoperatively following a first-time patellar dislocation, although the rate of recurrence may be as high as 50% [1, 2, 6]. In the 21st century, a new anatomic structure, medial patellofemoral ligament (MPFL), crucial for patellofemoral stability was determined [4–6, 8]. Patellar dislocation leads to the ligament rupture, resulting in weakened medial retinaculum and redislocation. This structure is injured in almost 95% of all patellar dislocations and it happens to be a risk factor for redislocation [4–6, 8, 9].

Advances in the understanding of the biomechanical importance of the MPFL have led to an increase in repair and reconstruction of this structure. This has resulted in the development of multiple techniques for MPFL reconstruction using different types of grafts and varying rehabilitation protocols [1, 4, 5, 8, 9]. The surgical technique with the best results and least complications still needs to be determined.

Due to the fact that the above mentioned surgical techniques are performed in very few hospitals in the

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Abbreviations

MPFL – medial patellofemoral ligament
PF – patellofemoral
TT-TG – tibial tubercle-to trochlear groove distance
ACL – anterior cruciate ligament
QT – quadriceps tendon

northern province of Serbia (Vojvodina), the aim of this study was to describe different operative techniques for the MPFL reconstruction, point to their advantages and disadvantages, analyze our first short-term results, and compare them with others.

Material and Methods

The surgical procedures of MPFL reconstruction were performed in the General Hospital Subotica in 15 patients. Eleven patients (73.3%) were female, and the average age was 18 years (range, 13 - 24). The results were evaluated using preoperative and postoperative radiographic diagnostics and physical examinations, including: patellar apprehension test, lateral glide and patellar tilt test, as well as Lysholm score [10]. The average follow-up period was 14 months (12 – 16 months). The participants gave data about their postoperative symptoms and return to non-restricted activities.

Two operative techniques were used. The first used gracilis tendon as a substitute for the *MPFL* (6 patients), the other a quadriceps tendon (9 reconstructions). The surgeries were indicated in patients with recurrent patellar dislocation with: torn MPFL, minor or moderate trochlear dysplasia, and no serious cartilage damage (Outerbridge grades 3 or 4) established by X-ray, magentic resonance imaging or previous arthroscopic findings [9, 11]. Both techniques have similar phases: arthroscopy, graft harvesting and preparation, patellar attachment, femoral attachment (tunnel), graft passage and fixation.

1. The first operative technique requires: gracilis muscle tendon, two anchors and one screw [9]. The gracilis tendon was harvested with stripper by palpating pes anserinus junction, as the size and strength has been shown to be sufficient for MPFL reconstruction (4 – 5 mm in diameter). A minimum graft length was 18 cm, whipstitched 10 mm at both ends. Afterwards, a 2 cm skin incision was performed from the superomedial corner, xtending the medial edge of the patella. Under fluoroscopic guidance, two transverse tunnels were made in the upper third of the patella. The tunnels were drilled parallel to one another, 1 cm apart. We used a 2.4 mm drill for a guide pin in a transverse fashion across the patella to a minimum depth of 25 mm. Over-drilling was performed with a 4.5 mm cannulated reamer to a depth of 25 mm. The graft was fixed to the patella by passing the tails of the graft ends through the eyelets of 4.75 mm SwiveLock™ anchors and pushed into the drill holes until the eyelet was fully seated. Then, femoral insertion was prepared, because the proper position of the femoral insertion of the MPFL is crucial to maintain proper

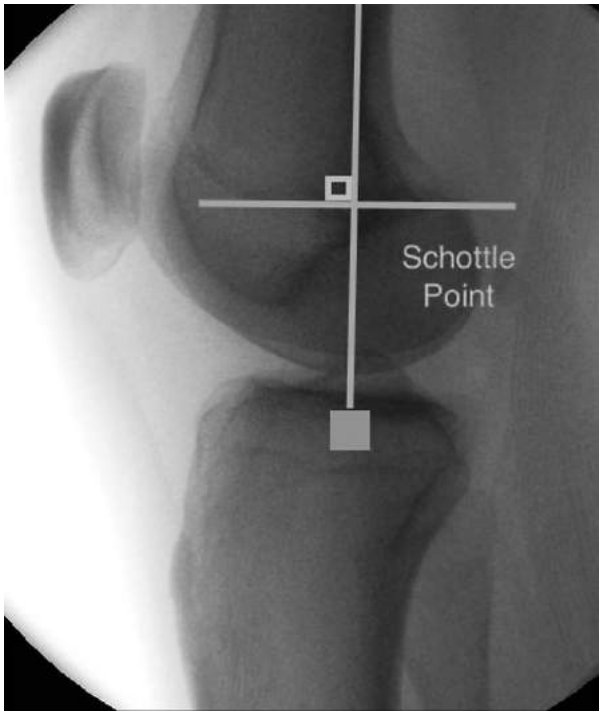

Figure 1. Femoral graft insertion (intraoperative X-ray)
Slika 1. *Rendgenska verifikacija pripoja kalema na butnoj kosti*

biomechanics of the patellofemoral (PF) joint. Profile X-rays were used for femoral insertion (**Figure 1**) [12]. The template can help to establish the position of the guide pin. The insertion point was approximately 1 mm anterior to the posterior cortex extension line, 2.5 mm distal to the posterior articular border of the medial femoral condyle, and proximal to the level of the posterior point of Blumensaat's line. A 2.4 mm guide pin was drilled and the femur was over-drilled with a 6 mm cannulated reamer. The graft was passed between the second and third layers of the medial side of a knee by identifying the space between the vastus medialis and the capsule. The graft was looped through the passing suture and the suture was pulled from the patellar origin to the insertion point at the medial femoral epicondyle. A 1.1 mm guide wire was placed into the drill hole next to the femoral guide wire to facilitate insertion of the 6 mm x 23 mm bio-interference screw. The graft was inserted into the socket with equal tension on both graft bundles (**Figure 2**). The best isometry was achieved when the graft indicated constant tension. That happens when the screw is placed into the femur and the knee is at 30˚ of flexion. The MPFL isometry may be provisionally evaluated at this time by maintaining adequate tension on the graft and cycling the knee through the range of motion. The final step is closure of the wound and positioning the brace on the knee joint in extension.

2. The second surgical technique [11] differs from the first only in harvesting a different graft,

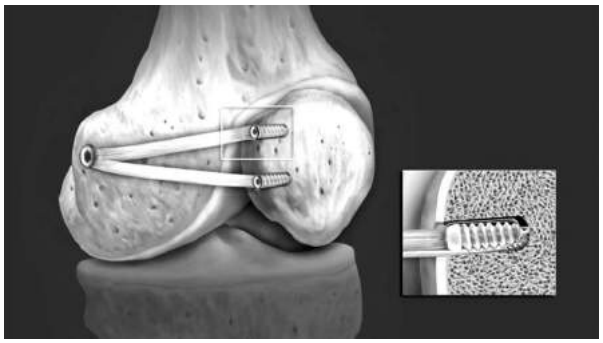

Figure 2. MPFL reconstruction with gracilis tendon
Slika 2. *Rekonstrukcija unutrašnje čašično-butne veze tetivom gracilisa*

part of a quadriceps tendon. It is technically easier and cheaper, because it requires only one screw. The incision is made over the tendon. A 10 to 12 mm wide, 3 mm thick and 8 to 10 cm long strip from the central aspect of quadriceps tendon is harvested subcutaneously. The tendon strip is then dissected distally on the patella, left attached, diverged 90° medially underneath the medial prepatellar tissue and fixed with 2 sutures. The graft is passed through a tunnel and fixed at 20° of knee flexion with a bioabsorbable interference screw (**Figure 3**). The wound is closed with a intradermal suture.

Antibiotic prophylaxis and the same rehabilitation protocol were used in both groups. Thromboprophylaxis was not used. The above techniques offer immediate, stable fixation and allow active quadriceps exercises at postoperative day one. A postoperative brace locked at 0°- 90° of flexion should be worn for a period of 4 weeks. Weight-bearing is limited to partial weight-bearing crutch ambulation until wound healing is complete and at that point it can be increased according to the pain tolerance of the patient. Full range of motion is allowed after 6 weeks with light jogging or cycling [9, 11]. The results are marked with a statistical significance level of $p < 0.0001$.

Open epiphyseal plates, high grade trochlear dysplasia, tibial tubercle–to trochlear groove *(TT-TG)* distance greater than 20 mm and serious cartilage lesions (grade 3 or 4) are limited for performing MPFL reconstruction alone [9, 11]. These

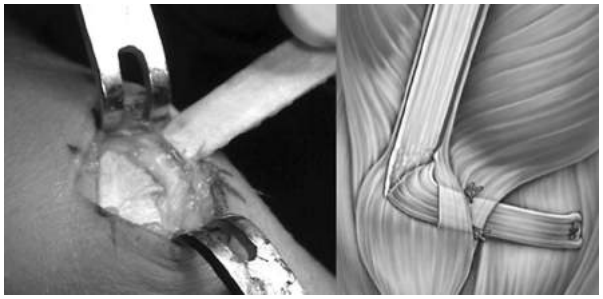

Figure 3. MPFL reconstruction with quadriceps tendon
Slika 3. *Rekonstrukcija unutrašnje čašično-butne veze tetivom kvadricepsa*

conditions were also exclusion criteria of our study. Patients who had additional procedures, like anteromedialization of the tibial tubercle and other knee operations, or did not comply with the rehabilitation protocol were also excluded from the study. The patients with habitual or first dislocations were not included in the study.

Results

In our study, the patellar dislocation was mostly caused by sport injury (6 patients; 40%). The second reason was a non serious trauma during daily activities with a little force; in our study this mechanism occurred in 5 cases (33.3%). Three patients fell from height (20%), and one injury (6.6%) was sustained in a traffic accident.

The participants reported from 3 to 20 patellar dislocations before undergoing surgery (8 on average).

No significant difference was registered between the affected side: 8 left and 7 right knees were operated.

There were no patients with limited range of motion or infection.

Postoperative X-rays showed correct position of graft tunnel(s) in all cases.

One surgical complication was registered, anchor breakage in the gracilis tendon group, without need for revision extraction. In the same group there was only one bad result due to the development of high grade PF arthrosis.

In the second group, where MPFL was substituted by quadriceps tendon, the main disadvantage was a big scar without functional loss.

Our patients did not experience recurrent postoperative episodes of dislocation or subluxation. By the final follow-up, clinical tests for patellar instability had disappeared in all patients.

A significant improvement was registered in patients' daily activities (instability, pain, swelling, weigh bearing, kneeling, squatting, climbing stairs) by Lysholm score (from 71.0 ± 10 points preoperatively to 95.5 ± 4.5 postoperatively, $p < 0.0001$).

There was no statistical difference in: range of motion, size of thigh muscles and postoperative Lysholm score between the groups (average 95.70 in quadriceps tendon and 95.25 in gracilis tendon group).

The return to unrestricted daily activities occurred in 14 of 15 patients. Only one patient did not return to competitive sport. Patients resumed full activity at 11 - 15 weeks after the surgery (after 3 months on average).

Discussion

The MPFL tear has been considered the "essential lesion" for patellar dislocations [4–6, 8, 9]. It represents a passive medial structure of a knee that prevents lateral patellar displacement during the initial degree of a knee flexion. The MPFL is most tightened at 20° - 30° of flexion and it plays an impor-

tant role in guiding the patella into the trochlear groove. Bone structures take over further stabilization [5, 6, 13]. During the MPFL rupture, medial knee stabilization is insufficient before placing the patella in the trochlear groove. PF instability follows. MPFL rupture is present in almost all repeated patellar dislocations, so it is reasonable that MPFL reconstruction is a key to PF joint stability [4–6, 8, 9].

The average length of the MPFL is 65.2 mm (from 56.8 to 77.8 mm). The width ranges between 5 – 12 mm, 8.8 mm on average [5, 6, 13]. The insertion of MPFL is 10.6 ± 2.9 mm wide in femur, near adductor tubercle, distal to insertion of adductor magnus tendon, and just below medial epicondyle. Distal fibers of MPFL are inserted to proximal two thirds of patella, and proximal fibers to vastus intermediacy tendon. The MPFL is related only to a bundle of fibers that has a junction on patella, so Tanaka et al. [14] recommended the term "medial patellofemoral complex", that would contain the fibers that are inserted to other anatomic structures, but functionally influence medial patellar stabilization. The confirmed causes of PF instability are: improper position of bone structures of lower extremity (patella alta, trochlear or patellar dysplasia, misalignment of the leg, rotational deformities of femur and tibia), as well as soft tissue disorders (atrophy of vastus medialis obliquus muscle, medial retinaculum laxity, overtightened lateral retinaculum and MPFL injury) [5, 6, 12, 14].

The first episode of patellar dislocation is common among young, physically active persons, most often in female teenage population [3, 4, 15]. Our results confirm that MPFL rupture happens most often in the second decade of life, and the incidence among females is almost three times higher than in males. After the initial injury, MPFL is ruptured resulting in patellar instability. Its femoral insertion is most often injured, but rupture can be placed also in patellar insertion or in the middle parts of ligament. The recurrent dislocation usually happens without a strong force and reduces spontaneously [3, 4, 15]. Repeated episodes of patellar dislocation result in PF pain, degenerative arthritis, and impairment of the activities of daily living. The history of many former dislocations, clinical examination and X-rays are mostly sufficient for accurate diagnosis. We used additional MRI diagnostics for: PF cartilage damage, trochlear morphology, measurement of TT-TG distance, present loose bodies and combined meniscal and ligament injuries, although MRI is today a standard method used worldwide for preoperative evaluation of knee structures [3, 4, 15].

Controversy persists as to whether first-line treatment of acute patellar dislocation should be conservative or surgical [15]. Almost a half of later injuries happen recurrently despite conservative treatment, leading to recommendation of surgical management of acute patellar dislocation, especially in patients with femoral avulsion of the MPFL [15]. On the other hand, the only prospective and randomized study to our knowledge [7] showed that surgical treatment did not show a demonstrable improvement in medium-term (7-year) outcomes over conservative treatment. No studies have demonstrated the efficacy of bracing and physical therapy in the treatment of acute patellar dislocations [4]. However, the aim of treatment is to decrease swelling, promote muscular strength, and increase the range of motion of the knee. Immobilization in extension may help the medial structures to heal, but stiffness may be a problem with this treatment [16].

Operative treatment for patellar dislocation has been published since the early 1900s, initially with an open-wedge osteotomy of the lateral femoral condyle. Over the past century, more than 100 different surgical procedures have been described in the literature [1, 2, 8, 9, 11, 12, 17–20]. These procedures typically involve a combination of lateral release, medial imbrication, distal realignment, and anteromedialization of the tibial tubercle, but the so-called gold-standard treatment for patellar instability has yet to be defined. The isolated lateral release is the only procedure that has been shown to be ineffective [21]. Comparing medial repair with nonoperative treatment of acute patellar dislocation, there is also no significant difference between the results [7]. Indications for a trochleoplasty include at least three episodes of patellar dislocation with high-graded trochlear dysplasia [17, 18]. Several types of distal realignment have been described and an indication is TT-TG distance greater than 20 mm [17, 18]. A medial transfer of the tibial tubercle (Elmslie-Trillat procedure) [19] and anteromedialization of the tibial tubercle [20] were created many decades ago.

Nowadays, MPFL reconstruction is most commonly performed in recurrent patellar dislocation [1, 8, 9, 11, 12, 15]. Although this procedure is spreading worldwide, the surgical technique with the best results and least complications needs to be determined [1]. There is still no consensus with regard to the choice of graft, its tension, or static versus dynamic reconstruction [1, 2, 11, 17, 18]. Many tendons and other structures are suitable and used for grafts, such as: gracilis, quadriceps, adductor magnus, semitendinosus, tibialis anterior, fascia lata, patellar ligament, and artificial ligaments [8, 9, 11, 12, 22–30]. Most of surgical techniques use hamstring tendons as the graft of choice [9, 12, 23–29]. We used gracilis tendon autograft in one group of patients and quadriceps tendon in the other. Steiner et al. [26] recommended the use of bone-quadriceps tendon autograft or bone-patellar tendon allograft for severely dysplastic knees in which more strength was thought to be warranted. Farr and Schepsis [27] support the use of a doubled semitendinosus allograft, not for its strength but rather to reproduce the broad attachment site on the patella.

Medial patellofemoral ligament reconstruction provides good results in terms of preventing future dislocations [9, 11, 12, 22–30]. However, not all patients with recurrent instability may benefit from this procedure. Nomura and Inoue [8] found only fair re-

sults in patients with preexisting chondromalacia patella. Thus, they recommended reconstruction only for patients without advanced changes in the patellar cartilage. We agree with this relative contraindication. Our good first results may be a consequence not only of excellent operative technique, but also careful patient selection. Our results and fist outcomes are comparable with others considering scores and complications [8, 15, 22, 28–30], because the average postoperative Lysholm score in other studies ranges between 88 and 96 points [8, 15, 22] and our patients resumed full activity 3 months after the operation that is also comparable with other published results [9, 11, 22].

The complication rate of MPFL reconstruction is very low (usually bellow 5%) [9, 11, 22, 27]. The most frequent are: reluxation, patellar fracture, improper bone tunnels and size of the graft, overtension of the graft and implant breakage [15, 23, 25, 32–40]. All of mentioned techniques use bone tunnels and anchors for graft fixation on the patella. There are few reports on MPFL reconstruction using a strip of quadriceps tendon (QT) without anchors or bone tunnels in the patella because quadriceps tendon is naturally connected to it [11, 22, 33]. We used the same technique in the second group. Despite good clinical results, the cosmetic appearance of longitudinal scar over the thigh, as well as technical difficulties of harvesting a consistently appropriate strip of QT, have prevented widespread use of this technique. Although it is relatively easy to perform and cheap, in our opinion this is the only disadvantage of this technique. To overcome some of the aforementioned limitations, a new harvesting technique for the QT has been developed, that not only allows a constant graft harvesting with respect to width and thickness, but also necessitates a smaller skin incision of 2 cm in comparison to former 10 cm [22]. Two small tunnel technique that we used in the second group allows safe placing of a single-tendon graft, thus minimizing potential complications and patellar fracture [29, 40].

Kumahashi et al. [15] reported 5% of complications that resulted in reoperation, such as removing an irritating titanium interference screw from the femoral side. Other authors used only bioabsorbable interference screws and reported 7 – 10% of cases of screw removal, due to screw protrusion or pain [23, 26]. Matthews and Schranz [25] reported even 28% of complications that needed reoperation. Five patients required a manipulation under anesthesia, because their flexion ability was less than 90° but subsequently regained a satisfactory range of motion. One patient developed a neuroma related to hamstring harvest, which was excised. Another patient underwent a washout for infection. Revisions after these procedures are mostly performed to relieve medial pain syndrome due to faulty placement of the femoral graft attachment, sometimes because improper gliding of patella in the trochlear groove, caused by the faulty position of graft and weakness of patellar stabilizers [12]. We avoided complications such as anchor penetration into the joint or pain regarding severe PF osteoarthritis or trochlear dysplasia by using intraoperative X-rays and careful patient selection.

Arnbjornsson et al. [16] evaluated patients with bilateral recurrent PF instability and compared the results of surgical treatment of one knee and conservative in the contralateral knee. At a mean of 14-year follow-up, 75% of the operated knees presented with degenerative changes compared to 29% in the conservatively managed knees [16]. Current techniques such as MPFL reconstruction, combined with less post-op immobilization and a more knowledgeable approach to postsurgical rehabilitation, could translate into surgical management with more encouraging long-term results. This is suggested by a few midterm studies. Nomura et al. [35, 36] reported (only) 12% of moderate PF osteoarthritis, 12 years after MPFL reconstruction. More discouraging is a study of Farr et al. [37] who used medialization of the tibial tubercle reporting severe cartilage lesions in 23% of patients. Those authors also reported worst radiographic results in patients treated late, suggesting that delayed surgical treatment, allowing recurrent patellar dislocation, may cause further chondral damage, as reported by other authors [37, 38]. There is no current evidence that surgical treatment of patellar instability prevents or delays early PF osteoarthritis [35–39]. Conclusions are similar to anterior cruciate ligament (ACL) reconstructions, considering prevention of cartilage damage, risk factors and outcomes [41–45]. It seems that patellar instability is very similar to instability of the knee joint. ACL is pointed as a key structure for femorotibial joint, as MPFL is in the patellofemoral joint. Risk factors, mechanisms of injury and anatomic junctions are well defined, so developed operative techniques must: achieve isometry, strength, prevent redislocations, minimize complications and improve patients' quality of life [41–46]. In our opinion, the choice of graft and implants is not crucial for final outcome. Although it is reasonable to assume that achieving stability can prevent cartilage damage, there is still no evidence that structure reconstruction affects prevention of osteoarthrosis.

The main limitations of this research are: short follow up period, small number of patients, and lack of some modern instruments that would reduce the scars. This study showed a zero redislocation rate and patient outcome scores compatible with other reported MPFL reconstructions. Patient selection remains vitally important to ensure optimal surgical outcomes.

Our study opens many questions concerning the best time for surgery and surgical technique, the ideal choice of graft and its tensioning, and whether surgical treatment of patellar instability can prevent early osteoarthrosis. Answers may be found by further investigations.

Conclusion

Recurrent patellar dislocation commonly occurs in young female athletes with risk factors. It is mostly caused by dysfunction of medial patella stabilizers, medial patellofemoral ligament in the first place, that is ruptured during the initial injury. Al-

most half of patients have recurrent dislocations after non-surgical treatment.

There is no gold standard surgical procedure for patellar dislocation, because many anatomical and functional factors affect the final surgical outcome.

Reconstruction of the medial patellofemoral ligament with gracilis and quadriceps tendons can prevent postoperative episodes of dislocation if proper surgical technique is used and in careful patient selection.

This study showed that both reconstructive techniques provide acceptable results in the treatment of recurrent patellar dislocation in short-term follow up.

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BODY COMPOSITION OF THE SERBIAN NATIONAL TRACK AND FIELD TEAM

TELESNA KOMPOZICIJA ČLANOVA ATLETSKE REPREZENTACIJE SRBIJE

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Summary

Introduction. The performance in athletics depends on various anthropometric factors as well as on the training process. The body fat percentage and running speed during the training sessions are the most important factors for running success. **Material and Methods.** The study included 61 athletes, members of the Serbian senior national track and field team. Nine morphological characteristics were measured and the sum of skinfolds, body density, body fat percentage and body mass index were calculated. **Results.** A one-way ANOVA showed a statistical significance between the height (F=2.97; p=.03), weight (F=7.00; p=.00), sum of skinfolds (F=4.30; p=.01), body density (F=4.09; p=.01), percentage of body fat (F= 4.02; p=.01), body mass index (F= 3.86; p=.01), and the athletic disciplines. The female athletes showed a statistically significant difference between height (F=3.54; p=.03), weight (F=3.70; p=.03) and body mass index (F=5.40; p=.01) related to disciplines. Of all the disciplines, the percentage of body fat was the highest in male throwers (10.10±3.61) and female sprinters (15.82±3.06). **Conclusion.** The male and female athletes of the Serbian national track and field team showed higher sums of skinfolds compared to top athletes and members of more successful national teams. However, it is possible to increase the loss of body fat and indirectly improve the athletic performance with adequate education of coaches and athletes, and application of other, more precise body composition measurement methods.

Key words: Body Composition; Athletes; Anthropometry; Body Fat Distribution; Body Mass Index; Skinfold Thickness; Sports

Sažetak

Uvod. Performanse u atletici su pod uticajem različitih antropometrijskih faktora kao i faktora u trenažnom procesu. Kao najvažniji faktor uspešnosti u trčanju, pored brzine trčanja tokom trenažnog procesa, izolovao se procenat masne mase u organizmu. **Materijal i metode.** Istraživanje je realizovano na 61 ispitaniku, članovima seniorske nacionalne atletske selekcije. Izmereno je 9 morfoloških karakteristika i izračunati su suma kožnih nabora, telesni denzitet, procenat masne mase i indeks telesne mase. **Rezultati.** *One-way ANOVA* je pokazala statističku značajnost između visine (F = 2,97; p = 0.03), mase (F = 7; p = 0.00), sume kožnih nabora (F = 4,30; p = 0.01), telesnog denziteta (F = 4,09; p = 0.01), procenta masne mase (F = 4,02; p = 0.01) kao i indeksa telesne mase (F = 3,86; p = 0.01) i disciplina kod atletičara. Kod atletičarki je utvrđena statistički značajna razlika između visine (F = 3,54; p = 0.03), mase (F = 3,70; p = 0.03), indeksa telesne mase (F = 5,40; p = 0.01) i disciplina. Od svih disciplina, procenat telesne masti je najveći kod bacača (10,10 ± 3,61) i sprinterki (15,82 ± 3,06). **Zaključak.** Kako je kod atletičara i atletičarki nacionalne selekcije, utvrđena veća suma kožnih nabora u odnosu na vrhunske atletičarke drugih, uspešnijih nacionalnih selekcija, uz odgovarajuću edukaciju trenera i atletičara, ali i korišćenjem drugih, preciznijih metoda procene kompozicije tela, moguće je povećati gubitke telesnih masti u organizmu i indirektno poboljšati učinak na terenu.

Ključne reči: telesna kompozicija; sportisti; antropometrija; distribucija masnog tkiva; indeks telesna mase; debljina kožnog nabora; sport

Introduction

The assessment of body composition gives an insight into the ratio between fat and lean mass in the human body. Fat tissue is widespread and made up of essential fat tissue (metabolically active) and fat storage tissue, which protects the organs of the abdomen and thorax. The assessment of body composition practically means the body fat percentage (BFP). The percentage of essential fat is higher in women (8 – 12% of the total body fat mass) than in men (3 – 5% of the total body fat mass) and it is considered the minimum for normal functioning of the organism, recommended by the National Academy of Sports Medicine (NASM) [1]. Any percentage of fat higher than recommended leads to health damage and development of numerous complications. Determination of the body composition or BFP is a key factor in the assessment of body health [2–5], but it is also useful in monitoring the potential effects of the training process and the health status in young athletes [6, 7]. Some anthropometric characteristics of individual athletes are believed to be an important determinant of success in sport [8]. Track and field performance depends on various factors as well as anthropometric factors in the training process [9].

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Abbreviations

BFP – body fat percentage
BF – body fat
BMI – body mass index
LSD – least significant difference

Morphological characteristics, such as skinfold thickness, BFP, limb girth and length, body weight, body height, and body mass index (BMI), have an impact on athletic performance, especially in running. The BFP has been identified as the most important factor for the running success, apart from the running speed during the training process [10].

Hetland et al. have shown that the regional and total body fat are inversely proportional to performance in runners [11], especially in the disciplines where the body leaves the ground (jumping), or it is in rapid acceleration above the ground (sprinting and hurdling), and where there are specific relations with the body height, fat tissue, lean weight components, the volume of the extremities and the lower limb girth [12].

The body fat can be determined in the following ways: by measuring the thickness of skinfolds and subcutaneous fat with calipers, since the BFP can be calculated due to the interaction between the specific gravity of the body and skinfold thickness in the specific places (above the biceps, triceps, below the blades and above the pelvis on the right side); by bioelectrical impedance analysis; electrical impedance, or opposition to the flow of an electric current through body tissues, which can then be used to estimate total body water, fat-free body mass, and body fat. Dual-energy x-ray absorptiometry is a technique using ionizing radiation through the body and recording the turn and attenuation of the received signal over the entire body or individual segments. In addition to the above, other methods can be applied, such as the method of hydrodensitometry, computed tomography of the body composition, quantitative magnetic resonance imaging and near infrared interactance [13, 14].

The measurement of anthropometric parameters and skinfold thickness is the simplest method; it does not require expensive equipment and specially trained personnel, and the results are obtained immediately, so the connection with the running performance can be intensively studied [15, 16].

Arrese and Ostariz (2006) found a high positive correlation between the skinfold thickness of the lower extremities and the running speed in several racing disciplines from sprinting to middle and long distance running. These morphological features may be useful predictors of athletic performance [17]. The sum of skinfold thickness was identified as an important predictor variable for running success, apart from the skinfolds which are measured separately [15, 18]. However, in various studies the sum of skinfolds does not always include the same individual skinfolds or the same number of skinfolds [6–8, 10, 16, 18, 20–25]. In the literature we have surveyed, the sum of skinfolds consisted mainly of the sum of seven to ten folds which included the upper body and lower extremities [6–8, 16, 17, 20–22]. The running performance is affected by the body weight [25], BMI [18, 26, 27] and the BFP [28, 29], besides the skinfolds and their sums.

The objective of this study was to assess the body composition of male and female athletes of the senior Serbian national track and field team, and determine differences in body composition in regard to athletic disciplines.

Material and Methods

The study included 35 men and 26 women, members of the senior track and field team of Serbia. The examinees were 19 to 33 years old (mean age 22.87±3.39). The study was conducted during the preparation of the official track and field team of Serbia in Bar (Montenegro), in April 2015, in accordance with the Declaration of Helsinki and with the approval of the competent Ethics Committee. The coaches and athletes were given a detailed explanation of the purpose of the research, the methods used, as well as the benefits and potential risks. All participants entered the study voluntarily. Those who refused to participate, athletes under the age of 18 years, those who were injured and who had not trained in the preceding three months, were not included in the study.

Among the male participants, 13 were sprinters, 5 were middle and long distance runners, 7 jumpers, 5 throwers and 5 decathlon athletes. As for the female participants, 14 were sprinters, 4 were middle and long distance runners, 6 jumpers and 2 throwers.

One of the inclusion criteria was at least two years of active competition at national and international levels. All athletes trained six to seven days a week, from two to four hours a day during the competition season, and they did not train for less than a month during each year. No changes were made in regard to the quantity or quality of the food they consumed.

The measurements were conducted in the morning hours. The instruments were standard, and their accuracy was checked and calibration performed before each measurement; the same person measured all anthropometric features, thus reducing the possibility of measurement errors.

Regarding morphological characteristics, the body height was measured for the evaluation of longitudinal dimensionality of the skeleton, and body weight, triceps skinfold, subscapular skinfold, chest skinfold, midaxillary skinfold, abdominal skinfold, suprailium skinfold and the thigh skinfold were measured for the evaluation of volume and body weight.

The body height was measured using "Martin" (SECA GmBH& Co., Hamburg, Germany) anthropometer with the accuracy of 1 mm. The body weight was measured using digital scales TANITA UM-72 (Body Composition Monitor Tanita Corp., Tokyo, Japan) with the accuracy of 0.1 kg. The skinfold data were obtained by using "John Bull" (CMS instruments, London, UK) calipers with the accuracy of 0.1 mm. The pressure on the tips of calipers was checked ac-

cording to the manufacturer's specifications and it was constant at 10 g/mm^2. Reading the results was carried out two seconds after achieving this pressure [30, 31]. The measurements were carried out three times on the right side of the body [30–32] and the mean value of three measurements was used for data analysis. The measurements were performed according to the method of the International Biological Program (IBP) [33].

To measure a skinfold, the skin was pinched by the left hand, with the thumb pointed downward, and the back of the hand was in full view of the person who performed the measurement. To raise the skinfold, the measurer used the thumb and index finger of the left hand to pinch the fold of a double layer of both adipose tissue and skin. In order to eliminate the muscle, the finger and thumb rolled the fold slightly, thereby also ensuring that there was a sufficiently large grasp of the fold. The near edges of the finger and thumb, in line with and straddling the landmark, raised the fold in the direction specified for each site. The calipers were held in the right hand with the fingers operating the movable arm. A full sweep of the needle was 20 mm, and this was reflected on the small scale on the caliper face. The calipers were applied to the fold so that there was 1 cm between the near edge of the fingers and the nearest edge of the caliper face. The reading of the dial to 0.1 mm was made 2 seconds after the complete release of the caliper trigger [32].

The body composition was assessed in each examinee using the technique of skinfolds, where the values of body density (g/cm^3) were obtained by means of the Jackson-Pollock equation (Jackson Pollock-7-site skinfold formula for body density) based on the sum of seven skinfolds [30]. The obtained values of body density were then converted to Siri equation, by which the percentage of body fat was calculated (% BF), while the value of the BMI (kg/m^2) of athletes was calculated as the ratio of body weight and height [31]. The obtained values were expressed as mean values both for male and female participants, as well as an average value of the above parameters of anthropometric characteristics for each group of track and field disciplines.

Data were processed by statistical package SPSS.20 (Statistical Package for the Social Sciences, V.20; SPSS Inc, Chicago, Illinois, USA). Distribution normality was tested by Shapiro-Wilk test.

Data analysis included the calculation of descriptive statistics of variables: arithmetic mean (M) and standard deviation (SD) value of the measurement results. The differences between the tested variables in relation to the track and field discipline of respondents were identified with one-way analysis of variance - ANOVA, including the least significant difference (LSD) Post Hoc test. Statistical significance was set at $p < 0.05$.

Results

The distribution normality was confirmed by the Shapiro-Wilk test for all variables analyzed in the study. **Table 1** shows the mean and standard deviation values for each tested variable, separately in relation to sex, for all participants. A wide range of results was observed for body height and body mass in the participants of both sexes, which is in accordance with a great number of track and field disciplines. On average, male participants had a lower sum skinfold thickness and BFP compared to women, while the body density and BMI were higher than average **(Table 1).**

The results of one–way ANOVA analysis indicate that the differences in the height of athletes who participated in various track and field disciplines were statistically significant (F=2.97, p=.03), while the subsequent comparisons using LSD test showed that the mean height values significantly differed between the sprinters and jumpers (p=.04), sprinters and throwers (p=.20) and sprinters and decathlon athletes (p=.10); the female athletes also showed a statistically significant difference in height (F=3.54, p=.03) in regard to the groups of disciplines, particularly in sprinters and jumpers (p=.01), while the difference in female throwers was at the limit value (p= .06), but not statistically significant.

A statistically significant difference in weight (F=7.01, p=.00) was observed among the males participants, sprinters and jumpers (p=.02), sprinters and throwers (p=.00) and sprinters and decathlon athletes (p=. 00), as well as between middle and long distance runners and throwers (p=.00) and middle and long distance runners and decathlon athletes (p=.01). The body weight also significantly differed among female athletes (F=3.70, p=.03), the throwers being heavier than sprinters (p=.01), jumpers (p=.02) and middle and long distance runners (p=.00) **(Table 2)**.

There was a statistically significant difference in the sum of skinfolds in male athletes (F= 4.30, p=.01), the sprinters having significantly lowest value of the sum of skinfolds in relation to the jumpers (p=.04), throwers (p=.00) and decathlon athletes (p=.01), and middle and long distance runners in relation to throwers (p=.03). There was no statistically significant difference in the sum of skinfolds in female athletes (F=0.76, p=.53).

The difference in body density was statistically significant in male athletes (F=4.09, p=.01), sprinters having significantly higher values of body density in relation to the jumpers (p=.05), throwers (p=.00) and decathlon athletes (p=.01), and the throwers in relation to middle and long distance runners (p=.04), while no significant difference was determined in female athletes (F=0.60, p=.62).

The BFP was statistically significantly different among the male participants in regard to the athletic discipline (F=4.02, p=.01); the sprinters had the lowest BFP (M=5.77 %), which was significantly lower compared to the jumpers (p=.04), throwers (p=.00) and decathlon athletes (p=.01), while no significant difference (F=0.60, p=.62) was determined in the female athletes. The body mass index differed in regard to the discipline both in the male (F=3.86, p=.01)

Table 1. The mean and standard deviation of tested variables and significance of differences between the tested variables by track and field disciplines given for male and female participants (One –way ANOVA)
Tabela 1. *Aritmetička sredina i standardna devijacija testiranih varijabli i značajnost razlika između testiranih varijabli po atletskim disciplinama prema polu (One –way ANOVA)*

Discipline/*Disciplina*	Height *Visina* (cm)	Body weight *Telesna masa* (kg)	Sum *Suma* (mm)	B. density *Telesni sastav* (g·cm^3)	BF *Masna masa* (%)	BMI/*Indeks telesne mase* (kg/m^2)
	M ± SD/*AS ± SD*					
Men/*Muškarci* Sprint/*Sprint*	180,61 ± 5,89	72,33 ± 6,20	46,74 ± 8,60	1,0861 ± 0,0029	5,77 ± 1,22	22,20 ± 2,04
Women/*Žene*	168,31 ± 5,36	60,66 ± 6,54	73,76 ± 18,48	1,0627 ± 0,0069	15,82 ± 3,06	21,35 ± 1,35
Men/*Muškarci* Middle and long dist.	182,8 ± 4,17	72,62 ± 4,62	53,62 ± 5,43	1,0833 ± 0,0023	6,94 ± 0,99	21,74 ± 1,46
Sr. i duge pruge Women/*Žene*	169,37 ± 5,36	57,62 ± 5,01	61,70 ± 14,92	1,0669 ± 0,0055	13,98 ± 2,39	20,05 ± 0,80
Men/*Muškarci* Jumps/*Skokovi*	186,14 ± 3,50	82,31 ± 8,43	60,89 ±17,47	1,0809±0,0071	8,06±3,14	23,91±2,63
Women/*Žene*	175,23±5,36	62,23±3,82	67,55 ± 10,70	1,0652 ± 0,0042	14,71 ± 1,81	20,27 ± 0,81
Men/*Muškarci* Throws/*Bacanja*	187,67 ± 6,73	90,98 ± 12,82	74,28 ± 24,11	1,0759 ± 0,0084	10,10 ± 3,61	25,78 ± 2,60
Women/*Žene*	175,75 ± 1,06	73,75 ± 6,01	76,90 ± 6,08	1,0641 ± 0,0014	15,18 ± 0,62	23,90 ± 2,27
Men/*Muškarci* Decathlon/*Desetoboj*	188,50 ± 6,25	88,56 ± 11,60	67,74 ± 16,65	1,0786 ± 0,0064	8,94 ± 2,70	24,82 ± 1,88

Sig. of difference *Značajnost razlike*	F	p	F	p	F	p	F	p	F	p	F	p
Men/*Muškarci*	2,97	.03	7,00	.00	4,30	.01	4,09	.01	4,02	.01	3,86	.01
Women/*Žene*	3,54	.03	3,70	.03	0,77	.53	0,60	.62	0,60	.62	5,40	.01

Legend: M – mean, SD – standard deviation, F – F ratio, p - significance of differences, sum- sum of seven skinfolds (mm), b. density - body density (g·cm^3)
Legenda: AS – aritmetička sredina, SD – standardna devijacija, F – F odnos, p – značajnost razlika, suma–suma sedam kožnih nabora (mm), ind. tel. mase – indeks telesne mase (kg/m^2)

and the female athletes (F=5.40, p=.01). The middle and long distance runners had the lowest average BMI, but it was not statistically significantly different than in sprinters (p=.69) and jumpers (p=.09); however, it was different in throwers (p=.01) and decathlon athletes (p=.03) who had a higher BMI. In male athletes, the BMI was significantly lower in sprinters than in throwers (p=.00) and decathlon athletes (p=.03), while in female athletes: sprinters (p=.01), middle and long-distance runners (p=.00) and jumpers (p=.00) also had a statistically significantly lower BMI than the throwers **(Table 2)**.

Discussion

The height of world-class sprinters ranges from 168 to 191 cm, and from 152 to 182 cm in females and males, respectively [34]. On average, the national team sprinters of both sexes had average values of body height, whereas they were taller than the American male (177 cm) and female sprinters (168 cm); however, the Serbian male sprinters were shorter than the elite male sprinters (181.6 cm), and on average, the Serbian female sprinters were taller than the elite female sprinters (168.2 cm) [32]. The Serbian national team athletes were shorter than the Croatian top 100 and 200 meter sprinters (182.7 cm) and 400 m (181.3 cm), while the athletes in this study were taller than the Croatian middle-distance runners (180.3 cm) and long-distance runners (181.9 cm) [22]. According to the literature data, the gradual decrease in running distance from marathon to 400-meters, the average body height of runners gradually increases [27, 35]. However, on average, the trend differs in 100 and 200 meter sprinters and they are shorter than 400 m runners (marathon: 171.9±6.28 cm, 3000 m: 175.02±6.55 cm, 400 m: 182.75±6.24 cm, 200 m: 180.99±6.17 cm and 100 m: 179.20±5.94 cm) [27]. Actually, 400 m runners are the tallest male runners [36], while Weyand and Davis confirmed this in both sexes [35]. In our study the sprinters were not divided by individual sprinting disciplines (100 m, 100 m hurdles, 200 m, 400 m and 400 m hurdles) so it was not possible to compare the height of runners in the group of sprinters.

According to Sedeaud et al. the body weight is inversely proportional to the race length, i. e. elite male sprinters have a greater body mass than middle and long distance runners, which is in accordance with Weyand and Davis research findings [35]. Weyand and Davis confirmed this both in male and female runners.

Comparing the results of this study with American sprinters, it can be concluded that the American

male sprinters (77 kg) have a higher body weight, while American female sprinters (58 kg) have a lower body weight compared to the sprinters of the Serbian national track and field team [34]. Compared to the Croatian sprinters (100 m and 200 m: 76 kg; 400: 72,7 kg) [22], our national team sprinters had a higher body weight. While Colombia's top long-distance runners were on average 170.6 cm tall and weighed 69.1 kg [19], the middle and long distance runners of our national team were taller and heavier on average. Our female middle and long distance runners, compared with sprinters, were a little taller and lighter which was also the case comparing to top runners (166,2 cm; 58,5 kg) [32]. In this study, the body height and body weight of sprinters and middle and long distance runners were similar, probably because the group of middle and long distance runners of both sexes consisted of mainly 800 m and 1500 m runners, whose body constitution is more like in sprinters.

This trend of body height and body weight of runners has been continuing since the Olympics in Munich (Germany, 1972) and Montreal (Canada, 1976) [36] till today [27, 34, 35].

The body weight and body height of jumpers, throwers and decathlon athletes are consistent with the requirements of their disciplines. In the group of jumpers, men and women were taller and heavier on average compared to the height (M=181 cm; W=166 cm) and weight (M=69.2 kg; W=59.4 kg) of elite athletes [37, 38]. Sadhu et al. found that the throwers were taller and heavier than the athletes in other disciplines [39] which is in accordance with the results of this study. Increased body weight is an advantage in throwing disciplines because more strength is necessary for throwing and it is proportional to the body mass [40]. The Serbian national team throwers were taller and heavier than throwers participating in Abraham's study in India [41], and shorter and less heavy than men and women in the study of Faber et al. [42] while decathlon athletes were slightly taller and heavier than the participants in the study done by Withers et al. [20].

The sum of skinfolds is an important predictor of results in running and jumping [15]. Legaz et al. found that the Spanish athletes had a lower sum of skinfolds, and concluded that high performance could be attributed to low skinfold levels [21].

The study results are consistent with the research of the Australian athletes, where the male and female sprinters had the lowest sum of skinfolds, i.e. 46.8 mm and 60.3 mm, respectively, and male throwers (javelin) (62,8 mm) and female throwers (95,3 mm) had the highest skinfold levels, proviso that the Serbian female sprinters had a high value of this parameter in relation to the Australian athletes [32]. In relation to the Croatian sprinters, whose average sum of skinfolds in 100 and 200 meter sprinters was 47,7 mm, and in 400 meter runners 47,2 mm [22], our national selection jumpers had a significantly higher sum of skinfolds than their Australian counterparts (which was 37.3 mm in jumpers and 43.2 mm in pole vaulters) [32].

Table 2. Significance of differences between the tested variables by track and field disciplines given for male and female participants (One-way ANOVA)
Tabela 2. *Značajnost razlika između testiranih varijabli po atletskim disciplinama prema polu (One-way ANOVA)*

Discipline/*Disciplina*	Height *Visina* (cm)	Body weight *Telesna masa* (kg)	Sum *Suma* (mm)	B. density *Telesni sastav* ($g \cdot cm^3$)	B. fat *Masna masa* (%)	B. mass index *Indeks telesne mase* (kg/m^2)
Men/*Muškarci*				p		
Sprint/Jumps *Sprint/Skokovi*	.04	.02	.04	.05	.04	.00
Sprint/Throws *Sprint/Bacanja*	.20	.00	.00	.00	.00	.04
Sprint/Decathlon *Sprint/Desetoboj*	.10	.00	.01	.01	.01	.03
Middle and long dist./Throws *Sr. i duge pruge/Bacanja*		.00	.03	.04	.04	.01
Middle and long dist./Decathlon *Sr. i duge pruge/ Desetoboj*		.01				.03
Women/*Žene*				p		
Sprint/Jumps *Sprint/Skokovi*	.01					
Throws/Sprint *Bacanja/Sprint*		.01				.01
Throws/Jumps *Bacanja/Skokovi*		.02				.00
Throws/Middle and long dist. *Bacanja/Sr.i duge pruge*		.00				.00

Legend: p - significance of differences, sum - sum of seven skinfolds (mm), b. density - body density ($g \cdot cm^3$), b. fat - body fat (%), b. mass index – body mass index (kg/m^2). Note: no statistically significant difference was found between the track and field disciplines in empty fields
Legenda: p – značajnost razlika, suma – suma sedam kožnih nabora (mm). Napomena: u praznim poljima nije došlo do statistički značajne razlike između atletskih disciplina

The results indicate that throwers have significantly higher skinfold levels than the track and field athletes, that is in accordance with Asian top throwers [41]. The sum of skinfolds can also predict the sprint performance and the best personal records in the female sprinters,

The Australian athletes, who have lower average sums of skinfolds, are much faster and have better medal score in major international competitions [45] in races at the 100, 200 and 400 meters, compared with their Serbian counterparts.

In various studies the sum of skinfolds does not always include the same individual skinfold points or their number [6–8, 10, 16, 17, 19–24], varying from three to ten [30, 31], and also does not include approximately the same number of respondents, so it is impossible to conduct a valid detailed analysis between athletes of different national track and field teams.

Body mass index is used as the most optimal indicator of the nutritional status level and idagnosis of obesity [44]. BMI decreases as the length of running distance increases, and as the performance increases the index decreases; however, it always lies in the proper optimum [27]. In the period from 1996 to 2011, the BMI and weight of the world's best sprinters (races from 100 to 400 m) were higher than in the middle and long distance runners (from 800 m to marathon). In addition, there was a significant positive correlation between the BFP and the best results in 100 m sprinters [45].

The study results suggest that the BMI in our sprinters and the middle and long distance runners is in the range of the world-class athletes included in the study of Sedeaud et al. (sprint 22 to 24 kg/m^2, middle and long distance 20 - 21 kg/m^2) [27] and American male sprinters (M=23,7 kg/m^2) and female sprinters (20,4 kg/m^2) [34]. The highest BMI was observed among the throwers of both sexes.

The BMI results of throwers are in agreement with the results of throwers who have no top results (25,7 kg/m^2) compared to the top throwers (28,4 kg/m^2) [46]. All male athletes in the study were taller, heavier and had a higher BMI compared to female athletes.

The previous studies have shown that runners of all disciplines have a lower BFP compared to other disciplines [24, 32] while throwers have the highest BFP in relation to other track and field athletes [41], which is in accordance with the study results for male participants.

This study also showed that the female sprinters had a slightly higher BFP compared to the throwers. This can be explained by a small sample size in the group of female throwers, one of them being a javelin thrower, and the demands for this discipline are different from those for other throwing disciplines, with a different body composition, which is a limitation of the study. Furthermore, most of the national team athletes are not professionals but amateurs, whose intensity and volume of training process are much lower compared to the professionals. Increasing demands of professional sports require different anthropometric characteristics and different body composition of these athletes compared to the amateurs. In most sports [46–49] including track and field disciplines, a statistically significant difference between elite (professional) and amateur athletes is determined in terms of anthropometric characteristics and body composition. Since a decreased sum of skinfolds can be attributed to high performance [21], this may be the reason why the sum of skinfolds is higher in athletes of the national selection than in top athletes.

The fact that the female participants in this study did not have top results in their disciplines may be the reason for the absence of statistically significant difference in the sums of skinfolds, body density, and BFP among athletes of various disciplines. The sum of skinfolds was measured in order to calculate the body density and the BFP; therefore, future studies should analyze individual skinfolds and differences in relation to other national teams.

In addition, a limitation of this study was a small sample of participants of different sex in certain disciplines and therefore the inability to divide the participants inside the groups and analyze them. Except for the above mentioned, different studies included different distributions of participants into groups, for example, in some studies sprinters were divided into subgroups of runners in the 100 m, 200 m and 400 m races, while in other studies hurdles (which belong to sprint events) were analyzed as jumps. Moreover, the literature results have been obtained by using a very wide range of participants who have been measured in different continuum of time. Apart from that, the literature gives a different number of skinfolds analyzed at different anatomical regions. For these reasons it was very difficult to make a detailed comparison of the body composition between athletes of the national selection and other national track and field teams.

Conclusion

Measurements of total and regional body composition may be useful to improve athletic results as well as to prevent injury and assess health risks. Considering the fact that our male and female athletes showed higher sums of skinfolds, compared to other elite athletes who belong to more successful national track and field teams, adequate education of coaches and athletes, as well as more accurate body composition assessment methods may increase the loss of body fat and indirectly improve the results.

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LAPAROSCOPIC LIVING DONOR LEFT NEPHRECTOMY

LAPAROSKOPSKA LEVOSTRANA DONORSKA NEFREKTOMIJA

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Summary

Introduction. Kidney transplantation is a treatment modality for patients with end-stage renal disease. Nowadays, in the Western world, laparoscopic living donor nephrectomy represents the treatment of choice for graft retrieval. The aim of this paper was to present the laparoscopic living donor left nephrectomy technique. **Results**. Only one living donor nephrectomy has been performed at the Clinical Center of Vojvodina so far. The authors reviewed the literature data on the results and complications of laparoscopic living donor nephrectomies. **Conclusion**. Laparoscopic living donor nephrectomy is a feasible procedure, but according to most authors, it should be performed by surgeons with significant experience in laparoscopic nephrectomy.

Key words: Laparoscopy; Nephrectomy; Living Donors; Kidney Transplantation; Minimally Invasive Surgical Procedures; Postoperative Complications; Treatment Outcome

Sažetak

Uvod. Transplantacija bubrega je terapijski modalitet koji omogućuje izlečenje bolesnika sa terminalnim stadijumom bubrežne insuficijencije. U zapadnim zemljama laparoskopska donorska nefrektomija predstavlja metodu izbora za dobijanje grafta. Cilj ovog rada je da se prikaže operativna tehnika laparoskopke leve donorske nefrektomije. **Rezultati.** U Kliničkom centru Vojvodine urađena je samo jedna laparoskopska donorska nefrektomija. Autori su prikazali rezultate i komplikacije ove procedure iz literature. **Zaključak.** Laparoskopska donorska nefrektomija je procedura koja se može izvesti ali, prema većini autora, treba da je izvode hirurzi koji imaju značajno iskustvo sa laparoskopskom nefrektomijom

Ključne reči: laparoskopija; nefrektomija; živi donori; transplantacija bubrega; minimalno invazivne hirurške procedure; postoperativne komplikacije; ishod lečenja

Introduction

One century ago, Alexis Carrel, a vascular surgeon, was awarded the Nobel Prize in medicine for his work in organ transplantation. In 1902, he claimed that organ transplantation was a mere clinical curiosity, but it might be of practical interest in the future. Nowadays, kidney transplantation has a practical significance and represents a treatment modality for patients with end-stage renal disease. During the last decade, the number of living donor kidney transplantations has increased, especially in Europe and the United States. Spain is one of the leading countries with 48.2 transplantations per million population, out of which 10.4% of living donor transplantations [1]. There are at least 3 reasons for the increasing number of living donors: the scarcity of deceased organ donors, better outcomes with living donor transplants, and improved safety for organ donors. One-year deceased donor graft survival was found among 88.1% to 95%, while three-year survival ranged from 83.7% to 87.5%. One-year living donor graft survival was 93% – 98% and three-year graft survival was 83.7% to 94.3% [2]. In 1995, Lloyd Ratner and Louis Kavoussi performed the first laparoscopic donor nephrectomy (LDN) at Johns Hopkins Hospital [3]. The aim of this paper is to present the laparoscopic living donor nephrectomy (LLDN) technique.

Laparoscopic living donor left nephrectomy technique

For a kidney transplant, usually the left kidney is taken, because the left renal vein is significantly longer compared to the contralateral vein, and therefore, the technique of the left LLDN is described in this paper. The surgical technique of the right kidney removal is similar, with differences in patient's positioning and anatomical relations.

Before the live donor kidney removal, both patients (donor and recipient) undergo standard preo-

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Abbreviations

LLDN – laparoscopic living donor nephrectomy
LDN – laparoscopic donor nephrectomy
Endo – GIA - endoscopic gastrointestinal automatic stapler
GIA – gastrointestinal anastomosis

perative preparation. Prior to LLDN, a check up instruments, suction device, irrigator, insufflator, and electrocautery is recommended. This procedure should be performed using atraumatic instruments and bipolar electrocautery.

After the induction of general anesthesia, an urinary catheter is placed, as well as a nasogastric tube. Then the patient is placed on the operating table in the right lateral position at the angle of 45 degrees. The angle of 45 degrees is obtained by placing a pillow behind the patient's back. The patient is fixed to the operating table with two solid wide bands. One band is placed over the chest and the other over the pelvis of the patient.

The procedure of kidney removal begins after standard preparation of the surgical field. Mini-laparotomy is performed on the edge of the left rectus abdominis muscle (Hasson technique) in the level of the umbilicus. A 12 mm trocar is placed trough the mini-laparotomy. This trocar is used for the creation of pneumoperitoneum; CO_2 is insufflated into the abdominal cavity until 12 mm Hg pressure is achieved. Pneumoperitoneum can also be created by a blind method using the Veress needle. Thereafter, a camera is introduced through this trocar for inspection of the peritoneal cavity and controlled placement of two additional trocars. A 10 mm trocar is placed between the umbilicus and the iliac crest, and a 5 mm trocar is placed in the middle of the left subcostal line **(Figure 1)**.

The first step involves opening the parietal peritoneum along the line of Toldt from splenic flexure of the colon to the iliac vessels **(Figure 2)**. The descending colon is mobilized and displaced medially. The left ureter is dissected from the level of iliac blood vessels up to the renal pelvis. The ureter should be dissected cautiously with the surrounding fat tissue to preserve blood supply **(Figure 3)**. The next step is the

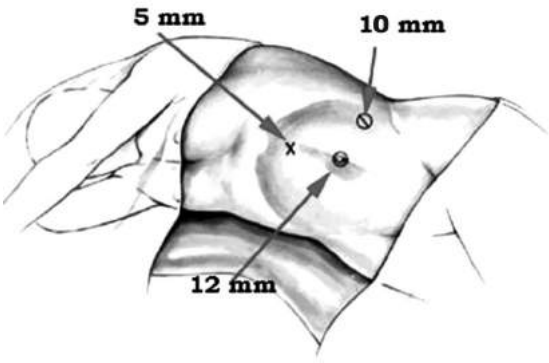

Figure 1. Patient position on operative table and trocar placement [2]
Slika 1. *Položaj pacijenta na operativnom stolu i postavljanje trokara [2]*

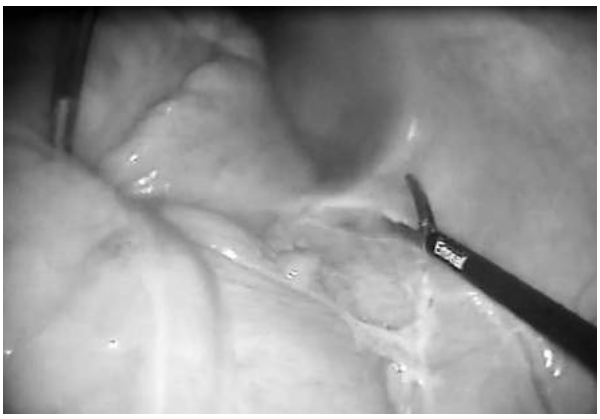

Figure 2. Incision of parietal peritoneum along the line of Toldt [2]
Slika 2. *Incizija parijetalnog peritoneuma duž Toldtove linije [2]*

dissection of renal blood vessels. The renal vein is dissected first. The gonadal and adrenal veins should be clipped and transected to assure adequate length of the left renal vein **(Figure 4)**. Thereafter, the left renal artery should be dissected up to the aorta.

Subsequently, dissection of the left kidney from the surrounding fat tissue should be started at the lower pole. This step is completed with upper pole dissection, especially taking care during the separation of the left adrenal gland. Following complete dissection of he left kidney, blood vessels and the ureter, mannitol, furosemide and heparin 5000 units are administered intravenously.

The ureter is clipped at the level of iliac vessels and transected above the clip. The left renal artery is dissected with endoscopic gastrointestinal anastomosis (endo-GIA) stapler, and the left renal vein laterally **(Figure 5)**.

Six to eight centimetres long laparotomy is made on the front abdominal wall and the kidney is removed. The wound is closed by layers using polydioxanone 1 surgical sutures.

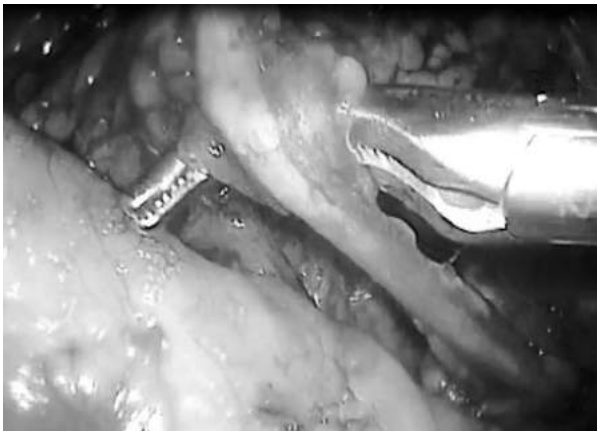

Figure 3. Identification and dissection of the left ureter [2]
Slika 3. *Identifikacija i disekcija levog uretera [2]*

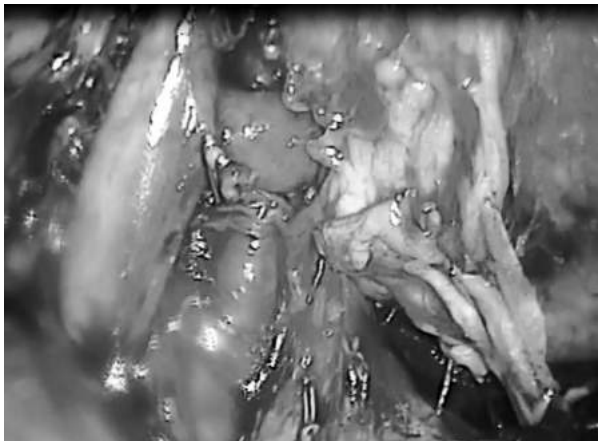

Figure 4. The left renal vein with clipped and transected adrenal and gonadal veins and the left renal artery [2]
Slika 4. *Leva bubrežna vena sa podvezanom i presečenom adrenalnom i gonadalnom venom i leva bubrežna arterija [2]*

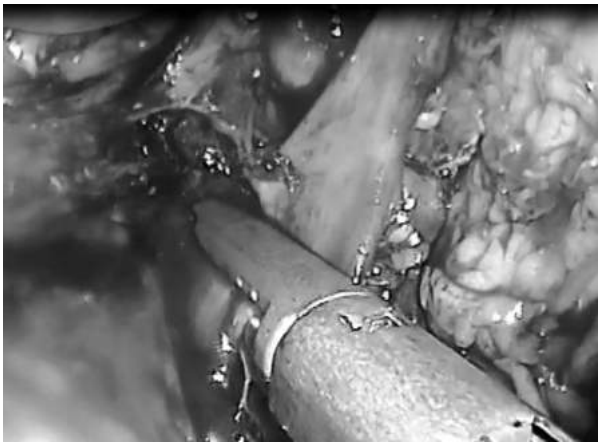

Figure 5. Placement of endo-GIA stapler on the left renal vein [2]
Slika 5. *Postavljanje endoskopskih gastrointestinalnih automatskih kopči na levu bubrežnu venu [2]*

Following the wound closure, pneumoperitoneum is re-established and hemostasis is controlled. After the drainage of the renal bed, trocars are removed and port sites are closed with surgical sutures.

Results

To date, only one laparoscopic donor nephrectomy was done at the Clinic of Urology in Novi Sad, with a functional graft 3 years after transplantation.

Obviously, this procedure is feasible in our hands, and hopefully, improvement of financial resources will enable more procedures in our institution.

Discussion

In 2005, the United Network for Organ Sharing reported that 83% of all living donor nephrectomies in the United States were performed laparoscopically. In 27 European countries, 65% of donor nephrectomies were performed by laparoscopic approach [1, 4].

Following the first 175 laparoscopic donor nephrectomies, Chan et al. reported that this procedure was associated with shorter hospital stay, and less postoperative analgesic requirements, as well as lower complication rates compared to the open living donor nephrectomy. The average blood loss in this group was 220 ml, and the average operating time was 220 minutes. The donor returned to work in less than two weeks [5].

Tooher et al. reported 0 – 13.3% conversion rate for LLDN. The reasons for conversion were intraoperative hemorrhage due to vascular injuries or lesion of the spleen, difficult kidney exposure due to donor obesity, vascular stapler malfunction and loss of pneumoperitoneum [6].

Chan et al. reported an overall complication rate of 11%. Major complications were found in 7 (4%) patients: postoperative retroperitoneal bleeding requiring transfusion (1.14%), GIA malfunction (0.6%), epigastric artery injury (0.6%), bowel injury (0.6%), pneumonia (0.6%), and incisional hernia (0.6%). Minor complications were noted in 12 patients (6.9%): transient thigh paresthesia (4%), superficial wound infections (2.83%), urinary tract infections (1.14%), mucus plug/atelectasis (0.6%), ileus (0.6%) and epididymitis (0.6%). The authors reported 3 (1.7%) conversions [5].

Burgas Revilla reported results of 417 cases of LLDN from 4 European transplantation centers [7]. The overall complications rate was 7.7%; 1.6% were severe and 6.1% minor complications. Severe complications included: intestinal injuries, hemorrhage, peritonitis, and hernia, and minor: urinary retention, urinary infection, wound infection, hematoma, testicular pain, and atelectasis. Harper et al. reported 5.4% of complications in 750 cases [8]. The mortality rate related to LDN varied from 0.03% to 0.06%, but generally, this procedure is considered to be safe [9].

Conclusion

Laparoscopic living donor nephrectomy is a feasible procedure, but most of the authors agree that it should be performed by experienced laparoscopic surgeons. This method enables shorter hospitalization, less analgesics consumption, better cosmetic result, and earlier return to work. Laparoscopic living donor nephrectomy is a safe method associated with a low complication rate.

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ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF ACINETOBACTER SPP IN THE PERIOD 2012 - 2015

ISPITIVANJE OSETLJIVOSTI ACINETOBACTER SPP NA ANTIMIKROBNE LEKOVE U PERIODU 2012−2015. GODINE

Sandra STEFAN MIKIĆ

Summary

Introduction. Representatives of the genus Acinetobacter have become an important cause of hospital-acquired infections due to their great ability to survive and spread in a hospital environment, as well as rapid development of resistance to many antibiotics. The aim of this study was to determine the incidence of nosocomial infections caused by Acinetobacter spp among patients hospitalized at the Clinic of Infectious Diseases of the Clinical Center of Vojvodina; determine the presence and prevalence of resistance to antimicrobials in strains Acinetobacter spp, isolated from patient materials routinely sampled at the Clinic of Infectious Diseases of the Clinical Center of Vojvodina in the period January 1, 2012 to December 31, 2015. **Material and Methods.** A retrospective study included 1.673 patients with infectious diseases of bacterial etiology treated at the Clinic of Infectious Diseases of the Clinical Center of Vojvodina. The analysis of blood cultures, urine, cerebrospinal fluid culture, wound/decubitus swab, throat swabs, cannula/tube swabs, and bronchial aspirate was performed to establish the incidence of infections caused by Acinetobacter spp and antimicrobial resistance. **Results.** During the four-year research, Acinetobacter spp was isolated from blood samples in 14/260 (5.4%), urine in 6/198 (3.0%), cerebrospinal fluid in 2/43 (4.7%), wound/decubitus swabs in 33/128 (25.8%), throat swabs in 14/124 (11.3%) cannula/tube swabs and bronchial aspirate in 32/72 (44.4%) samples. The isolates of Acinetobacter spp showed the highest susceptibility to colistin (100%). Resistance to carbapenems and piperacillin/tazobactam accounted for nearly 100% in all tested isolates, while resistance to other antibiotics was over 63.6%, except to tobramycin whose resistance accounted for 11.1%. **Conclusion.** Representatives of the genus Acinetobacter are a common cause of nosocomial infections in hospitalized patients. Acinetobacter spp is only sensitive to colistin (100%), while it is resistant in various percentages to all other tested antibiotics.

Key words: Microbial Sensitivity Tests; Acinetobacter; Anti-Infective Agents; Cross Infection

Sažetak

Uvod. Predstavnici roda *Acinetobacter* važni su uzročnici bolničkih infekcija zbog velike sposobnosti preživljavanja i širenja u bolničkoj sredini kao i brzog razvoja rezistencije na brojne antibiotike. Cilj rada bio je utvrđivanje učestalosti bolničkih infekcija izazvanih *Acinetobacter spp* i prisustva i učestalosti rezistencije na antimikrobne lekove kod sojeva *Acinetobacter spp*, izolovanih iz bolesničkog materijala rutinski uzorkovanog na Klinici za infektivne bolesti Kliničkog centra Vojvodine u periodu 1.1.2012−31.12.2015. godine. **Materijal i metode.** Retrospektivna studija je obuhvatila 1 673 pacijenta sa dijagnozom infektivnih bolesti bakterijske etiologije lečenih na Klinici za infektivne bolesti Kliničkog centra Vojvodine. Analizom primoizolata izolovanih iz bolesničkog materijala (hemokulture, urinokulture, kulture likvora, brisa rane/dekubitusa, brisa grla i brisa kanile/tubusa i aspirat bronha) pratili smo učestalost infekcija izazvanih *Acinetobacter spp* i antimikrobnu rezistenciju na antibiotike. **Rezultati.** U toku četvorogodišnjeg ispitivanja iz hemokultura izolovano je 14/260 (5,4%) izolata *Acinetobacter spp*, iz urinokultura 6/198 (3,0%), iz likvora 2/43 (4,7%), iz brisa rane/dekubitusa 33/128 (25,8%), iz brisa grla 14/124 (11,3%), a iz brisa kanile/tubusa i aspiratata bronha 32/72 (44,4%) izolata. Najveću osetljivost izolati *Acinetobacter spp* pokazali su na kolistin (100%). Rezistencija na karbapeneme i piperacilin/tazobaktam iznosila je skoro 100% kod svih ispitanih izolata, dok je rezistencija na druge antibiotike iznosila preko 63,6%, osim na tobramicin − iznosila je 11,1%. **Zaključak.** Predstavnici roda *Acinetobacter* značajni su uzročnici bolničkih infekcija kod hospitalizovanih pacijenata. *Acinetobacter spp* je osetljiv jedino na kolistin (100%), a rezistentan u različitom procentu na sve ostale ispitivane antibiotike.

Ključne reči: testovi mikrobne osetljivosti; Acinetobacter; antimikrobni lekovi; bolničke infekcije

Introduction

The World Health Organization defines antimicrobial resistance as the resistance of microorganisms to a drug that was previously effective. The resistance of bacteria to antibiotics is called antibiotic resistance [1]. Multidrug-resistant (MDR) bacteria is the term used for bacterial strains resistant

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Abbreviations

Spp – species
CCV – Clinical Centre of Vojvodina
MDR – multidrug resistant
US – United States

to three or more groups of antimicrobial drugs. Cross-resistant bacteria are those that have developed resistance to a variety of drugs that have a similar mechanism of action [2]. The main cause for developement of antibiotic resistance is irrational use of antibiotics [3].

Representatives of the genus Acinetobacter are strictly aerobic, gram-negative, immobile (Greek "akinetos" - immobile), catalase positive, indole negative, non-fermentable coccobacilli. Within this genus there are over 20 different species, the most important among them - Acinetobacter calcoaceticus-baumannii complex which is responsible for most human infections [4]. Most of the clinical isolates of Acinetobacter baumannii, which cause infections of hospitalized patients, using genotyping methods, are divided into three European (international) clones, of which the European clone I (EU I) and European clone II (EU II) are most dominant. The permeability of the outer membrane layer of Acinetobacter baumannii (less than 5% in comparison to other gram-negative microorganisms), congenital decreased susceptibility to antibiotics, in combination with rapid acquisition of resistance mechanisms using mutation or genetic elements (plasmids, transposons and insertion sequences) are responsible for rapid emergence of multi-resistant isolates. Another important feature of this microorganism is the ability to survive in wet and dry conditions up to 4 months, with the ability to form a biofilm which plays a significant role. Survival of isolates that have such capability is twice as long (36 vs. 15 days) in comparison to isolates which are not capable to form a biofilm. Isolates that are capable to form biofilms are multiresistant isolates, because a biofilm is a community of well-structured microcolonies which has the ability for long-term survival and causes changes to the genetic material. Colonization by Acinetobacter baumannii precedes the biofilm formation, often in intensive care units [5].

Acinetobacter may be part of normal bacterial flora of the skin and mucous membranes or various secretions of healthy people. Also, Acinetobacter colonizes the oral cavity, the respiratory and gastrointestinal tract. As an opportunistic bacteria it can be a significant cause of serious hospital infections, mainly contaminating catheters and the equipment for mechanical ventilation. Because of this, it commonly causes bacteremia and nosocomial pneumonia in patients on mechanical ventilation, urinary tract infections, infections of the skin and soft tissues, as well as meningitis and endocarditis [4].

These infections are most common in immunocompromised patients, patients with severe underlying disease, and those who have undergone invasive diagnostic procedures. Risk factors for colonization and infection include recent surgery, central venous catheters, tracheostomy, parenteral nutrition and uncontrolled use of broad-spectrum antibiotics (third generation cephalosporins, fluoroquinolones, carbapenems) [4].

Acinetobacter has the ability to survive on various surfaces for long periods of time. These bacteria have a number of mechanisms of resistance, from enzymes that break down the beta-lactam ring, through the modification of the enzyme against aminoglycosides and changing binding site of quinolones, to changing different mechanisms of drug elimination and outer membrane proteins, so that the outcome of treatment of infections caused by Acinetobacter is uncertain. These mechanisms, either individually or in cooperation, define the resistance of Acinetobacter spp to antibiotics. Infection with MDR strains in hospitals further complicates the patients' conditions, especially in intensive care units, prolonging hospitalization and increasing mortality. Hospital mortality of patients with Acinetobacter spp infections accounts for 8 – 23%, and in intensive care units even for 10 – 43% [6].

Acinetobacter is resistant to various antibiotics from different groups. Its multiresistant isolates are increasingly common around the world and the infections they cause represent a serious therapeutic problem. Carbapenems (imipenem, meropenem) are β-lactam antibiotics with the broadest spectrum of activity. When they emerged in the 1980s, for a long time they were the first line drugs in the treatment of infections caused by gram-negative nonfermentable pathogens, and they represented a new treatment option for serious infections. However, despite the early efficiency of carbapenem in the treatment of infections caused by Acinetobacter, nowadays increasing carbapenem-resistant Acinetobacter isolates are reported worldwide [4]. Multidrug resistant isolates are resistant to three or more groups of antibiotics that can be applied in the treatment of infections caused by these microorganisms (aminoglycosides, carbapenems and quinolones). Although rare, pandrug resistant isolates have also been described, which show resistance to sulbactam, minocycline, tigecycline and colistin.

Material and Methods

The study was conducted as a retrospective study, analyzing medical records of the patients treated at the Clinic of Infectious Diseases of the Clinical Center of Vojvodina (CCV) in the period from January 1, 2012 to December 31, 2015. It included 1.673 patients diagnosed with bacterial infections. The data were obtained from the medical histories of patients diagnosed with sepsis, urinary infections (complicated urinary tract infections), infections of the skin and subcutaneous tissue, respiratory infections and pneumonia. The analysis of patient material (blood cultures, urine, cerebrospinal fluid culture, wound/decubitus swabs, throat swabs, cannula/tube swabs

and bronchial aspirates) routinely sampled at the Clinic of Infectious Diseases of the CCV in the aforementioned period, was performed to establish the incidence of infestions caused by Acinetobacter spp and antimicrobial resistance.

The inclusion criteria were: clinical picture of bacterial infection, as demonstrated by laboratory findings and X-ray findings of pneumonia.

The results of bacterial isolation and identification and antimicrobial susceptibility test results were obtained from standard reports on bacteriological examination. Isolation and identification was done in the laboratories of the Microbiology Center of the Institute of Public Health of Vojvodina in Novi Sad using standard bacteriological techniques. The causes are shown as the absolute number of isolates, as well as the percentage of their representation in the calendar year when they were isolated. The bacterial susceptibility to antimicrobials was expressed as percentage of resistant and susceptible strains and only primoisolates were analyzed. Susceptibility to antimicrobial drugs was analyzed only if there were more than two isolates in a single year. Strains showing an intermediate degree of susceptibility were classified as resistant, whereas MDR strains showed resistance to three or more groups of antimicrobial drugs.

Results

During the four-year research, 4.460 samples were examined, of which 825 were positive, and 101 Acinetobacter spp were isolated.

During this period, 1.682 blood samples were analyzed and a total of 260/1.682 (15.5%) positive isolates were found. In 2012, there were 64/353 (18.1%); in 2013, 46/474 (9.7%); in 2014, 62/512 (12.1%); and in 2015, 88/343 (25.6%) isolates. The most commonly identified pathogens from blood cultures were coagulase-negative Staphylococcus spp in 121/260 (46.5%), followed by Staphylococcus aureus 27/260 (10.4%), Escherichia coli 26/260 (10.0%), Acinetobacter spp 14/260 (5.4%), and Streptococcus pneumoniae, Klebsiella pneumoniae, and Streptococcus viridians, each in 12/260 (4.6%). Other agents were present in less than 4%. In 2012, Acinetobacter spp was isolated from blood cultures in 2/64 (3.2%), in 2013, in 1/46 (2.2%), in 2014, in 6/62 (9.7%), and in 2015, in 5/88 (5.7%).

During the research period, 1.344 urine cultures were analyzed, and 198/1345 (14.7%) positive isolates were found. In 2012, there were 34/320 (10.6%); in 2013, 47/274 (17.1%); in 2014, 38/372 (10.2%); and in 2015, 79/348 (22.7%) isolates. The most commonly isolated were Escherichia coli in 69/198 (34.8%), Enterococcus spp in 36/198 (18.2%), Klebsiella pneumoniae in 28/198 (14.1%), Proteus mirabilis in 26/198 (13.1%), Pseudomonas aeruginosa in 25/198 (12.6%) and Acinetobacter spp in 7/198 (3.5%). Other causes were found in less than 3%. The incidence of Acinetobacter isolates from positive urine cultures per year was: in 2012, 2/34 (5.9%); in 2013, 0/47 (0%); in 2014, 2/38 (5.3%); in 2015, 2/79 (2.5%).

The test results of 325 samples of cerebrospinal fluid showed that 43 (13.2%) were positive. In 2012, there were 12/70 (17.1%) positive isolates, in 2013, 10/69 (14.5%); in 2014, 13/104 (12.5%); and in 2015 there were 8/82 (9.8%). During the four-year research, the most common microorganism isolated from the cerebrospinal fluid was Streptococcus pneumoniae found in 14/43 (32.6%), followed by coagulase-negative Staphylococcus spp in 12/43 (27.9%); Listeria monocytogenes and Neisseria meningitidis each in 3/43 (6.9%); Acinetobacter spp and Streprococcus viridans each in 2/43 (4.7%). Other causes were found in less than 3%. One isolate of Acinetobacter spp was found in the cerebrospinal fluid during 2012 and 2014, while in 2013 and 2015 not a single positive isolate was found.

The bacteriological examination of 183 wound/decubitus swabs was performed during the research period. Positive isolates were found in 128/183 (69.9%). In 2012, there were 30/35 (84.6%); in 2013, 34/47 (72.3%); in 2014, 35/63 (55.6%); and in 2015 there were 29/38 (76.3%) positive isolates. The most commonly isolated microorganisms were Acinetobacter spp in 33/128 (25.8%), followed by Staphylococcus aureus in 28/128 (21.9%); Pseudomonas aeruginosa in 26/128 (20.3%); Proteus mirabilis in 14/128 (10.9%); Enterobacter spp in 10/128 (7.8%); Klebsiella pneumoniae in 9/128 (7.0%); and Enterococcus spp in 8/128 (6.25%). Other pathogens were found in less than 6%. The incidence of Acinetobacter spp isolates in wound/decubitus swabs per year was: in 2012, 6/30 (20.0%); in 2013, 10/34 (29.4%); in 2014, 8/35 (22.9 %); and in 2015, 9/29 (31.0%).

During the four-year research period, 770 throat swabs were examined and 124/770 (16.1%) positive isolates were found. In 2012 there were 35/194 (18%); in 2013, 37/232 (15.9%); in 2014, 35/185 (18.9%); and in 2015, 17/159 (10.7%) isolates. The most common isolated pathogen was Staphylococcus aureus found in 61/124 (49.2%). The incidence of Staphylococcus aureus isolates in 2012 was 62.8% (22/35); in 2013, 37.8% (14/37); in 2014, 45.7% (16/35); and in 2015 it was 52.9% (9/17). The incidence of Acinetobacter spp was 14/124 (11.3%), Klebsiella pneumoniae in 13/124 (10.5%), Streptococcus pyogenes in 9/124 (7.3%), Enterobacter spp in 8/124 (6,5%), and Pseudomonas aeruginosa in 5/124 (4.0%). Other pathogens were found in less than 4%. The incidence of Acinetobacter spp isolates in wound/decubitus swabs was as follows: in 2012, 4/35 (11.4%); in 2013, 5/37 (13.5%); in 2014, 3/35 (8. 6%); and in 2015, 2/17 (11.8%).

During the same period, bacteriological tests of 153 swabs taken from cannula tubes and bronchial aspirate were performed, and positive isolates were found in 72/153 (47.1%). In 2012, there were 18/37 (48.6%) positive isolates, in 2013, 21/40 (52.5%); in 2014, 21/59 (35.6%); and in 2015, 12/17 (70.6%) isolates. The most common pathogens were Acinetobacter spp in 32/72 (44.4%), Pseudomonas aeruginosa in 18/72 (25.0%), Klebsiella pneumoniae in

Table 1. Antimicrobial susceptibility of Acinetobacter spp isolated from blood
Tabela 1*. Osetljivost izolata Acinetobacter spp na antimikrobne lekove iz hemokultura*

Antibiotic	Acinetobacter spp							
	2012		2014		2015		Total/*Ukupno*	
	S	R	S	R	S	R	S	R
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Imipenem	0 (0.0)	2 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)	5 (100.0)	0 (0.0)	13 (100.0)
Meropenem	0 (0.0)	2 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)	5 (100.0)	0 (0.0)	13 (100.0)
Piperacillin/Tazobactam	0 (0.0)	2 (100.0)	0 (0.0)	6 (100.0)	–	–	0 (0.0)	8 (100.0)
Gentamicin	0 (0.0)	2 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)	4 (100.0)	0 (0.0)	12 (100.0)
Amikacin	0 (0.0)	2 (100.0)	0 (0.0)	6 (100.0)	1 (20.0)	4 (80.0)	1 (7.7)	12 (92.3)
Tobramycin	2 (100.0)	0 (0,0)	5 (83.3)	1 (16,7)	1 (100.0)	0 (0.0)	8 (88.9)	1 (11.)
Ciprofloxacin	0 (0.0)	2 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)	5 (100.0)	0 (0.0)	13 (100.0)
Levofloxacin	0 (0.0)	2 (100.0)	0 (0.0)	6 (100.0)	0 (0.0)	5 (100.0)	0 (0.0)	13 (100.0)
Colistin	–	–	6 (100.0)	0 (0.0)	4 (100.0)	0 (0.0)	10 (100.0)	0 (0.0)
Total/*Ukupno*	2		6		5		13	

S - susceptible/*osetljivo*, R − resistant/*rezistentno*

10/72 (13.9%), Enterobacter spp and coagulase negative Staphylococcus spp in 7/72 (9.7%) each, and Stenotrophomonas maltophilia in 6/72 (8.3%). The incidence of Acinetobacter spp per year was: in 2012, 6/37 (16.2%); in 2013, 9/21 (42.9%); in 2014, 7/21 (33.3%); and in 2015, 10/12 (83.3%).

The study showed that the incidence of Acinetobacter spp was highest in swabs taken from cannula/tubes and bronchial aspirate - 32/72 (44.4%), then in wound/decubitus swabs in 33/128 (25.8%) of isolates, in throat swabs in 14/124 (11.3%), in blood cultures in 14/260 (5.4%), in cerebrospinal fluid cultures in 2/43 (4.7%), and the lowest incidence of Acinetobacter spp was found in urine cultures, in 6/198 (3.0%) isolates.

Acinetobacter spp isolates from blood cultures were resistant to all tested antibiotics, except colistin and tobramycin. All Acinetobacter spp isolates from blood tested during 2013, 2014 and 2015, were 100% susceptible to colistin, while in 2012 susceptibility to this antibiotic had not been studied. In the reported period, the susceptibility to tobramycin was 88.9% (**Table 1**).

Antimicrobial resistance of Acinetobacter spp taken from wound/decubitus swabs during the study period was almost 100% to all tested antibiotics,

Table 2. Antimicrobial susceptibility of Acinetobacter spp isolated from woud/decubitus swabs
Tabela 2*. Osetljivost izolata Acinetobacter spp na antimikrobne lekove iz brisa rana/dekubitusa*

Antibiotic	Acinetobacter spp									
	2012		2013		2014		2015		Total/*Ukupno*	
	S	R	S	R	S	R	S	R	S	R
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Ampicillin/ Sulbactam	0 (0.0)	6 (100.0)	1 (10.0)	9 (90.0)	0 (0.0)	8 (100.0)	0 (0.0)	5 (100.0)	1 (3.4)	28 (96.6)
Piperacillin/ Tazobactam	0 (0.0)	6 (100.0)	0 (0.0)	1 0(100.0)	0 (0.0)	8(100.0)	-	-	0(0.0)	24 (100.0)
Imipenem	1 (16.7)	5 (83.3)	0 (0.0)	10 (100.0)	0 (0.0)	8 (100.0)	1 (11.1)	8 (88.9)	2 (6.1)	31 (93.9)
Meropenem	1 (16.7)	5 (83.3)	0 (0.0)	10 (100.0)	0 (0.0)	8 (100.0)	1 (11.1)	8 (88.9)	2 (6.1)	31 (93.9)
Gentamicin	4 (66.7)	2 (33.3)	8 (80.0)	2 (20.0)	0 (0.0)	8 (100.0)	0 (0.0)	9 (100.0)	12 (36.4)	21 (63.6)
Amikacin	0 (0.0)	6 (100.0)	0 (0.0)	10 (100.0)	0 (0.0)	8 (100.0)	0 (0.0)	9 (100.0)	0 (0.0)	33 (100.0)
Tobramycin	2 (33.4)	4 (66.6)	4 (40.0)	6 (60.0)	2 (25.0)	6 (75.0)	0 (0.0)	2 (100.0)	8 (30.8)	18 (69.2)
Ciprofloxacin	0 (0.0)	6 (100.0)	0 (0.0)	10 (100.0)	0 (0.0)	8 (100.0)	0 (0.0)	9 (100.0)	0 (0.0)	33 (100.0)
Levofloxacin	3 (50.0)	3 (50.0)	0 (0.0)	10 (100.0)	0 (0.0)	8 (100.0)	0 (0.0)	9 (100.0)	3 (9.1)	30 (90.9)
Colistin	-	-	10 (100.0)	0 (0.0)	8 (100.0)	0 (0.0)	5 (100.0)	0 (0.0)	23 (100.0)	0 (0.0)
Total/*Ukupno*	6		10		8		9		33	

S - susceptible/*osetljivo*, R - resistant/*rezistentno*

Table 3. Antimicrobial susceptibility of Acinetobacter spp isolated from throat swabs
Tabela 3. *Osetljivost izolata Acinetobacter spp na antimikrobne lekove iz brisa grla*

Antibiotic	Acinetobacter spp									
	2012		2013		2014		2015		Total/*Ukupno*	
	S	R	S	R	S	R	S	R	S	R
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Imipenem	0 (0.0)	4 (100.0)	2 (40.0)	3 (60.0)	0 (0.0)	3 (100.0)	0 (0.0)	2 (100.0)	2 (14.3)	12 (85.7)
Meropenem	0 (0.0)	4 (100.0)	2 (40.0)	3 (60.0)	0 (0.0)	3 (100.0)	0 (0.0)	2 (100.0)	2 (14.3)	12 (85.7)
Ampicillin/ Sulbactam	0 (0.0)	4 (100.0)	0 (0.0)	5 (100.0)	0 (0.0)	3 (100.0)	–	–	0 (0.0)	12 (100.0)
Piperacillin/ Tazobactam	0 (0.0)	4 (100.0)	2 (40.0)	3 (60.0)	0 (0.0)	3 (100.0)	–	–	2 (16.7)	10 (83.3)
Gentamicin	0 (0.0)	4 (100.0)	2 (40.0)	3 (60.0)	0 (0.0)	3 (100.0)	1 (50.0)	1 (50.0)	3 (21.4)	11 (78.6)
Amikacin	0 (0.0)	4 (100.0)	2 (40.0)	3 (60.0)	0 (0.0)	3 (100.0)	1 (50.0)	1 (50.0)	3 (21.4)	11 (78.6)
Tobramycin	–	–	5 (100.0)	0 (0.0)	3 (100.0)	0 (0.0)	-	-	8 (100.0)	0 (0.0)
Ciprofloxacin	0 (0.0)	4 (100.0)	2 (40.0)	3 (60.0)	0 (0.0)	3 (100.0)	1 (50.0)	1 (50.0)	3 (21.4)	11 (78.6)
Levofloxacin	1 (25.0)	3 (75.0)	0 (0.0)	5 (100.0)	0 (0.0)	3 (100.0)	1 (50.0)	1 (50.0)	2 (14.3)	12 (85.7)
Colistin	–	–	5 (100.0)	0 (0.0)	–	–	–	–	5 (100.0)	0 (0.0)
Total/*Ukupno*	4		5		3		2		14	

S - susceptible/*osetljivo*, R - resistant/*rezistentno*

except colistin and tobramycin. In the examined period, the susceptibility to colistin was 100% and to tobramycin 30.8%. The isolates were susceptible to gentamicin and levofloxacin during 2012, while during 2014 and 2015, resistance to these antibiotics was 100% (**Table 2**).

Resistance to carbapenem of isolates from the throat swabs was 100%, in all isolates in 2012, 2014 and 2015, while in 2013, it was recorded in three isolates (60%). Susceptibility to ampicillin/sulbactam was not recorded during the first three years of testing, while in 2015 there were no information about susceptibility to this antibiotic. Susceptibility to colistin was 100% in 2013, the only year that focused on examining the susceptibility to this antibiotic. Susceptibility to tobramycin was tested in 2013 and 2014, and it was 100% (**Table 3**).

Antimicrobial susceptibility of Acinetobacter spp isolated from cannula/tubes swabs and bronchial aspirate during the period of research was recorded only to colistin (100%). The antimicrobial susceptibility to this antibiotic was carried out only in 2015, in 2 isolates. A lower susceptibility (20%) was recorded to ampicillin/sulbactam and 17.4% to tobramycin. Resistance of Acinetobacter spp to other antibiotics was over 82.6% (**Table 4**).

Discussion

During the past decades, Acinetobacter baumannii has become one of the leading causes of nosocomial infections worldwide. A study that examined the prevalence of infections in intensive care units in 75 countries on five continents, confirmed that infections caused by Acinetobacter baumannii are among the five most frequent infections [5]. In the European countries, it approximately causes from 2% to 10% of all infections caused by gram-negative microorganisms, and in the United States (US) about 2.5% [7]. Our study shows that Acinetobacter spp causes blood infections in 2.2% up to 9.7% of inpatients.

In regard to data from our country, the study of Šuljagić and Mirović in 2006, showed that Acinetobacter spp caused nosocomial blood infections with an incidence of 7.1% [8], which corresponds with our data on blood infections in 2015, with an incidence of 5.7%. In our study, the incidence of Acinetobacter spp in blood cultures was 5.4%, taking the fourth place, behind the cannula/tubes swabs and bronchial aspirate, the wound/decubitus swabs, and throat swabs, whereas according to the results of American authors it was in the second place, after isolates from the respiratory tract, with an incidence of 23.9% [9]. Our results from 2014 are identical with the data from Saudi Arabia, where the incidence was also 9.7% [10].

The lowest incidence of Acinetobacter spp was found in cerebrospinal fluid and urine. Acinetobacter spp was not isolated from urine in 2013, while the highest incidence was recorded in 2012, 5.9%.

During 2013 and 2015, not one strain of Acinetobacter was isolated from the cerebrospinal fluid, and in 2012 and 2015, one isolate was found each year.

During the four-year research, Acinetobacter spp was isolated from wound/decubitus swabs in 25.8% of hospitalized patients. According to literature data, Acinetobacter spp was found in skin swabs of patients who were not hospitalized, from 0.5 to 3%, and in hospitalized patients in up to 75% [11–13]. The results of our research on the dominance of Acinetobacter spp from wound swabs are similar to the findings of other authors who examined the the

Table 4. Antimicrobial susceptibility of Acinetobacter spp isolated from the cannula/tubes swabs and bronchial aspirate
Tabela 4. *Osetljivost izolata Acinetobacter spp na antimikrobne lekove iz brisa kanile/tubusa i aspirata bronha*

Antibiotic	Acinetobacter Spp									
	2012		2013		2014		2015		Total/*Ukupno*	
	S	R	S	R	S	R	S	R	S	R
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Ampicillin/ sulbactam	3 (50.0)	3 (50.0)	0 (0.00)	9 (100.0)	1 (20.0)	4 (80.0)	–	–	4 (20.0)	16 (80.0)
Piperacillin/ tazobactam	0 (0.0)	6 (100.0)	0 (11.1)	9 (100.0)	0 (0.0)	6 (85.7)	–	–	0 (0.0)	22 (100.0)
Imipenem	0 (0.0)	6 (100.0)	1 (11.1)	8 (88.9)	1 (14.3)	6 (85.7)	0 (0.0)	10 (100.0)	2 (6.3)	30 (93.7)
Meropenem	0 (0.0)	6 (100.0)	1 (11.1)	8 (88.9)	1 (14.3)	6 (85.7)	0 (0.0)	10 (100.0)	2 (6.3)	30 (93.7)
Gentamicin	0 (0.0)	6 (100.0)	1 (11.1)	8 (88.9)	1 (14.3)	6 (85.7)	0 (0.0)	10 (100.0)	2 (6.3)	30 (93.7)
Amikacin	0 (0.0)	6 (100.0)	0 (0.0)	9 (100.0)	0 (0.0)	7 (100.0)	0 (0.0)	10 (100.0)	0 (0.0)	32 (100.0)
Tobramycin	1 (20.0)	4 (80.0)	0 (0.0)	9 (100.0)	3 (42.9)	4 (57.1)9	0 (0.0)	2 (100.0)	4 (17.4)	19 (82.6)
Ciprofloxacin	0 (0.0)	6 (100.0)	0 (0.0)	9 (100.0)	0 (0.0)	7 (100.0)	0 (0.0)	10 (100.0)	0 (0.0)	32 (100.0)
Levofloxacin	0 (0.0)	1 (100.0)	0 (0.0)	9 (100.0)	0 (0.0)	7 (100.0)	0 (0.0)	10 (100.0)	0 (0.0)	27 (100.0)
Colistin	–	–	–	–	–	–	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)
Total/*Ukupno*	6		9		7		10		32	

S - susceptible/*osetljivo*, R - resistant/*rezistentno*

dominance of gram negative bacteria from swabs of infected decubital wounds, whose localization is usually near urogenital and the end of gastrointestinal tract [14, 15].

The results of our research on the incidence of Acinetobacter spp in patient material routinely sampled at the Clinic of Infectious Diseases of the CCV, in the period from January 1, 2012, to December 31, 2015, is somewhat similar to the findings from US [9] and Great Britain [16], where the highest percentage of Acinetobacter spp was also isolated from cannula/tubes swabs and bronchial aspirate. In our study, the prevalence ranged from 16.2% in 2012, up to 83.3% in 2015, which shows that Acinetobacter spp is becoming a leading cause of nosocomial infections in our environment.

Multiresistant isolates are increasingly common around the world and represent a serious problem for clinicians [4]. Many isolates of Acinetobacter spp have developed resistance to antibiotics, including until now successful, aminopenicillins, ureidopenicillin, cefamandole and cephalothin, cephamycin, cefoxitin, most of the aminoglycosides, chloramphenicol, tetracycline, and the more recent antibiotics, such as cefotaxime, ceftazidime, imipenem, tobramycin, amikacin, and fluoroquinolones [17].

All strains of Acinetobacter spp from blood cultures in our study, were resistant to carbapenems, piperacillin/tazobactam, aminoglycosides, quinolones. Susceptibility was registered only to colistin and tobramycin. According to the Meropenem Yearly Susceptibility Test Information Collection (MYSTIC) study, in the period from 2002 to 2004, resistance to meropenem in Europe was 26.9%, 30.2% to imipenem 66% to ciprofloxacin, and 52.4% to gentamicin [15], while in our study, ten years later, the susceptibility to these antibiotics was not observed, as shown by our results from 2014 and 2015, where resistance was recorded to all antibiotics except colistin and tobramycin. The study of Šuljagić and Mirović, conducted in 2006, examined the resistance of Acinetobacter spp isolated from blood of patients hospitalized in the intensive care units, showed that all isolates were resistant to gentamicin, and 71% to ciprofloxacin, but did not register resistance to imipenem [8]. Rapid development of resistance to carbapenems in the last decade [17] explains existence of differences in the susceptibility of isolates of Acinetobacter spp to imipenem in the aforementioned and our study. All strains of Acinetobacter spp were susceptible to colistin, as shown by studies carried out in Bulgaria from 1999 to 2006, where only colistin proved effective [18]. These strains that are susceptible only to colistin were also described in Korea in a study published in 2008 [19]. In Taiwan, there were isolates that were resistant to all available antibiotics, including colistin [20].

Due to the small number of isolates of Acinetobacter spp from cerebrospinal fluid and urine, data on their susceptibility were not analyzed.

Isolates of Acinetobacter spp from wound swabs in our study indicate that it is a MDR bacteria. The study conducted at the Institute of Public Health of Vojvodina at the Center for Microbiology, included strains of Acinetobacter spp isolated from wound swabs of patients hospitalized at institutes and clinics in CCV in Novi Sad, show that it is a MDR bacteria [4]. The above-mentioned study, recorded a lower rate of resistance to carbapenems of 61.8%, and in our study it was 83.3% in 2012, 100% in 2013 and 2014, and 88.9% in 2015. The emergence of an

increasing number of strains resistant to carbapenems caused the empirical use of these antibiotics [21]. Acinetobacter spp in our study did not show resistance to colistin, as found in literature data [22–24]. Susceptibility testing to colistin in our study was conducted in 2013, 2014, and 2015, but not for all isolates.

Susceptibility of isolates from throat swabs to colistin was done only in 2013, when all isolates were susceptible to this antibiotic. Resistance to carbapenems observed in the four-year period was 85.7%. Resistance was recorded in all isolates in 2012, 2014 and 2015, while in 2013 it was recorded in 60% of isolates. A disturbing percentage of resistant isolates of Acinetobacter baumanii to carbapenems in recent years has been observed in Croatia, according to the Committee for Antibiotic Resistance in the Croatian Academy of Medical Sciences, amounting to 90% in major Croatian hospitals [5]. In our study, susceptibility to tobramycin during 2013 and 2014 was 100%, while in 2012 and 2015, susceptibility to this antibiotic was not examined. Almost all isolates were resistant to piperacillin/tazobactam, ampicillin/sulbactam, gentamicin, amikacin, ciprofloxacin and levofloxacin. A combined application of ampicillin/sulbactam, may be effective, especially in hospitals where this agent is rarely used [25]. In our study, the resistance to this antibiotic in the surveyed period was 100%.

High resistance of Acinetobacter spp, isolated from cannula/tubes swabs and bronchial aspirate, to almost all tested antimicrobials except colistin were observed, but susceptibility to this antibiotic was carried out only in the course of 2015, only in 2 isolates. Also, in 2015, susceptibility to ampicillin/sulbactam and piperacillin/tazobactam was not tested, because since 2015, susceptibility testing to antibiotics is performed according to the EUCAST standard, which does not include testing to these antibiotics. Some authors recommend the use of a combination of ampicillin/sulbactam [4]. In our study, the resistance to this antibiotic was 80%.

Some of the epidemiological studies may have included isolates that were not responsible for infections, but simply colonized ill patients. In terms of resistance, 34% of Acinetobacter isolates in the National Healthcare Safety Network of the United States were resistant to cephalosporins, carbapenems, fluoroquinolones and aminoglycosides [26], as show the findings of antibiotic resistance of Acinetobacter spp isolated from cannula/tubes swabs and bronchial aspirates. In another national surveillance study conducted in the US in 2010, 44.7% and 49.0% were resistant to imipenem and meropenem, respectively, and 5.3% were resistant to colistin in vitro, whereas in our study resistance to colistin was not recorded [27].

Current data indicate that colistin is the main and only therapeutic option, and its unique pharmacokinetic properties have led many to suggest the use a combination of antibiotics. To maintain the susceptibility of colistin, carbapenems, sulbactam, rifampicin and tigecycline have been the most studied, in order to find a combination that would provide the best clinical efficacy and reduce toxicity [27].

Conclusion

Representatives of the genus Acinetobacter are a common cause of infections in hospitalized patients with bacterial infections. During the four-year research, the incidence of Acinetobacter spp isolated from blood cultures was 5.4% (14/260), from urine cultures 3% (6/198), from cerebrospinal fluid cultures 4.7% (2/43), from wounds/decubitus swabs 25.8% (33/128), from throat swabs 11.3% (14/124) and from cannula/tubes swabs and bronchial aspirate 44.4% (32/72). All strains of Acinetobacter spp isolated from patient material during the investigation period were susceptible to colistin (100%). In the examined period, resistance of Acinetobacter spp to β-lactams, carbapenems, aminoglycosides and fluoroquinolones was over 63.6%, except to tobramycin, but only from blood cultures, whith resistance of 11.1%. All strains of Acinetobacter spp were multiresistant.

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CONE BEAM COMPUTED TOMOGRAPHY IN IMPLANT DENTISTRY

KOMPJUTERIZOVANA TOMOGRAFIJA KONUSNOG ZRAKA U ORALNOJ IMPLANTOLOGIJI

Zagorka M. MITROVIĆ and Ana J. TADIĆ

Summary

Introduction. Cone beam computed tomography is the most reliable procedure in diagnostic radiology; it is of great importance in the prevention of complications and in improving the treatment outcome. Therefore, it is necessary to use it in the phases of preparation, implementation and verification of the therapy results. As part of the standard pre-implant procedure, this current technique is irreplaceable for making treatment plans regarding surgical performance and postoperative monitoring of patients. The emphasis is on precise planning of implant therapy and prevention of possible complications. **Strengths and limitations of the cone beam computed tomography.** Maxillofacial diagnosis used to be limited to the conventional two-dimensional radiography or to the multislice computed tomography, both providing an insight into the third dimension, but with a high dose of radiation. Using the cone beam technology, possibilities for a wide range of three-dimensional diagnosis have been created. Computed tomography provides sophisticated, high resolution visualization of bone architecture while reducing the radiation dose. **Cone beam computed tomography in implant dentistry.** This three-dimensional technique has a special importance in implant dentistry. The main characteristic of the cone beam computed tomography images is precise distinction of details, where the spatial relations between anatomical structures and their topography are clearly defined. The tomographic images enable measuring the density, buccal alveolar bone height of every part of the jaw, visualization of pathological structures and bone sloping, as well as all anatomical structures. **Conclusion.** Nowadays, implant dentistry is impossible without using the cone beam computed tomography, computer softwares, and series of programs focused on analysis, planning, virtual placement of implants in the desired position and all the other processes necessary for dental implementation. Cone beam computed tomography diagnosis is considered to be the best diagnostic method because, of all the three-dimensional imaging techniques, it has the highest diagnostic value and low level of radiation exposure.

Key words: Dental Implantation; Cone-Beam Computed Tomography; Imaging, Three-Dimensional; Planning Techniques; Diagnosis

Sažetak

Uvod. Snimci napravljeni pomoću tehnike kompjuterizovane tomografije konusnog zraka predstavljaju najverodostojniji radiološko-dijagnostički postupak koji doprinosi prevenciji komplikacija i povećava mogućnost uspeha tretmana. Stoga je primena ove tehnike neophodna u fazama pripreme, sprovođenja i verifikacije rezultata terapije. Kao deo standardne predimplantološke procedure, ova savremena metoda je nezamenjiva pri izradi plana terapije, za hiruško izvođenje i za postoperativno praćenje pacijenta. Akcenat je na preciznom planiranju implantološke terapije i na smanjivanju mogućih komplikacija. **Prednosti i ograničenja tehnike kompjuterizovane tomografije konusnih zraka.** Dijagnostika maksilofacijalne regije bila je ograničena na konvencionalnu dvodimenzionalnu radiografiju ili na snimke multislajsne kompjuterizovane tomografije koji su pružali uvid u treću dimenziju, ali sa visokom dozom zračenja. Primenom tehnologije konusnih zraka stvorene su mogućnosti širokog spektra primene trodimenzionalne dijagnostike. Kompjuterizovana tomografija omogućava sofisticiranu vizualizaciju koštane arhitekture sa visokom rezolucijom i smanjenom dozom zračenja. **Tehnika kompjuterizovane tomografije konusnih zraka u implantologiji.** Glavna karakteristika tomografskih snimaka jeste precizno razlikovanje detalja, gde su jasno definisani prostorni odnosi anatomskih struktura i njihova topografija. Tomografska snimanja omogućavaju merenje gustine, visine i bukolingvalnog promera alveolarne kosti svakog dela vilice, te vizualizaciju patologije, nagiba kosti, kao i druge anatomske strukture. **Zaključak.** Danas dentalna implantologija nije moguća bez korišćenja tomografskih uređaja i programske podrške računara u vidu niza programa usmerenih na analizu, planiranje, virtuelnu ugradnju implantata u željeni položaj i svih ostalih procesa koji su neophodni za sprovođenje terapije. Tomografska dijagnostika se smatra najboljim dijagnostičkim postupkom zato što, od svih trodimenzionalnih sistema, daje najveće dijagnostičke vrednosti emitujući najmanju dozu zračenja.

Ključne reči: oralna implantologija; kompjuterizovana tomografija konusnog zraka; 3D imidžing; planiranje; dijagnoza

Introduction

In modern dentistry, when planning implant placement, precision is of utmost importance. It is important to take the anatomical relations into account, in order to avoid unforeseen situations, to determine the best position for implants, and to choose the most suitable implant system. This can be achieved using two-dimensional (2D) and three-dimensional (3D) planning, stereolithography and realistic 3D biomodels. Conventional radiographic techniques (occlusal, retroalveolar, orthopantomography and tomography images) have

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Abbreviations

2D – two-dimensional
3D – three-dimensional
CBCT – cone beam computed tomography
FBCT – fan beam computed tomography
DVT – digital volume tomography
FOV – field of view
DICOM – digital imaging and communications in medicine

disadvantages (deformation, poor resolution, zooming, etc.) and limitations while interpreting soft and bone tissues. Therefore, they are replaced by more recent, advanced radiographic methods, such as computed tomography, (cone beam computed tomography – CBCT and fan beam computed tomography – FBCT), as well as digital volume tomography (DVT). New techniques are used in combination with appropriate interactive 3D interpretation and digital image analysis software. Identification of pathological processes and analysis of anatomical structures, important for adequate planning in implant dentistry, are based precisely on modern radiographic methods. Sagittal and transverse sections, as well as 3D reconstruction, enable more successful preoperative planning and adequate positioning of the implant. Stereolithography and other biomodels are modern methods of organ-model reproduction, and they are used for 3D display of complex anatomical structures. Production of surgical splints is based on preoperative implant placement in models. Interactive, computer-aided diagnosis has a great advantage compared to conventional planning techniques. Selection of recording technique should take into consideration clinical variables such as: number of places for implants, volume of alveolar bone and the need for bone grafting, quality and availability, costs of recording methods, and low radiation exposure.

Cone Beam Computed Tomography

Cone Beam Computed Tomography is an advanced digital recording technique that allows the operator to generate multiplanar "slices" and to reconstruct a 3D image of the target area using rotating conical X-ray through a series of mathematical algorithms **(Figure 1)**. Mozzo introduced CBCT technology in 1998, and a new form of 3D evolution was established [1]. Several studies showed that CBCT technique makes high quality and precise cross-sectional images with a relatively low exposure to radiation [2]. The use of CBCT in dentistry is growing exponentially, due to increased production of equipment and a growing acceptance of this recording technique. The size of the field of view (FOV) describes the scan volume of CBCT scanning machines and depends on the size of the detector, its shape, beam projection geometry and possibilities of beam focusing, which may differ from manufacturer to manufacturer. Collimation width of ionizing radiation is limited to the recording target area, due to which the exposition is lower, and the FOV is selected specifically for each case.

In general, based on the size of the FOV, CBCT units can be classified into small, medium and large volume units. Small volume CBCT machines are used

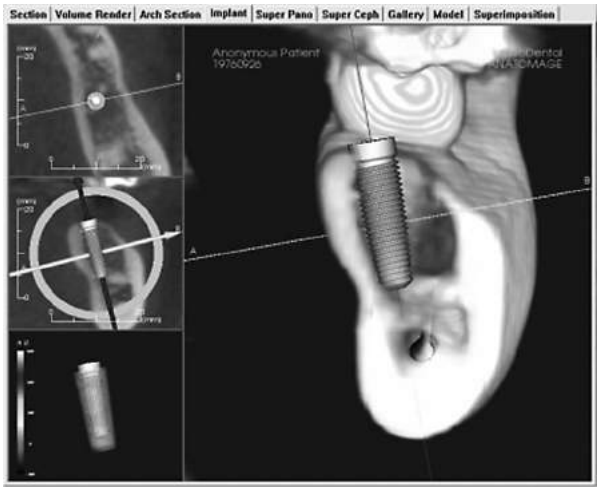

Figure 1. Placement of the implant using a 3D image
Slika 1. *Pozicioniranje implantata pomoću trodimenzionalnog snimka*

to scan sextants or quadrants of one jaw only. They usually provide higher image resolution since the X-ray scattering (noise) is reduced, as well as the FOV. Medium volume CBCT machines are used to scan both jaws, while large FOV equipment allows visualization of the entire head [3]. The main limitation of the large FOV CBCT units is the size of the field exposed to radiation.

If the selected voxel size is minimal, devices with large FOV have reduced image resolution compared with intraoral radiographs or with images recorded on small FOV CBCT devices with inherently small size of voxels [4]. Curtailing the volume should be based on the clinician's evaluation of a particular situation. For the purposes of implant placement, small and medium FOV are suitable to visualize the desired area. CBCT equipment with a small volume provides several advantages over the CBCT equipment with a large volume: increased spatial resolution, reduced radiation exposure, smaller interpretation area, cheaper appliances, etc.

Features:

– Fast scanning; acquisitions in 10 – 20 sec, complete 3D image reconstruction in less than a minute
– Small form factor (117 cm (46") x 137 cm (54"), suitable for installation even in the smallest offices
– FOV – 16 cm x 13 cm to 16 cm x 21 cm in extended FOV mode
– High resolution; voxel sizes down to 100 microns with a focal spot of 0.5 mm
– Digital flat rate detector is incomparably superior to image intensifier and transmits the lowest doses of radiation, that do not increase over time
– The highest efficiency in its class allows minimal radiation dose
– 14 bit sensor provides 16.384 shades of gray in favor of a better contrast
– Image processing protocols with extremely low radiation dose
– X-ray tube with a fixed anode has low maintenance costs and long service life

– Software for detailed and accurate visualization and image processing in 3D format
– Adjustable panoramic tools and cross-sections enable easy planning of implant installation and precise geometric measurements
– Predefined protocols and templates save time and increase productivity
– Export to digital imaging and communications in medicine (DICOM) 3.0 and compatibility with all leading picture archiving and communication system (PACS) and DICOM Worklist systems allow easy integration in large imaging centers
– Networking ensures multiple workstations over a network access images within one doctor's office.

Advantages and limitations of CBCT

Cone Beam Computed Tomography imaging provides direct visualization of the dental status, including 3D images of the maxillofacial skeleton, compared to 2D imaging that provides insight in only 2 dimensions. The ability to visualize a complete geometrical shape of the target region, avoiding superposition and planar observation, allows accurate radiological interpretation without any assumptions [5]. Significance of this recording combined with 3D optical input model has the potential to reduce the percentage of mistakes in implant placing. However, the quality of the interpretation is based on the evaluation skills and thoroughness of the diagnostician, on using native and independent treatment planning softwares, and on determination of the appropriate FOV for each particular case **(Figure 2)**. There are several manufacturers of CBCT machines in dental radiology. This has led to significant variability in radiation dosage, scanning, facilitated utilization, image resolution and software dynamics among the CBCT appliances.

The most significant limitations of CBCT devices are the lack of accurate presentation of the soft tissue internal structure, limited correlation between Hounsfield units for standardized quantification of bone density, and different types of artifacts arising mainly from metal restorations that can interfere with the diagnostic process by masking the underlying structure [6]. In order to improve visualization of the gingival soft tissue contour and thickness, it is necessary to place cotton rolls or separate the lip from the buccal cavity by air.

The highest aspects of available software applications include their ease of navigation, costs, quantity and quality of available diagnostic tools, and implant planning modules. By application of advanced softwares, waste impacts or artifact can be significantly reduced, all in order to enhance the accuracy of diagnosis and reduce the limitations of this type of recording.

Cone Beam Computed Tomography technique in implant dentistry

The use of 3D data in the field of diagnostics and treatment planning has been improved through the availability of CBCT. Its implementation helps the clinicians to estimate the 3D anatomy of the area where the implant is to be placed. After collection and processing the data, the software reconstructs the CBCT information [7]. In order to meet prosthetic requirements it is necessary to choose an ideal location for the implant placement, defining the appropriate quality and volume of the bone where osteotomy can be performed, and a stable position for the implant provided. The 3D visualization and evaluation of the implant area structure is defined by planning phase analysis using the following parameters:

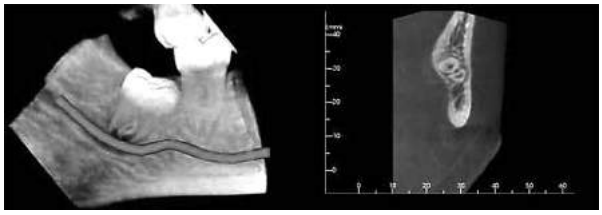

Figure 2. Surgical planning
Slika 2. *Hirurško planiranje*

1. Assessment of the available bone (height, width, relative quality of the cortical and spongious parts)
2. Determination of the 3D topography of the alveolar ridge
3. Identification and localization of vital anatomical structures such as inferior alveolar nerve, mental foramen, maxillary sinus, floor of the nasal cavity, etc.
4. Potential tissue for implant placement evaluation
5. Fabrication of CBCT-derived implant surgical guides
6. Communication of the diagnostic treatment planning information to all implant team members
7. Evaluation of prosthetic/restorative possibilities via implant software applications
8. Evaluation of postoperative acceptance of implants.

In addition, a CBCT scan, combined with software modeling, can be used as a platform for treatment planning and it can virtually simulate perfect placement of the implant defining the surgical, prosthetic and orthodontic conditions.

Discussion

There are about 30 different types of CBCT devices, so it is important to entirely conduct the research on the same device.

Implementation of the CBCT technique in implant dentistry is divided into 4 categories:

1. CBCT and diagnostics

Cone Beam Computed Tomography is an excellent diagnostic modality in oral implantology, which is used to assess the implant site, presence of pathological changes and foreign bodies, morphology and relation with the surrounding anatomical structures.

2. CBCT and implant planning

In dental implant planning, the CBCT technique is most frequently used in the linear measurement of

the ridge. CBCT images are reliable and show all the data on the amount of existing bone in the jaw for preoperative planning. The existence of metals, prosthetic restorations, does not affect the measurement accuracy of the CBCT images. Another advantage is the possibility of determining the topography of the ridge and the relation between the surrounding anatomical structures in all three dimensions. CBCT can accurately determine the thickness of the cortical bone (buccal, lingual and palatal), floor of the nasal cavity and maxillary sinus walls.

Evaluation of bone density is of a great importance. It is proved that CBCT can determine distribution of trabecular bones, showing a high correlation with the primary stability of the implant. It identifies the blood vessels on the side walls of the maxillary sinus, which is necessary in cases of sinus augmentation. CBCT technique is of great importance to doctors in the prevention of postoperative complications.

3. CBCT and surgical guidance

In oral surgery, CBCT is divided into passive, semi-active and active.

– Passive CBCT provides information on linear measurements, relative bone quality, 3D ridge topography, and proximity of vital anatomical structures.

– Semi-active CBCT includes the use of imported data that simulate the virtual implant preceding the development of surgical guides being used during the implant placement. Selecting the site of implant placement is in accordance with the restorative needs and depends on the computer program protocol. A template should be made prior to the scanning.

– Active CBCT refers to the use of data for surgical navigation systems performing fully computer-guided implant placement.

4. CBCT and post-implant assessment

The presence of beam hardening and artifacts surrounding the implant in some cases may complicate the CBCT visualization of the bone-implant interface.

Conclusion

The decision whether to use Cone Beam Computed Tomography should be based on clinical history and examination. The benefits must exceed the risk of exposing the patient to ionizing radiation, especially when children are involved, and when a recording with a large field of view volume is necessary.

Based on information obtained by three-dimensional imaging procedures, it is suggested that the Cone Beam Computed Tomography technique should be used as an imaging alternative in cases where bone augmentation is suspected, where conventional radiography may not be able to determine the structure in three dimensions as previously described:

– Computer guided implant planning and placement including navigation systems

– Placement of the implant in a highly esthetic zone

– Pre- and post-surgical evaluation of implant acceptance

– History or trauma to the jaws, foreign bodies, maxillofacial lesions, developmental anomalies, etc.

– Evaluation of post-implant complications.

It is important to bear in mind that the smallest possible field of view should be used, and that the entire image volume should be interpreted.

The use of Cone Beam Computed Tomography requires careful and proper handling and Cone Beam Computed Tomography scans help to improve the surgical accuracy, reduce postoperative morbidity, and are valuable in restorative phase of treatment.

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CASE REPORTS
PRIKAZI SLUČAJEVA

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Case report
Prikaz slučaja
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CENTRAL PANCREATECTOMY IN SURGICAL TREATMENT OF PANCREATIC INSULINOMA - A CASE REPORT

CENTRALNA PANKREATEKTOMIJA U HIRURŠKOM TRETMANU INSULINOMA PANKREASA − PRIKAZ SLUČAJA

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Summary

Introduction. Insulinomas are the most common pancreatic neuroendocrine tumors. They are typically small solitary tumors and in most cases they are benign intrapancreatic lesions. Indications for central pancreatectomy in modern surgery are limited. Historically, this surgical technique has been predominantly used for pancreatic trauma and chronic pancreatitis. Currently, it is reserved for selective management of benign lesions located in the neck and the body of the pancreas. **Case Report.** We presented a case of a successful surgical treatment of insulinoma located in the pancreatic body. We discussed the diagnosis, localization and surgical management of this uncommon disease. We also discussed the safety and effectiveness of central pancreatectomy in the treatmant of benign lesions of the pancreatic body. **Conclusion**. Insulinomas are rare pancreatic neuroendocrine tumors presenting with hypoglycemic symptoms. Surgical removal through enucleation or segmental resection of the pancreas is the mainstay of therapy. Central pancreatectomy may preserve endocrine and exocrine function, as well as the immunological role of the spleen. It is a safe surgical technique with low mortality, but potentially high complication rate. The most common complication is pancreatic fistula.

Key words: Pancreatectomy; Insulinoma; Signs and Symptoms; Hypoglycemia; Diagnosis; Pancreatic Neoplasms; Neuroendocrine Tumors; Treatment Outcome; Risk Factors; Pancreatic Fistula

Sažetak

Uvod. Insulinomi su najčešći pankreasni neuroendokrini tumori. Insulinomi su po pravilu mali solitarni tumori; u najvećem broju slučajeva predstavljaju dobroćudne intrapankreatične promene. Indikacije za centralnu pankreatektomiju u modernoj hirurgiji značajno su sužene. Posmatrano istorijski, ova hirurška metoda korišćena je dominantno u lečenju pankreasnih trauma i hroničnog pankreatitisa. Trenutno se koristi u selektivnom hirurškom lečenju dobroćudnih tumora lokalizovanih u vratu i telu pankreasa. **Prikaz slučaja.** Prikazujemo slučaj uspešnog hirurškog lečenja insulinoma lokalizovanog u telu pankreasa. U radu razmatramo dijagnozu, lokalizaciju i hirurško lečenje ove retke bolesti. Takođe razmatramo bezbednost i efikasnost centralne pankreatektomije u lečenju dobroćudnih promena tela pankreasa. **Zaključak**. Insulinomi su retki pankreasni neuroendokrini tumori praćeni simptomima hipoglikemije. Hirurško uklanjanje enukleacijom ili segmentalnom resekcijom pankreasa predstavlja glavni način lečenja. Centralna pankreatektomija može sačuvati endokrinu i egzokrinu funkciju pankreasa, kao i imunološku ulogu slezine. To je bezbedna hirurška tehnika sa niskim mortalitetom, ali sa potencijalno visokom stopom komplikacija. Najčešća komplikacija je pankreasna fistula.

Ključne reči: pankreatektomija; insulinom; znaci i simptomi; hipoglikemija; dijagnoza; neoplazme pankreasa; neuroendokrini tumori; ishod lečenja; faktori rizika; pankreasna fistula

Introduction

Pancreatic neuroendocrine tumors (pancreatic NETs) are uncommon neuroendocrine neoplasms that are believed to arise from pancreatic endocrine cells. Pancreatic NETs are also called islet cell tumors, because the endocrine cells of the pancreas are commonly located in clusters, anatomically called islets of Langerhans [1]. The functional pancreatic NETs are well-differentiated neoplasms with very diverse presentations related to their ability to produce and secrete hormones or peptides, such as insulin, gastrin, glucagon, vasoactive intestinal polypeptide (VIP), and somatostatin, causing characteristic hormonal syndromes [2, 3]. Of these functional tumors, up to 70% are insulinomas. Insulinomas are typically solitary tumors small in size (<1 cm). Approximately 90% of insulinomas are benign lesions that are almost always (>99%) intrapancreatic in location [4]. Insulinoma patients usually present with

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Abbreviations

Pancreatic NETs	– pancreatic neuroendocrine tumors
CECT	– contrast-enhanced computed tomography
CT	– computed tomography

symptoms of hypoglycemia. Hypoglycemia is defined by Whipple's triad or Whipple's criteria consisting of central nervous system symptoms of neuroglycopenia, a simultaneous low blood glucose level, and relief of the symptoms after administration of glucose [5]. Central pancreatectomy was first described and performed by Guillemin and Bessot in 1957, in the treatment of chronic pancreatitis. This surgical procedure is currently reserved for selective management of benign lesions located in the pancreatic neck and body. The main benefit of central pancreatectomy is the preservation of pancreatic endocrine and exocrine function, as well as spleen preservation, that is important especially in younger patients [6].

Case report

We present a case of sporadic insulinoma in a young, 24-year-old female patient, who presented with a 2-month history of episodic shaking, diaphoresis, increased hunger, confusion, obtundation and fainting. Symptoms of neuroglycopenia were predominant, so the family members reported that the patient has undergone a personality change. Subsequently, the patient was admitted to the Psychiatry Clinic, Clinical Center of Vojvodina. Initial laboratory investigations showed low blood glucose of 1.8 mmol/L (normal range, 4.4 to 6.1 mmol/L). Due to repeatedly low blood glucose levels, an endocrinologist was consulted. The patient was then admitted to the Clinic of Endocrinology for further examination as a possible case of pancreatic insulinoma. A 72-hour mentored fasting test was done, during which blood was drawn and results showed low blood glucose level, (2.1 mmol/L), elevated insulin of 74.6 mU/l (normal range, 3-25 mU/l) and C-peptide level of 8.4 ng/ml (normal range, 0.8-3.9 ng/ml). The hypoglycemic symptoms were relieved after glucose administration. The patient underwent an abdominal contrast-enhanced computed tomography (CECT) scan that showed a 12 x 15 x 17 mm, well-demarcated, heterogeneous lesion within the body of the pancreas **(Figure 1)**. Locoregional lymphadenopathy and liver metastasis were excluded by CECT. The patient was then admitted to the Clinic of Abdominal, Endocrine and Transplantation Surgery, Clinical Center of Vojvodina, and underwent surgical treatment. Central pancreatectomy was performed, with complete removal of the tumor **(Figure 2)**, and conservation of head and distal pancreas. The main pancreatic duct within the head of the pancreas was individually ligated with a permanent suture, and posterior pancreatic capsules were approximated with full-thickness interrupted absorbable sutures **(Figure 3)**. Anterior and posterior wall of pancreas were approximated with full-thickness interrupted absorbable sutures. The reconstruction of pancreaticoenteric anastomosis was accomplished with a retrocolic, Roux-en-Y pancreaticojejunostomy **(Figure 4)**. The specimen of resected pancreatic tissue was transected to show a well-demarcated lesion **(Figure 5)**. Histological evaluation and immunohistochemical examination of the specimen confirmed a pancreatic NET - insulinoma. The patient had an uneventful recovery. The post-operative follow-up showed resolution of hypoglycemic symptoms and normal blood glucose and insulin levels. Computed tomography (CT) imaging showed no evidence of tumor recurrence.

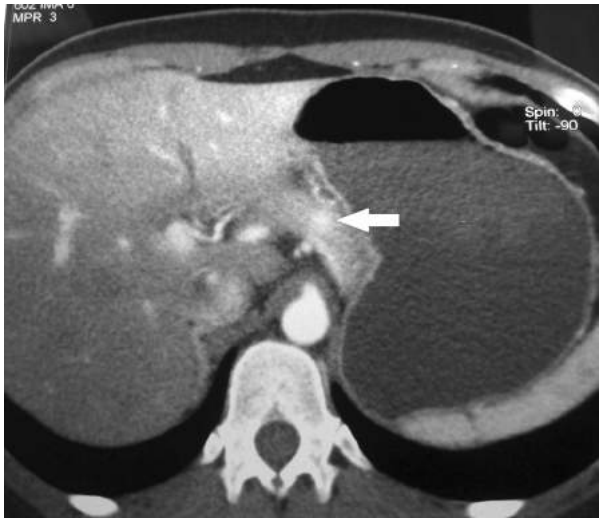

Figure 1. Axial view of the abdominal CECT scan: showing 12 x 15 x 17 mm well demarcated lesion located within the neck of the pancreas (arrow)
Slika 1. *Aksijalni presek kontrastom poboljšane kompjuterizovane tomografije: prikazuje 12 x 15 x 17 mm jasno ograničenu promenu lokalizovanu u vratu pankreasa (strelica)*

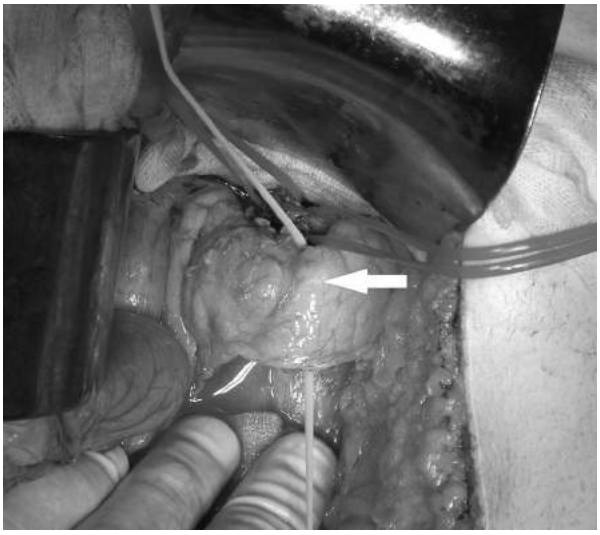

Figure 2. Intraoperative view showing the insulinoma in the pancreatic body (white arrow)
Slika 2. *Intraoperativni prikaz insulinoma tela pankreasa (bela strelica)*

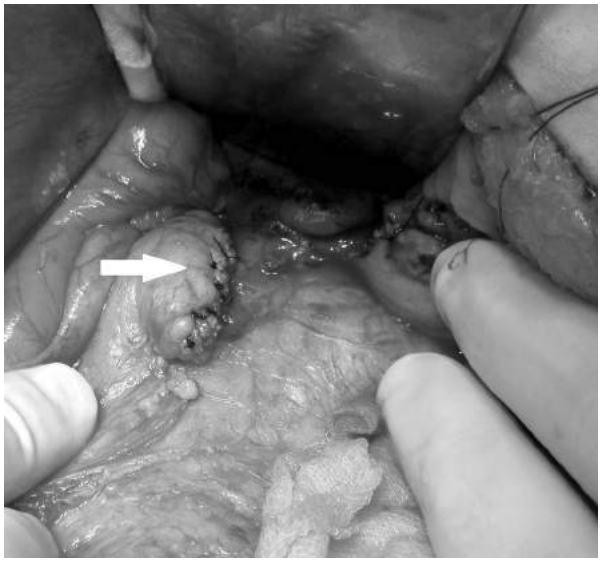

Figure 3. Intraoperative view showing the preserved head of the pancreas after central pancreatectomy (white arrow)
Slika 3. *Intraoperativni prikaz prezervirane glave pankreasa nakon centralne pankreatektomije (bela strelica)*

Discussion

Insulinomas are functional pancreatic NETs which secrete endogenous insulin autonomously, regardless of blood glucose levels, resulting in a state of hyperinsulinemia [7]. In the majority of cases they present as solitary sporadic tumors localized in the pancreas, but they can also be part of multiple endocrine neoplasia type 1 (MEN 1) [4]. Insulinomas are generally small tumors (<1 cm) that are best located by using endoscopic ultrasound (EUS). Although the majority of insulinomas have a benign course and can be managed by surgery, it is important to diagnose large tumors with possible liver metastases using CT or magnetic resonance imaging (MRI), because it may completely change the surgical strategy [3].

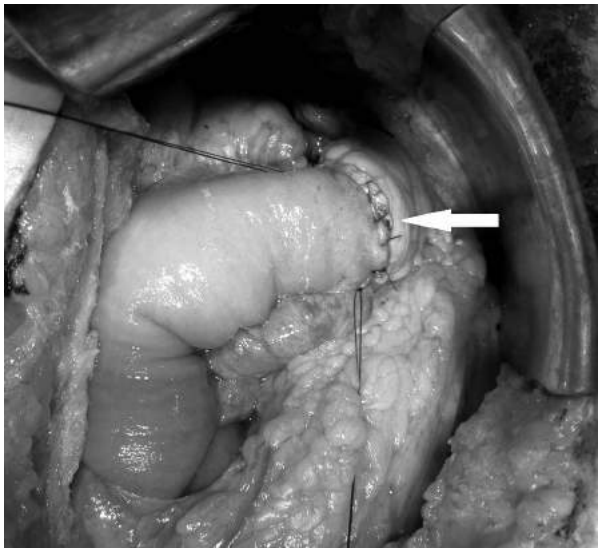

Figure 4. Intraoperative view after Roux-en-Y, end-to-end pancreaticojejunostomy (white arrow)
Slika 4. *Intraoperativni prikaz nakon Roux-en-Y, termino-terminalne pankreatikojejunostomije (bela strelica)*

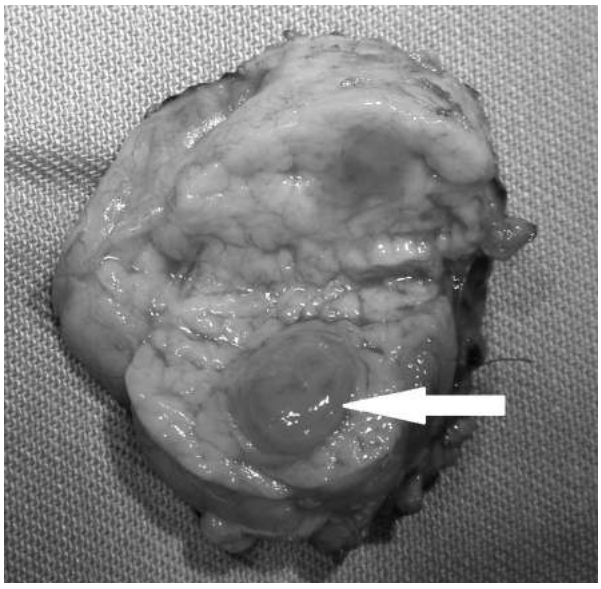

Figure 5. The transected specimen of the resected pancreatic tissue with well-demarcated lesion – insulinoma
Slika 5. *Transecirani preparat reseciranog tkiva pankreasa sa jasno ograničenom promenom − insulinom*

Pancreatic leak is the most common complication of this surgical technique. The pancreaticoenteric anastomosis is the weak point of every pancreatic resection that includes drainage of the pancreatic remnant to the gastrointestinal tract. The majority of pancreatic leaks have a benign course and do not require any intervention, except long-term maintenance of intraoperatively placed drains [8]. In complicated cases, pancreatic leaks may lead to formation of abscess and/or destruction of the surrounding tissues. If erosion of blood vessels occurs, it can cause severe hemorrhage, which is the major cause of postoperative mortality [9]. In our case, the exocrine function of the pancreas was reestablished with a retrocolic, Roux-en-Y pancreaticojejunostomy. For more common pancreatoduodenectomies, we routinely perform a 2-layer, end-to-side, duct-to-mucosa pancreaticojejunostomy with a free-floating stent [10]. Preserved exocrine and endocrine function of pancreas are major benefits of this surgical technique. Meta-analysis by Iacono et al., which included two prospective and nineteen retrospective studies emphasize the significance of preserved exocrine and endocrine function in central pancreatectomy, in comparison to distal pancreatectomy [11]. Although technically demanding and not always feasible, spleen preservation is a major immunological advantage. Patients without a spleen have an impaired phagocytosis and opsonization, as well as decreased levels of immunoglobulins. Overwhelming postsple-

nectomy infection (OPSI) syndrome is a rare but serious complication of splenectomy, with mortality rates approaching 50% [12].

Conclusion

Insulinomas are rare pancreatic neuroendocrine tumors, but they should always be considered in the differential diagnosis of any patient presenting with frequent hypoglycemic symptoms. Surgical removal through enucleation or segmental resection of the pancreas is the mainstay of therapy. Central pancreatectomy may preserve endocrine and exocrine function, as well as the immunological role of the spleen. It is a safe surgical technique with low mortality, but potentially high complication rate. The most common complication is pancreatic leak. Central pancreatectomy is a demanding surgical procedure and should only be performed at high-volume centers by experienced surgeons.

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PARACARDIAL CYST IN AN INFANT WITH PLEURAL EFFUSION - A CASE REPORT

PARAKARDIJALNA CISTA KOD ODOJČETA SA PLEURALNOM EFUZIJOM − PRIKAZ SLUČAJA

Olgica MILANKOV[1,2], Radoica JOKIĆ[1,2,3], Radojica SAVIĆ[1,2] and Milena BJELICA[2]

Summary

Introduction. Paracardial cysts are rare lesions adjacent to the heart, mostly congenital in origin. They include pericardial and neural cysts, bronchogenic cysts, esophageal duplication cysts, neurenteric cysts, and cysts of other origin. **Case report.** A four-month-old female was admitted to our department for diagnostic evaluation of a left pleural effusion. The child did not have any difficulties. Computed tomography and magnetic resonance imaging confirmed a giant dumbbell-shaped extrapulmonary multiloculated cyst with fluid-filled cavities, detached from the pericardium, bronchial tree and pleura. Left-sided thoracoscopy confirmed a cystic formation attached to the lung parenchyma, esophagus, pericardium and diaphragm. Its outer surface was glistening and filled with clear fluid. During cyst wall preparation, an opening of the esophageal wall was noticed, and a conversion to the left posterolateral thoracotomy was made. The cyst was removed completely, and the defect of anterior wall of the esophagus was sutured, via the nasogastric tube. Histopathological examination confirmed the diagnosis of a pericardial cyst. **Conclusion.** Pericardial cysts are rare and often clinically silent. If the existence of these cysts is suspected, a thorough work-up is required in order to make an accurate diagnosis.

Key words: Pleural Effusion; Mediastinal Cyst; Infant; Signs and Symptoms; Diagnosis; Treatment Outcome; Thoracoscopy; Esophageal Fistula

Sažetak

Uvod. Parakardijalne ciste su cistične formacije koje se nalaze pored srca ili vode poreklo od srčanih struktura a uključuju perikardne i neuralne ciste, bronhogene ciste, duplikature jednjaka, neurenterične ciste i ciste drugog porekla. **Prikaz slučaja.** Odojče uzrasta četiri meseca primljeno je na naše odeljenje radi dijagnostičke evaluacije levostranog pleuralnog izliva. Odojče nije imalo nikakve tegobe. U sklopu dijagnostike urađena je kompjuterizovana tomografija i magnetna rezonancija, koje su potvrdile postojanje ekstrapulmonalne multilokularne ciste izuzetno velikih dimenzija u obliku tega, sa šupljinama ispunjenim tečnošću koja nije u vezi sa perikardom, bronhijalnim stablom niti pleurom. Levostranom torakoskopijom potvrđena je cistična formacija koja prianja za plućni parenhim, jednjak, perikard i dijafragmu. Spoljašnja površina ciste bila je sjajna dok je cista bila ispunjena bistrom tečnošću. Tokom preparacije zida ciste uočeno je postojanje otvora na zidu jednjaka te je načinjena posterolateralna torakotomija. Cista je u potpunosti uklonjena, dok su na defekt na prednjem zidu jednjaka postavljene suture sa nazogastričnom sondom kao protezom. Histopatološki nalaz je potvrdio dijagnozu perikardne ciste. **Zaključak.** Perikardna cista se javlja retko i obično je asimptomatska. Ako se posumnja na postojanje ove ciste, potrebna je detaljna dijagnostika da bi se postavila prava dijagnoza.

Ključne reči: pleuralni izliv; medijastinalna cista; odojče; znaci i simptomi; dijagnoza; ishod lečenja; torakoskopija; ezofagealna fistula

Introduction

Paracardial cysts are rare lesions adjacent to the heart, commonly of congenital origin. They include pericardial and neural cysts, bronchogenic cysts, esophageal duplication cysts, neurenteric cysts, and cysts of other origin. These formations are mostly located behind the heart, and usually found incidentally upon chest ultrasound, radiography, computed tomography, magnetic resonance imaging, cardiac ultrasound, or on thoracoscopy and thoracic surgery. The differential diagnosis includes lymphangioma, congenital diaphragmatic hernia or thymic cyst [1].

Case report

A four-month-old female was admitted to our department for diagnostic evaluation of a left pleural effusion. This was an accidental finding during previous hospitalization due to prolonged jaundice (at two months of age), when abdominal ultrasound was performed. In the meantime, an ultrasound follow-up was performed. However, the effusion measuring 6 – 11 mm remained in the left phrenicocostal sinus. The child did not have any difficulties.

She was a late preterm baby, born at 36 weeks of gestation, as the first child of nonrelated parents, after second pregnancy (one induced abortion due to absence of cardiac action). During this pregnancy, ultrasound examination revealed a pericardial effusion and supraventricular tachycardia. The baby's birth weight was 2,59 kg, body length 48 cm, and Apgar score 9/9. She was examined by a cardiologist, and no pericardial effusion or tachycardia were observed.

On admission she was alert, with a rectal temperature of 37 °C, respiratory rate 28 per minute,

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Abbreviations
CT – computed tomography

pulse rate 122 per minute. The body weight was 7200 g (50th centile), body length 67 cm (90th centile). The respiratory system examination revealed a bilaterally clear chest. On precordial examination, the heart sounds were soft and feeble. Apart from mild eczema, the physical examination revealed no abnormalities or any irregularities.

The chest X-ray showed widened mediastinum, with right paracardial lung infiltration shadow, that followed the contours of the heart. The control ultrasound examination suggested a large cystic lesion occupying a space in the mediastinum, involving both sides of the chest. The portion of the cyst in the right paracardiac region was 44 x 45 mm, and the portion in the left paracardiac region was 51 x 75 mm. A subsequent computed tomography (CT) and magnetic resonance imaging (MRI) confirmed a giant dumbbell-shaped extrapulmonary multiloculated cyst with fluid-filled cavities, detached from the pericardium, bronchial tree and pleura **(Figure 1)**.

Left sided thoracoscopy confirmed a cystic formation that was attached to the lung parenchyma, esophagus, pericardium and diaphragm. Its outer surface was glistening and the cyst was filled with clear fluid. During cyst wall preparation, an opening of the esophageal wall was observed, and a conversion to the left posterolateral thoracotomy was made. The cyst was removed completely, and the defect of the anterior esophageal wall was sutured, via the nasogastric tube. During surgery, esophagography showed no anastomotic leaks. At the end of surgery, a thoracic drain was placed. Postoperatively, the child was admitted in a surgical intensive care unit, and was extubated on the first postoperative day. Antibiotic therapy was initiated with ceftriaxone (Longaceph^{R}) and metronidazole (Efloran^{R}) during the first 7 days. Control X-ray of the heart and lungs showed a right paracardial lung infiltration shadow, as described previously. The right costophrenic sinus was clear. Left-sided pleural effusion was found. On the sixth postoperative day, the child developed fever and signs of sepsis. Control esophagogram revealed an esophageal anastomotic leak. Antibiotics were changed according to the antibiogram and drainage of the thorax continued. On the twelfth postoperative day, there was no contrast leakage at the anastomotic site. Ten days later, a large pneumothorax occurred on the left lung and was treated. After that, the postoperative course was uneventful.

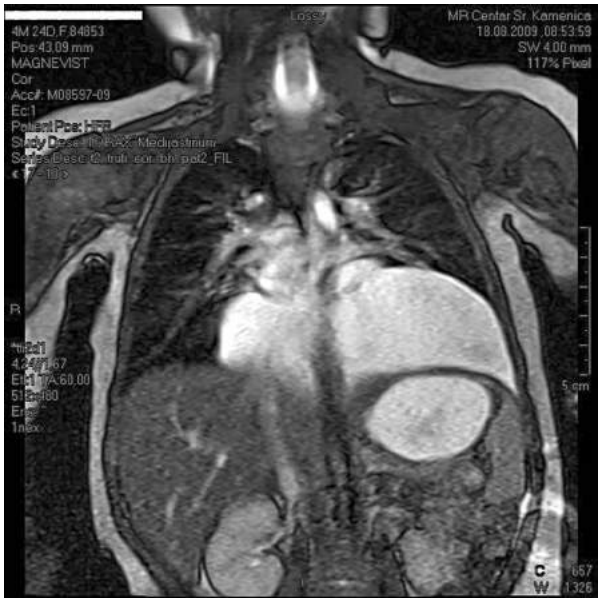

Figure 1. A giant dumbbell-shaped extrapulmonary multiloculated cyst with fluid-filled cavities, detached from the pericardium, bronchial tree and pleura
Slika 1. *Ekstrapulmonalna multilokularna cista izuzetno velikih dimenzija u obliku tega sa šupljinama ispunjenim tečnošću koja nije u vezi sa perikardom, bronhijalnim stablom niti pleurom*

Repeated CT scan of the chest showed the previously described septated cystic lesion in the right hemithorax (38 x 84 x 46 mm) and vascular malformations of the great arteries. The cardiologist performed echocardiography which confirmed a small atrial septal defect without hemodynamic significance that required no treatment.

The histopathological examination confirmed the diagnosis of a pericardial cyst.

Discussion

Mediastinal cysts are uncommon and usually diagnosed by routine radiographic imaging procedures.

Pericardial cysts are defined as unilocular, fluid-filled masses that arise from the mediastinal fat, with walls composed of connective tissue and a single layer of mesothelial cells. They can communicate with the pericardial space. Pericardial effusion may sometimes occur because of spontaneous emptying or rupture of the cyst into the pericardial space. This may explain resolution of the cyst as well as the transient appearance of a small pericardial effusion, as seen in our patient prenatally [2].

Lymphangiomas are cystic malformations of the lymphatic vessels that appear as single or multiloculated fluid-filled cavities. Surgical excision of the cyst is the treatment of choice, but spontaneous regression may occur as well. The chest lymphangioma appears to be a lesion usually not associated with other congenital abnormalities [3].

Single cysts located in the posterior mediastinum encompass derivatives of the primitive foregut (enteric, bronchogenic, and esophageal duplication) and, occasionally, atypically located pericardial cysts. Neurenteric canal cyst is presumably the result of incomplete separation of the notochord from the foregut in embryogenesis. The extraspinal form is usually located in the right posterior chest and associated with vertebral anomalies [4]. As a reflection of the cyst's size and proximity to the heart,

great vessels and airways, mediastinal shifting and compression of the surrounding structures may be encountered. As such, mediastinal cysts tend to present with respiratory symptoms, including tracheomalacia or bronchomalacia.

Bronchogenic cysts result from abnormal budding of the ventral diverticulum of the primitive foregut. On ultrasound exam they present as single unilocular, echo-free cystic structures within lung parenchyma or within the posterior mediastinum. Unlike neurenteric cysts, bronchogenic cysts are usually small and not associated with prenatal complications, based on the limited experience with prenatally diagnosed cases [5]. However, mediastinal bronchogenic cysts are located near the carina between the trachea and the esophagus and, therefore, obstruction of the main bronchi resulting in respiratory distress is a well-established complication.

The differential diagnosis of paracardial cysts includes pericardial cyst, lymphangioma, esophageal duplication cyst, bronchogenic cyst and neurenteric cyst. Pericardial cysts may spontaneously resolve, while cysts of other entities are likely to persist and require surgical treatment.

In the available literature, we found no connection with genetic disorders for this kind of anomaly, which certainly does not exclude the possibility of their existence. The etiology of the cyst is often not known when being treated by the surgeon, therefore it is necessary to perform thorough diagnostic evaluation that would precede thoracic surgery.

Conclusion

Pericardial cysts are rare, often clinically silent, but may cause life threatening complications. As a result, it is necessary to keep such anomalies in mind, especially when evaluating patients who have chest complaints. If the existence of these cysts is suspected, thorough work-up is required to make an accurate diagnosis.

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A SHORT JOURNEY THROUGH THE HISTORY OF MEDICAL ETHICS

KRATKO PUTOVANJE KROZ ISTORIJU MEDICINSKE ETIKE

Artur BJELICA

Summary

Introduction. The understanding of history in general, as well as of the history of every particular human activity, is of utmost importance. Judging from the vast amount of available literature, this is especially true for the history of medical ethics. This article is a brief survey of the history of medical ethics from the ancient times to the present days. It includes the most important events, prominent names in the field of medicine of the given time, and the heritage they left behind in different parts of the world. **Ancient Times.** Although certain codes associated with the practice of healing existed in the ancient civilizations of Mesopotamia and Egypt, the most important is the heritage of ancient Greeks, primarily due to the activities of a small medical school on the island of Cos, headed by Hippocrates. **Middle Ages.** Even though the Middle Ages are often called the "dark ages", this era was marked by significant scientific and medical advancements. It was the time when the first medical guilds were founded, and great medical works of Greco-Roman authors were rediscovered and translated. **The Age of Enlightenment and the 19th Century.** This was the period when numerous writings on medical ethics appeared, and medical associations were founded, first of all in the Great Britain and the United States of America. **Modern Times.** The twentieth century was characterized by unprecedented advances in medical practice and research. Of special importance is the foundation of the World Medical Association. **Conclusion.** In all the cultures of the world, through all the ages, the individuals involved in healing of the sick had to respect certain ethical codes of conduct.

Key words: History of Medicine; Ethics, Medical; Famous Persons

Sažetak

Uvod. Poznavanje opšte istorije, kao i istorije svake pojedine ljudske aktivnosti, od neporecive je važnosti. Sudeći prema ogromnoj količini raspoložive literature, ovo naročito važi za istoriju medicinske etike. U radu se daje sažet pregled istorije ove etičke discipline od davnih vremena do današnjih dana. Navode se najvažniji događaji, imena istaknutih delatnika na polju medicine u pojedinim vremenima, kao i nasleđe koje su oni ostavili u različitim regionima sveta. **Stari vek.** Iako su neki kodeksi o praktikovanju lečenja postojali još i u starim civilizacijama Mesopotamije i Egipta, najvažnije za nas je nasleđe stare Grčke, u prvom redu zahvaljujući radu jedne male grupe tamošnjih medicinara, na čelu sa Hipokratom. **Srednji vek.** Mada se srednji vek često naziva „mračnim dobom", ovu eru su obeležila značajna dostignuća u nauci i medicini. To je bilo vreme osnivanja medicinskih esnafa i ponovnih otkrića i prevođenja medicinskih radova grčko-rimskih autora. **Doba prosvetiteljstva i 19. vek.** To je bio period pojave brojnih radova iz medicinske etike i osnivača medicinskih asocijacija, prvenstveno u Velikoj Britaniji i Sjedinjenim Američkim Državama. **Moderna vremena.** Dvadeseti vek je obeležen do tada neviđenim napretkom u medicinskoj praksi i istraživanju. Posebno važno bilo je osnivanje Svetske medicinske asocijacije. **Zaključak.** U svim kulturama i tokom svakog vremenskog perioda pojedinci koji su se bavili lečenjem ljudi pridržavali su se određenih etičkih kodeksa.

Ključne reči: istorija medicine; medicinska etika, poznate ličnosti

Introduction

Although history is concerned with the past, it is a key to better understanding of present and future. The manifold importance of history can be best perceived from famous Cicero quotes, known in several variations, of which we chose this one: History is the witness of the times, the light of truth, the life of memory, the teacher of life, and the messenger of antiquity (Historia est testis temporum, lux veritatis, vita memoriae, magistra vitae, nuntia vetustatis), mostly remembered as: History is life's teacher (Historia magistra vitae est). Although it is related to history in general, it may also concern the history of every branch of human activity [1].

It goes without a doubt that every human activity has its own history, be it long or short. Studies in any subject are often "spiced up" with a smaller or greater

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Abbreviations
AMA – American Medical Association
WMA – World Medical Association

amount of pertinent history. When it comes to the history of medical ethics, one may be surprised by how much attention has been given to the subject. There are numerous books, treatises, reviews and articles, of which Google gives hundreds of thousands of hits in response. As for the books, let's mention only two, just for illustration. One of them, which stands out for its comprehensiveness, is "The Cambridge World History of Medical Ethics" a huge volume of 904 pages, written by tens of authors. It was "the first comprehensive scholarly account of the global history of medical ethics", published in 2008 [2]. Eight years earlier, the rival university (Oxford) published "A Short History of Medical Ethics", a rather slim book (168 pages), written by Albert R. Jonsen [3]. Thus, those who want to deepen their knowledge in this field, the recommended choice, though limited to only two options, will suit the purpose.

After the above introductory remarks, whose purpose is to emphasize the importance of the planned undertaking, we have to choose a guidebook for our journey. Certainly, the mentioned Cambridge book would not be practical because of its weight; hence, we will take a much lighter "travel book" [4]. Of course, we will also use some other sources to get more detailed information on this specific tour. Since we are going to cover vast time periods and great distances, move from one era to another, and from one region to another, we need to take a deep breath and start the journey.

Ancient Times

Although certain codes associated with the practice of healing existed in the ancient civilizations of Mesopotamia (e. g. Code of Hammurabi) and Egypt (a number of papyri), the most important is the heritage of ancient Greece, the cradle of Western civilization [5, 6].

In the ancient Greece, Asclepius, son of Apollo, was the god of medicine. His five daughters (Hygieia, Iaso, Aceso, Aglaea and Panacea) represent five aspects of good health and healing. His statue, shown with a rod entwined by a snake, has remained a symbol of medicine. The legend says that he was killed by Zeus, and that he had a temple on the island of Cos. It might seem that it is not a pure coincidence that the same island was the "birthplace" of medicine as a scientific discipline [7, 8].

Indeed, the foundation of Western medicine is related to the activity of a small medical group on the island of Cos, headed by Hippocrates (c. 460 - 377 BC). Interestingly, both his father and his grandfather were also physicians. Hence, he is referred to as the father of Western medicine, and the Hippocratic School of medicine made a lasting contribution to the field. This school established medicine as a special field distinct from the other existing disciplines, as well as a profession [9].

Hippocrates traveled around Greece and taught students that medical conditions should not be attributed to divine actions, but that there were scientific reasons for diseases. He claimed that all diseases originate in natural causes. He made the diagnosis and prescribed simple treatments like diet, hygiene, and sleep. His name is known even to those who are not engaged in medicine due to the famous Hippocratic Oath, which is still taken by physicians today [10].

Even though it had little influence on the development of medical ethics in the West, one ought to mention significant achievements of Indian Ayurvedic medicine. In the canonical text *Charaka Samhita*, there is also an oath of initiation similar to the Hippocratic Oath. However, it should be noticed that the practice of physicians was limited to their own castes [11].

To follow the line of development of medicine and medical ethics that was more important for the Western civilization, we have to return to the above "Greek story". After Greece was conquered by the Romans, many Greek doctors continued their practice throughout the Roman Empire. The well known author of that time, Scribonius Largus, a physician who settled in Britain with the Emperor Claudius in AD 43, was one of those concerned with medical ethics and Hippocratic Oath. Another great name of the Roman times was Galen (AD 129 - 216), who was the first to introduce scientific experimentation and dissection. According to him, a good physician had to gain the patient's trust, and deserved appropriate rewards [12].

After the fall of the Roman Empire, physicians in the countries of Christianity, Judaism and Islam became custodians of Hellenic and Roman medical knowledge. The split of Christianity into the Eastern and Western churches led to a decline in the training and medical practice, as these were provided mainly by religious (monks and nuns) and not by secular people.

Islamic scholars from the caliphates of Baghdad, Damascus, Cairo, Cordoba, etc made significant contributions to medicine and medical ethics as well. Two outstanding men, known by their westernized names are: Al-Razi, known in the West by his Latin name, Rhazes (865 – 925), who wrote "Practical Ethics", and Ibn Sina, also known in the West by a Latinized name, Avicenna (980 – 1037), wrote in the spirit of Hippocrates and Galen, but emphasizing the importance of religious beliefs [13].

Of Jewish medieval physicians, the best known is Moses ben Maimon, or Maimonides (1135 – 1204), who was born and educated in Cordoba, but lived in Cairo.

He translated works of Hippocrates, Galen and Avicenna, and commented on ethical aspects of good medical practice in his well-known aphorisms [14].

Middle Ages

Although the Middle Ages are often called the "dark ages", this era was marked by significant sci-

entific and medical advancements. At universities, medical students had to study the works of Hippocrates and Galen for five years after studying humanities, followed by one year of supervised practice before obtaining their degree. At that time (13th century) medical guilds appeared in Paris, Venice and Florence. Apart from protecting their livelihood, the guild members were also engaged in charity work.

The age of the Renaissance was the time of rediscovery and translation of great medical works of Greco-Roman authors. As some doctors also conducted scientific research, new discoveries were made in anatomy and physiology. The duties of practitioners, forced upon by an outbreak of plague, were considered burning ethical issues, being a point of disagreement between the Catholic and Protestant churches for centuries. While Martin Luther and some Catholic theologians argued that the practitioners had to stay and treat the sick, Calvinists and rabbinical authorities thought that educated people should flee, to save their lives for the good of the society. An idealistic view on this issue was expressed by apothecary William Boghurst: "… Ministers must preach, captains must fight, and physicians attend upon the sick" [15].

The further survey of the historical development of medicine and medical ethics will be limited to several Western countries.

The Age of Enlightenment and the 19th Century

As far as Britain is concerned, one has to mention great contributions of the outstanding professor of medicine at the University of Aberdeen and professor of physics at the University of Edinburgh, John Gregory (1725 – 1773). He wrote "Lectures Upon the Duties and Qualifications of a Physician", a work which was greatly influenced by the philosophical concepts of his great contemporaries – David Hume and Adam Smith [16]. In practice, he treated patients of all classes with the same compassion and care, which, in a strictly class-conscious society, was a revolutionary concept. And he requested the same from his students. His successor was Thomas Percival (1740 – 1804), who wrote "Medical Ethics, or a Code of Institutes and Precepts Adapted to the Professional Conduct of Physicians and Surgeons". It is interesting to note that the proposals of this treatise were not adopted by the British Medical Association at its foundation meeting in 1857 [17].

However, the "Code of Medical Ethics" of the American Medical Association (AMA), founded in 1847, was largely based on Percival's work. The three chapters of this document: "Of the Duties of Physicians to their Patients, and of the Obligations of Patients to Their Physicians", "Of the Duties of Physicians to Each Other and to the Profession at Large", and "Of the Duties of the Profession to the Public, and of the Obligations of the Public to the Profession", elaborated all the essential aspects of the physician-patient-society relationships. Although this code was in the beginning accepted widely in the United States of America and reprinted in London, Berlin, Paris, Vienna, and elsewhere, because of the disputes that had arisen over some of its articles, many specialists quit the AMA. To reconcile the advocates of opposed attitudes, in 1903 the AMA adopted the "Principles of Medical Ethics". It should be added that this document has been revised several times [18, 19].

Modern Times

The twentieth century was marked by an unprecedented proliferation of advances in medical practice and research. Of special significance was the discovery of the molecular structure of deoxyribonucleic acid (DNA) in 1953, which opened new fields of research in genetics. Breakthroughs were also made in surgery, including organ transplantation, development of oral contraceptives, improvements in diagnostic technology such as ultrasounds, computerized axial tomography (CAT) and positron emission tomography (PET) scans, synthesis of new potent drugs, etc. These advances have raised certain questions about the roles and responsibilities of all health care professionals, patients and their families, and the public in general. The issues that have been (and still are) subject of discussions and negotiations include the patients rights, access to healthcare resources, and the readiness of physicians to fight for their individual and collective rights.

Finally, we have to say that this survey cannot be complete without paying due attention to the role of the World Medical Association (WMA). It is an international and independent confederation of national medical associations, founded in 1947 by physicians from 27 countries; the number of member associations in 2013 being 102. Its purpose is to provide a forum for active cooperation aimed at achieving consensus concerning high standards of medical ethics and promote the professional freedom of physicians worldwide. In the domain of Ethics, the WMA, through various declarations, resolutions and statements, aims to help national medical associations, governments and international organizations in their actions concerning all the aspects of medical ethics [20].

Conclusion

What to say upon ending this journey? Firstly, we are aware that in all the cultures of the world and through all the ages, individuals involved in healing of the sick had to respect certain ethical codes. There are numerous written documents testifying of this, of which the best known is the Hippocratic Oath. Although it was written in the late fifth century before Christ, it is still taken upon graduation in many countries of the world. The other sources about the history of medical ethics that have been passed down to us, from the ancient to more recent ones, also contain praiseworthy messages which are in compli-

ance with the mentioned Cicero quotes. However, when reading history, we are constantly tempted to compare the-state-of-the-art in the past and in the present. A general conclusion might be that all the documents written on the subject of our concern here, especially the older ones, assume a rather idealized physician-patient relationship, which is possible when a patient is treated by only one doctor. Today, when a number of different specialists are involved, the ethical issues become more complex, which presents a challenge to both physicians and patients.

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PIONEERS OF PEDIATRIC SURGERY IN NOVI SAD

PIONIRI DEČJE HIRURGIJE U NOVOM SADU

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Summary

Introduction. Until the mid-twentieth century, children with surgical conditions in Novi Sad were treated at the City Hospital, along with adult patients. The idea of establishing the pediatric surgery service came from Dr. Nestor Teodorović, but his idea was embraced and developed by Dr. Vladimir Jakovljević. In 1956, the Department of Pediatric Surgery was founded, and Dr. Dušan Jovanović, a young specialist, was the head of the department. As the number of children patients was growing, the need for organisational separation of pediatric surgery grew as well. In 1959, the Department of Pediatric Surgery and Orthopedics was founded, with 55 beds. **Pioneers.** Dr. Dušan Jovanović remained the head of the department, and Dr. Miroljub Vidaković started his specialization in pediatric surgery. Over the following years, seven more doctors began their specialist training: Dr. Dušan Pajić in 1962, Dr. Slobodan Petrović in 1963, Dr. Stanislav Stojanović, Dr. Branislava Savić Kozomorić, Dr. Živorad Jocić in 1965, and two years later Dr. Božidar Rašić and Dr. Velimir Stojanović. The young specialists initiated new pediatric surgical disciplines: neonatal surgery, urology and thoracic surgery, with 70 beds. The professional surgical team consisted of surgeons and anesthesiologists: Prim. Dr. Klara Gašpar Klopka, Prim. Dr. Đerđi Terek Turajlija and Dr. Olga Grozdanova. In 1977, pediatric surgery was integrated with other pediatric health services, and the Pediatric Surgery Department became the Pediatric Surgery Clinic and was moved into a new purpose built building of the Institute for Mother and Child Health Care. At present, the Pediatric Surgery Clinic in Novi Sad, a tertiary health care institution, is located at the Institute for Child and Youth Health Care of Vojvodina, as a specialized regional center. It has five operating theatres, employing 36 doctors, specialists and subspecialists in surgery and anesthesiology. The pioneer generation had established high professional standards, core values and a deep belief in the dignity of hard work and true commitment.

Key words: Pediatricians; Surgeons; History of Medicine; Hospitals, Pediatric; History, 20th Century

Sažetak

Uvod. Do sredine dvadesetog veka, u Novom Sadu, deca sa hirurškim oboljenjima i povredama lečena su u Gradskoj bolnici, gde i odrasli bolesnici. Ideja o osnivanju službe dečje hirurgije potekla je od dr Nestora Teodorovića ali je zaživela i ostvarena tek kada je dr Vladimir Jakovljević došao na mesto načelnika hirurgije u bolnici. Uz razumevanje i pomoć starijih kolega, 1957. godine dr Dušan Jovanović, specijalista dečji hirurg osniva Odsek za dečju hirurgiju i ortopediju sa 55 postelja jer broj malih pacijenata raste i nastaje potreba za izdvajanjem odeljenja kao posebne celine. **Pioniri.** Na specijalizaciju iz dečje hirurgije 1959. godine dolazi dr Miroljub Vidaković, 1962. dr Dušan Pajić, 1963. dr Slobodan Petrović, dve godine kasnije dr Stanislav Stojanović, dr Branislava Savić Kozomorić, dr Živorad Jocić, a potom dr Božidar Rašić i dr Velimir Stojanović. Pristizanjem mladih specijalista razvijaju se nove discipline hirurgije dečjeg uzrasta: hirurgija novorođenčeta, urologija i grudna hirurgija. Profesionalni tim za operacionom stolom zajedno sa hirurzima činili su anesteziolozi: dr Klara Gašpar Klopka, dr Đerđi Terek Turajlija i dr Olga Grozdanova. Dečja hirurgija 1977. godine integriše se sa pedijatrijskom hospitalnom službom i preseljava u novi objekat Instituta za zdravstvenu zaštitu majke i deteta, prerasta u Kliniku za dečju hirgiju, proširuje program dijagnostičkih procedura i elektivnih operacija, primaju se mladi lekari na specijalizaciju. Danas, Klinika za dečju hirurgiju u Novom Sadu je tercijerna zdravstvena ustanova u sastavu Institutta za zdravstvenu zaštitu dece i omladine Vovodine i predstavlja visoko specijalizovan regionalni centar. Klinika ima pet operacionih sala i 36 lekara, specijalista i supspecijalista iz hirurgije i anesteziologije. Generacija pionira postavila je visoke profesionalne standarde, propisala kvalitetne radne normative i prenela mladim generacijama veru da se svim srcem posvete odgovornim i dostojanstvenim zadacima dečje hirurgije.

Ključne reči: pedijatri; hirurzi; istorija medicine; pedijatrijske bolnice; istorija, 20. vek

Introduction

Until the mid-twentieth century, children with surgical conditions in Novi Sad were treated at the City Hospital **(Figure 1)**, along with adult patients. The operative program comprised abdominal and trauma surgery patients. The idea to establish a pediatric surgery service first came from Dr. Nestor

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Teodorović, head of the Second Surgical Department. His early death prevented him from realizing this idea, but Dr. Vladimir Jakovljević, head of the First and Second Surgical Departments at the City Hospital in Novi Sad embraced and developed the idea. Upon his initiative, in December 1954, a young specialist in general surgery, Dr. Dušan Jovanović was given approval to specialize in pediatric surgery at the University Children's Hospital in Belgrade [1].

In January 1956, Dr. Jovanović returned from Belgrade as a pediatric surgery specialist, and a twenty-bed Pediatric Surgery Unit was opened for the first time in Novi Sad. As the number of children patients was growing, the need for adequate organisational separation of pediatric surgery grew as well. In 1959, the 55-bed ward became the Department of Pediatric Surgery and Orthopedics. Dr. Dušan Jovanović remained its head, and Dr. Miroljub Vidaković began his specialization in pediatric surgery. Over the following years, seven more doctors started a specialist training: Dr. Dušan Pajić in 1962, Dr. Slobodan Petrović in 1963, Dr. Stanislav Stojanović, Dr. Branislava Savić Kozomorić and Dr. Živorad Jocić in 1965, and two years later Dr. Božidar Rašić and Dr. Velimir Stojanović. The young specialists initiated new pediatric surgical disciplines: neonatal surgery, urology and thoracic surgery, with 70 beds [2].

In Novi Sad, the idea of integrating pediatric surgery with pediatric health services came to fruition when the Pediatric Surgery Department became Pediatric Surgery Clinic and moved into a new, purpose built wing of the Institute for Mother and Child Health Care. In 1977, its capacity increased to 86 beds and three operating theatres, four subspecialized departments, an outpatient department, and a 24-hour emergency department for the population of the whole Province of Vojvodina. New equipment had contributed to the improvement of surgical outcomes in neonatal emergencies. Development of pediatric anesthesia and technological support had significantly improved surgical treatment of children. After the establishment of the Intensive Care Unit, critically ill patients were monitored and received better care, which resulted in reduced mortality, particularly decreasing the newborn death rate. The advancement of professional medical knowledge and skills was remarkable with introduction of new surgical techniques and protocols, especially after the doctors returned from advanced training at highly specialized centers of pediatric surgery in London, Paris, Munich, etc. The intensive clinical work of the team of doctors **(Figure 2)** was successful in research and health projects, and the Pediatric Surgery Clinic, with its subspecialty units, was a valuable base for theoretical and clinical knowledge taught at the Novi Sad Faculty of Medicine, founded in 1960 [3].

Figure 1. The facade of the building in which the First and the Second Surgical Departments of the City Hospital in Novi Sad were located and where the medical care of children started in the early twentieth century. Two figures of angels on the facade are symbolic protectors of the sick, injured and weak.

Slika 1. *Fasada zgrade Prvog i Drugog hirurškog odeljenja Gradske bolnice u Novom Sadu gde je početkom dvadesetog veka započelo lečenje malih pacijenata. Fasadu krase dva anđela kao zaštitnici bolesnih, povređenih i nemoćnih.*

The pioneers

Prof. Dr. Dušan Jovanović (1922 – 2009) was the founder and the first executive director (1977 – 1986) of the Novi Sad Pediatric Surgery Clinic. He started his medical studies in Szeged, Hungary, and graduated from the University of Belgrade after the end of World War II [4]. As a young physician, in 1953 he completed specialization in general surgery, and then in pediatric surgery (1956). He broadened his professional experience in Paris, at the surgical clinic at *Hôpital des Enfants Malades*, under the mentorship of Prof. Dr. Marcel Fèvre. Dr. Jovanović contributed a lot in recruiting new surgeons, upgrading medical facilities, as well as in developing subspecialty services. He was a professor of surgery at the Novi Sad Faculty of Medicine (1977 – 1986), full-heartedly devoted to the interests and prosperity of the Pediatric Surgery Clinic.

Prof. Dr. Dušan Pajić (1931 – 2015) was the pioneer in pediatric orthopedics at the Pediatric Surgery Clinic in Novi Sad. He was head of the Pediatric Orthopedic Department, head of Pediatric Surgery Clinic, director of Institute, and professor of surgery at the Faculty of Medicine. A visionary of great energy, Dr. Pajić focused on the area of pediatric ortopedics which had not been fully investigated, with significant incidence of conditions among children that needed medical treatment. It is the outstanding accomplishment of this orthopedic surgeon that nowadays there are no bow legged children, leg length discrepancy caused by hip dislocation and torticollis or wry neck deformities in the region of Vojvodina, which were quite frequent deformities in the mid-20th century in Vojvodina. Dr. Pajić was always a step ahead of his time; he

Figure 2. The pioneers of pediatric surgery in Novi Sad (from left to right, above to below): Prof. Dr. Dušan Jovanović, Prof. Dr. Dušan Pajić, Prof. Dr. Slobodan Petrović, Prof. Dr. Stanislav Stojanović, Prim. Dr. Branislava Kozomorić, Prim. Dr. Božidar Rašić, Prim. Dr. Klara Klopka, Prim. Dr. Đerđi Terek Turajlija, and Dr. Olga Grozdanova

Slika 2. *Pioniri dečje hirurgije u Novom Sadu (sleva nadesno, odgore prema dole): prof. dr Dušan Jovanović, prof. dr Dušan Pajić, prof. dr Slobodan Petrović, prof. dr Stanislav Stojanović, prim. dr Branislava Kozomorić, prim. dr Božidar Rašić, prim. dr Klara Klopka, prim. dr Đerđi Terek Turajlija, dr Olga Grozdanova*

insisted on introducing innovative new approaches in diagnostics and treatment of orthopedic conditions in children. He wrote ten books, presenting his great knowledge and experience in surgery. Even in retirement, he was the inspirer of a higly valuable literary contribution to surgery; together with a number of distinguished surgeons, he was the editor and co-author in "Surgery: Selected Chapters", an exceptional book published in 2009.

Prof. Dr. Slobodan Petrović (1933 – 2015) was a groundbreaker in surgical treatment of urogenital problems in children and adolescents. As a specialist in both pediatric surgery and urology, he had the honor to learn from the pioneer of pediatric urology, Sir David Innes Williams at the Hospital for Sick Children in London, where Dr. Petrović spent several months in a specialist advanced clinical training. Later, he extended his clinical experiences while on a similar training at the Urologischen und Kinderurologischen Klinik der Universitätsmedizin in Mainz, Germany. After his return to the Novi Sad Pediatric Surgery Clinic he set out to introduce specific diagnostic methods and to broaden the operative program by performing complex surgeries in the whole urinary tract. Dr. Petrović was the head the Pediatric Urology Department and it grew into a prominent clinical unit and a representative part of the Pediatric Surgery Clinic. Dr. Petrović also taught surgery at the Faculty of Medicine (1989 – 1998). and in his later career he was a Clinic executive director (1994 – 1998).

Prof. Dr. Stanislav Stojanović (1935 – 2008) was the first head (1977 – 2000) of the Pediatric Abdominal Surgery Ward. As a specialist in both general surgery and pediatric surgery, he never hesitated to perform even the most challenging elective and urgent abdominal surgeries. He was engaged as a supervisor to many postgraduates in the MSM and PhD programs in surgery at the Novi Sad Faculty of Medicine. During the time when he was the vice-dean, due to his good managerial skills, Dr. Stojanović established a relationship between medicine and management to the benefit of the Pediatric Surgery Clinic increasing its prominence in many respects. Dr. Stojanović's contribution to the pediatric surgery was acknowledged and he was awarded the Novi Sad October Prize in 1988.

Prim. Dr. Branislava Kozomorić was the first head (1977 – 1993) of the Neonatal and Infant Surgery Ward. As a restless enthusiast, from the very beginning she was a groundbreaker in a very difficult field – diagnostics and operative treatment of congenital anomalies and diseases of the newborn and infants, and further broadened her surgical knowledge and skills during her four-month advanced training at the Children's Hospital in Munich (Kinderchirurgische Klinik und Poliklinik im Dr. von Haunerschen Kinderspital). Dr. Kozomorić had all the qualities of a highly experienced clinician genuinely devoted to her patients, and until the last day of her 40-year career, she performed surgeries and was engaged in the 24-hour surgical service. She is well remembered for her exceptional dedication by many of her trainees.

Prim. Dr. Božidar Rašić joined the physician team in 1967, as a young MD of encyclopedic knowledge and love for surgical literature. Dr. Rašić was an abdominal surgeon, at disposal for both planned and urgent surgical procedures. His special qualities as a primarius were patience, kind attitude, and a high level of professional competence.

The professional team consisted of surgeons and anesthesiologists.

Prim. Dr. Klara Gašpar Klopka was the founder and a distinguished head of the Department of Pediatric Anesthesiology and Resuscitation. She was a hardworking, responsible anesthesiologist, always willing to share her knowledge and experience with her coworkers and young physicians.

Prim. Dr. Đerđi Terek Turajlija was an experienced anesthesiologist, predominantly working with the newborns. She was an exceptional anesthesiologist, and after the operating theatre, greately contributed to the post-operative pain management in the youngest patients.

Dr. Olga Grozdanova (1941 – 2008) was a role model of a reliable anesthesiologist who was always willing to be part of the operating team, for both planned and urgent surgeries.

At present, the Pediatric Surgery Clinic in Novi Sad is a tertiary health care institution located at the Institute for Child and Youth Health Care of Vojvodina as a specialized regional center. It has five operating theatres, 36 doctors, specialists and subspecialists in surgery and anesthesiology. The classical delivery of surgical services has been innovated, and the specialized health care services are now provided for children and young people aged 0 – 18 years. The years during which the Clinic was being established and the accomplishments of its leading specialists represented a sound foundation for the future of pediatric surgery in Novi Sad. Pictures on the wall of the Clinic's amphitheatre are the reminders of the pioneer generation who had established high professional standards, core values, and a deep belief in the dignity of hard work and true commitment.

This paper is dedicated to the 60th anniversary of Pediatric Surgery in Novi Sad.

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IN MEMORIAM
IN MEMORIAM

Dr Panta Lazić
(1946–2017)

Dr Panta Lazić, istaknuti vojvođanski lekar, intelektualac i književnik, iskreni patriota rodnog Sombora, umro je dana 12. januara 2017. u svojoj 71. godini od teškog infarkta miokarda na rukama najvećih francuskih kardiohirurga. Rođen je 15. maja 1946. godine, a diplomirao na Medicinskom fakultetu u Novom Sadu 29. juna 1971, a specijalistički ispit iz neuropsihijatrije položio je 20. septembra 1977. godine. Njegovog oca Đorđa, lekara sa dve specijalnosti, kolege i vršnjaci smatrali su najobrazovanijim među lekarima Vojvodine svoga vremena. Panta Lazić je od 1972. radio u Medicinskom centru *Dr Radivoj Simonović* u Somboru pa do 1993. godine, kada se preselio u Francusku.

Postspecijalističko usavršavanje u trajanju od godinu dana (1980/1981) proveo je u *Dnevnoj bolnici* i *Medicinsko-psihološkom centru* prof. dr Iva Pelisjea (*Yves Pelicier*) bolnice *Neker* (*Necker*) u Parizu kao stipendista francuske vlade. Tu je odbranio naučni rad *Hopital de jour − une perspective de la psychiatrie sociale* (Dnevna bolnica − jedna od perspektiva socijalne psihijatrije), čime stiče zvanje stranog asistenta pri *Pariskoj akademiji – Univerzité de Paris V − Rene Descartes*, a kod nas nostrifikacijom i zvanje magistra nauka. Zatim je 1981. završio šestomesecni staž u bolnici *Neker* u Parizu, kojom je rukovodio prof. Benoa (*Benoit*), područje *Groupe d'Etudes Abord Corporel Therapeutique* (Studijska grupa: Terapijski telesni pristup − tehnika relaksacije). Ove su studije značile i priznavanje treće godine kontinuiranog programa *Sistemske porodične terapije* pri *Pariskoj asocijaciji istraživanja i rada sa porodicama* (*Association parisienne de Recherche et de Travail avec les Families − APRTF*) u Parizu.

Dr Panta Lazić je bio psihijatar koji je značajno doprineo pshijatriji u našoj zemlji. Osnovao je 1983. godine psihijatrijsku *Dnevnu bolnicu* u Somboru i delovao na širenju parcijalne psihijatriske hospitalizacije posebno u Vojvodini, na osnovu stručnih znanja stečenih u Francuskoj 1980/81. Osnivanjem *Dnevne bolnice* on je učinio mnogo: u psihijatrijsku negu uveo je humani pristup idejom da psihijatrijski bolesnik ne sme da bude vezan za krevet, promovisao je princip resocijalizacije kroz kreativne delatnosti. Izložbe umetničkih radova pacijenata *Dnevne bolnice* u Somboru postale su svojevrstan spoj umetnosti i medicine, ali i ogledalo stručnog dosega njenog osnivača. *Dnevna bolnica* u Somboru poslužila je kao model i za osnivanje *Dnevne bonice* pri *Psihijatrijskoj klinici* u Novom Sadu.

Dr Lazić je izvanredno povezivao discipline u vezi sa njegovom užom strukom, što se primećivalo u njegovoj *Dnevnoj bolnici*. On je isto tako vešto realizovao komunikaciju među medicinskim disciplima, što je pokazao trinaestogodišnjim vođenjem *Somborskih medicinskih dana,* na kojima su učestvovali vrhunski eksperti iz cele tadašnje SFRJ. U organizaciji *Dana* učestvovao je od 1975. do 1993. godine; svaki skup bio je posvećen jednoj novoj aktuelnoj temi, koji je pratilo izdavanje značajnih tematskih zbornika. *Dani* su se održavali u zgradi *Narodnog pozorišta* sagrađenog 1890. godine.

Značajno je njegovo organizovanje multidisciplinarnih skupova od 1974. godine − javne tribine i predavanja; pokrenuo je teme koje ubrzo stiču i jugoslovenski renome zahvaljujući činjenici da su bile uključene i u radio-televizijske programe od kojih su neke doživele i reprize, praćene u štampi. Radi se o izlaganjima poput *Muzika i zdravlje,* prof.

Vladete Jerotića uz muzičke ilustracije pijaniste i profesora Akademije muzičkih umetnosti u Beogradu Dušana Trbojevića, ili izlaganje prof. Ljubomira Erića na temu *Likovna ekspresija mentalnih bolesnika* uz izložbu originalnih crteža, ili predavanje prof. Stojana Vučkovića *Psihijatrija i sociologija* i slično.

Dr Lazić je bio društveni i kulturni poslenik. U doba kada su svetski mediji počeli da demonizuju našu zemlju, on je 1991. godine osnovao *Edukativni centar Jugoslavija–Francuska* u Somboru (*Centre d'Etudes et de Reflexions Yougoslavie–France*, Sombor), čiji je bio predsednik i stručni rukovodilac od osnivanja do 2003. godine, a koji je osnovan u okviru novoobnovljene Sekcije Somborskog društva za kulturnu saradnju Jugoslavija–Francuska, čijem je obnavljanju takođe bio inicijator.

Godine 1991. bio je i predstavnik organizacije *Hopital sans frontiers* (Bolnica bez granica) iz Pariza, koja je tada, posredstvom *Edukativnog centra Jugoslavija–Francuska* i zahvaljujući značajnoj finansijskoj pomoći Evropske unije, opremila jednu bolnicu kod nas, u blizini vukovarskog ratišta, savremenim aparatima, instrumentima i lekovima neophodnim za potrebe vanrednih uslova i koja je bila aktivna do 1992. godine.

Kao ekspert iz svoje oblasti, dr Lazić je držao predavanja po pozivu na klinikama u zemlji, u brojnim podružnicama Srpskog lekarskog društva, kao i u inostranstvu. U listi tih predavanja u njegovoj biografiji od 1984. pa do kraja njegove plodne karijere, svake godine je bilo jedno ili više prestižnih predavanja po pozivu.

Bio je autor ili prvi koautor poglavlja u međunarodnim tematskim publikacijama. Koautor je poglavlja u internacionalnom udžbeniku E*uropean Handbook of Psychiatry and Mental Health*. Bio je član Uređivačkog odbora *European Journal of Psychiatry.*

U Društvu lekara Vojvodine Srpskog lekarskog društva savesno je obavljao počev od 1975. godine devet odgovornih funkcija za koje je dobio i priznanja (Plaketa SLD 1986).

Od 1993. godine radio je u Francuskoj, u Bolničkom udruženju *Franš–Komte* (*Association Hospitaliere de Franche–Comté* – AHFC) kao psihijatar specijalizovanih psihijatriskih bolnica *Sen Remi*: (*Centre Hospitalier Specialise de Saint-Remy* – CHS, možda najvećom psihijatrijskom ustanovom u Francuskoj i sa tradicijom od skoro jednog stoleća. Dr Lazić je psihijatar medicinsko-psihološkog centra (*Centre medico-psychologique – CMP*) u Vezulu (*Vesoul*), referentni psihijatar *Dnevne bolnice* (*Hopital de Jour Adultes*) u Vezulu i referentni-psihijatar *Terapijskog ateljea* (*Atelier Therapeutique*) u Vezulu.

Dr Panta Lazić je bio čovek od akcije, stvaralac i organizatror navedenih instutucija i skupova, specifičnog ličnog i profesionalnog profila.

Isto tako, dr Lazić je bio čovek koji se znao dohvatiti pera. Pisao je stručne i naučne radove, ali je pisao i poeziju i jedan roman. U Francuskoj su izdate dve zbirke njegovih pesama (dvojezično), a kod nas su objavljeni roman ***Padalice*** (2015) i knjiga poezije ***Žuborim te tiho***.

Njegove kolege iz Francuske takođe su se oprostile od uvaženog kolege rečima žaljenja i poštovanja.

Mi koji smo imali sreću da ga poznajemo svedoci smo da je neumorno radio. Osnaživao zajednicu u kojoj živimo, boreći se vrlo uspešno, zahvaljujući svojoj energiji i inventivnosti, za istinu da su duševno zdravlje pojedinca i zdravlje sredine u potpunosti međuzavisni.

Prof. dr Milan Stanulović

UPUTSTVO ZA AUTORE

Časopis ***Medicinski pregled*** objavljuje radove koji prethodno nisu objavljeni niti poslati u drugi časopis. U Časopisu mogu biti objavljeni radovi iz različitih oblasti biomedicine, koji su namenjeni lekarima različitih specijalnosti.

Od 1. januara 2013. godine *Medicinski pregled* je počeo da koristi usluge *e-Ur* − Elektronskog uređivanja časopisa. Svi korisnici sistema − autori, recenzenti i urednici, moraju biti registrovani korisnici sa jednom elektronskom adresom.

Korisnici časopisa treba da se registruju na adresi:
http://aseestant.ceon.rs/index.php/medpreg/user/register

Prijava rada treba da se učini na adresi:
http://aseestant.ceon.rs/index.php/medpreg/

U postupku prijave neophodno je da se pošalje saglasnost i izjava autora i svih koautora da rad nije delimično ili u celini objavljen ili prihvaćen za štampu u drugom časopisu.

Elektronsko uređivanje časopisa obezbeđuje korišćenje sistema *CrossCheck*, koji prijavljene radove automatski proverava na plagijarizam i autoplagijarizam. Autori ne bi smeli da pošalju isti rad u više časopisa istovremeno. Ukoliko se to desi, glavni urednik časopisa *Medicinski pregled* ima pravo da rad vrati autorima bez prethodnog slanja rada na recenziju; da odbije štampanje rada; da se obrati urednicima drugih časopisa u koje je rad poslat ili da se obrati direktoru ustanove u kojoj su autori rada zaposleni.

Primaju se samo radovi koji su napisani na engleskom jeziku, uz sažetak rada i naslov rada koji treba da budu napisani na engleskom i srpskom jeziku.

Radove koji su pristigli u časopis *Medicinski pregled* pregleda jedan ili više članova Uređivačkog odbora Časopisa. Oni radovi koji su napisani prema pravilima Časopisa šalju se na anonimnu recenziju kod najmanje dva recenzenta, stručnjaka iz odgovarajuće oblasti biomedicine. Načinjene recenzije radova pregleda glavni urednik ili članovi Uređivačkog odbora i one nisu garancija da će rad biti prihvaćen za štampu. Materijal koji je pristigao u časopis ostaje poverljiv dok se rad nalazi na recenziji, a identitet autora i recenzenata su zaštićeni, osim u slučaju ako oni odluče drugačije.

U časopisu *Medicinski pregled* objavljuju se: uvodnici, originalni članci, prethodna ili kratka saopštenja, pregledni članci, stručni članci, prikazi slučajeva, članci iz istorije medicine i drugi članci.

1. Uvodnici – do 5 strana. Sadrže mišljenja ili diskusiju o posebno značajnoj temi za Časopis, kao i o podacima koji su štampani u ovom ili nekom drugom časopisu. Obično ih piše jedan autor po pozivu.

2. Originalni članci – do 12 strana. Predstavljaju rezultate istraživanja autora rada i njihovo tumačenje. Istraživanje treba da bude obrađeno i izloženo na način da se može ponoviti, a analiza rezultata i zaključci jasni da bi se mogli proveriti.

3. Pregledni članci – do 10 strana. Predstavljaju sistematsko, sveobuhvatno i kritičko izlaganje problema na osnovu analiziranih i diskutovanih podataka iz literature, a koji oslikavaju postojeću situaciju u određenom području istraživanja. Literatura koja se koristi u radu mora da sadrži najmanje 5 radova autora članka iz uže naučne oblasti koja je opisana u radu.

4. Prethodna ili kratka saopštenja – do 4 strane. Sadrže izuzetno važne naučne rezultate koje bi trebalo objaviti u što kraćem vremenu. Ne moraju da sadrže detaljan opis metodologije rada i rezultata, ali moraju da imaju sva poglavlja kao originalni članci u sažetoj formi.

5. Stručni članci – do 10 strana. Odnose se na proveru ili prikaz prethodnog istraživanja i predstavljaju koristan izvor za širenje znanja i prilagođavanja originalnog istraživanja potrebama postojeće nauke i prakse.

6. Prikazi slučajeva – do 6 strana. Opisuju retke slučajeve iz prakse. Slični su stručnim člancima. U ovim radovima prikazuju se neuobičajeni oblici i tokovi oboljenja, neočekivane reakcije na primenjenu terapiju, primene novih dijagnostičkih procedura ili retke i nove bolesti.

7. Članci iz istorije medicine – do 10 strana. Ovi članci opisuju događaje iz prošlosti sa ciljem da omoguće očuvanje medicinske i zdravstvene kulture. Imaju karakter stručnih članaka.

8. Ostali članci – U časopisu Medicinski pregled objavljuju se feljtoni, prikazi knjiga, izvodi iz strane literature, izveštaji sa kongresa i stručnih sastanaka, saopštenja o radu pojedinih zdravstvenih organizacija, podružnica i sekcija, saopštenja Uredništva, pisma Uredništvu, novosti u medicini, pitanja i odgovori, stručne i staleške vesti i članci napisani u znak sećanja (*In memoriam).*

Priprema rukopisa

Kompletan rukopis, uključujući tekst rada, sve priloge i propratno pismo, treba poslati na elektronsku adresu koja je prethodno navedena.

Propratno pismo:

– mora da sadrži izjavu svih autora da se radi o originalnom radu koji prethodno nije objavljen niti prihvaćen za štampu u drugim časopisima;

– autori svojim potpisom preuzimaju odgovornost da rad ispunjava sve postavljene uslove i da ne postoji sukob interesa i

– autor mora navesti kategoriju članka (originalni rad, pregleni rad, prethodno saopštenje, stručni rad, prikaz slučaja, rad iz istorije medicine, itd.).

Rukopis

Opšta uputstva

Tekst rada treba da bude napisan u programu *Microsoft Word* za *Windows*, na A4 formatu stranice (sve četiri margine 2,5 cm), proreda 1,5 (isto važi i za tabele), fontom *Times New Roman*, veličinom slova 12 *pt*. Neophodno je koristiti međunarodni sistem mernih jedinica (*SI*), uz izuzetak temperature (° *C*) i krvnog pritiska (*mmHg*).

Rukopis treba da sadrži sledeće elemente:

1. Naslovna strana

Naslovna strana treba da sadrži: kratak i sažet naslov rada, bez skraćenica, skraćeni naslov rada (do 40 karaktera), imena i prezimena autora (ne više od 6) i afilijacije svih autora. Na dnu strane treba da piše ime, prezime i titula autora zaduženog za korespondenciju, njena/njegova adresa, elektronska adresa, broj telefona i faksa.

2. Sažetak

Sažetak ne može da sadrži više od 250 reči niti skraćenice. Treba da bude strukturisan, kratak i sažet, sa jasnim pregledom problema istraživanja, ciljevima, metodama, značajnim rezultatima i zaključcima.

Sažetak originalnih i stručnih članaka treba da sadrži uvod (sa ciljevima istraživanja), materijale i metode, rezultate i zaključak.

Sažetak prikaza slučaja treba da sadrži uvod, prikaz slučaja i zaključak.

Sažetak preglednih članaka treba da sadrži Uvod, podnaslove koji odgovaraju istima u tekstu i Zaključak.

Navesti do 10 ključnih reči ispod sažetka. One su pomoć prilikom indeksiranja, ali autorove ključne reči mogu biti izmenjene u skladu sa odgovarajućim deskriptorima, odnosno terminima iz *Medical Subject Headings*, *MeSH*.

Sažetak treba da bude napisan na srpskom i engleskom jeziku. Sažetak na srpskom jeziku trebalo bi da predstavlja prevod sažetka na engleskom, što podrazumeva da sadrži jednake delove.

3. Tekst članka

Originalni rad treba da sadrži sledeća poglavlja: Uvod (sa jasno definisanim ciljevima istraživanja), Materijal i metode, Rezultati, Diskusija, Zaključak, spisak skraćenica (ukoliko su

korišćene u tekstu). Nije neophodno da se u posebnom poglavlju rada napiše zahvalnica onima koji su pomogli da se istraživanje uradi, kao i da se rad napiše.

Prikaz slučaja treba da sadrži sledeća poglavlja: Uvod (sa jasno definisanim ciljevima), Prikaz slučaja, Diskusija i Zaključak.

Uvod

U poglavlju Uvod potrebno je jasno definisati predmet istraživanja (prirodu i značaj istraživanja), navesti značajne navode literature i jasno definisati ciljeve istraživanja i hipoteze.

Materijal i metode

Materijal i metode rada treba da sadrže podatke o vrsti studije (prospektivna/retrospektivna, uslove za uključivanje i ograničenja studije, trajanje istraživanja, demografske podatke, period praćenja). Detaljno treba opisati statističke metode da bi čitaoci rada mogli da provere iznesene rezultate.

Rezultati

Rezultati predstavljaju detaljan prikaz podataka koji su dobijeni istraživanjem. Sve tabele, grafikoni, sheme i slike moraju biti citirani u tekstu rada i označeni brojevima po redosledu njihovog navođenja.

Diskusija

Diskusija treba da bude koncizna, jasna i da predstavlja tumačenje i poređenje rezultata studije sa relevantnim studijama koje su objavljene u domaćoj i međunarodnoj literaturi. U poglavlju Diskusija potrebno je naglasiti da li su postavljene hipoteze potvrđene ili nisu, kao i istaknuti značaj i nedostatke istraživanja.

Zaključak

Zaključci moraju proisteći isključivo iz rezultata istraživanja rada; treba izbegavati uopštene i nepotrebne zaključke. Zaključci koji su navedeni u tekstu rada moraju biti u saglasnosti sa zaključcima iz Sažetka.

4. Literatura

Potrebno je da se literatura numeriše arapskim brojevima redosledom kojim je u tekstu navedena u parentezama; izbegavati nepotrebno velik broj navoda literature. Časopise bi trebalo navoditi u skraćenom obliku koji se koristi u *Index Medicus* (*http://www.nlm.nih.gov/tsd/serials/lji.html*). Pri citiranju literature koristiti Vankuverski sistem. Potrebno je da se navedu svi autori rada, osim ukoliko je broj autora veći od šest. U tom slučaju napisati imena prvih šest autora praćeno sa *et al*.

Primeri pravilnog navođenja literature nalaze se u nastavku.

Radovi u časopisima

∗ Standardni rad

Ginsberg JS, Bates SM. Management of venous thromboembolism during pregnancy. J Thromb Haemost 2003;1:1435-42.

∗ Organizacija kao autor

Diabetes Prevention Program Research Group. Hypertension, insulin, and proinsulin in participants with impaired glucose tolerance. Hypertension 2002;40(5):679-86.

∗ Bez autora

21st century heart solution may have a sting in the tail. BMJ. 2002;325(7357):184.

∗ Volumen sa suplementom

Magni F, Rossoni G, Berti F. BN-52021 protects guinea pig from heart anaphylaxix. Pharmacol Res Commun 1988;20 Suppl 5:75-8.

∗ Sveska sa suplementom

Gardos G, Cole JO, Haskell D, Marby D, Pame SS, Moore P. The natural history of tardive dyskinesia. J Clin Psychopharmacol 1988;8(4 Suppl):31S-37S.

∗ Sažetak u časopisu

Fuhrman SA, Joiner KA. Binding of the third component of complement C3 by Toxoplasma gondi [abstract]. Clin Res 1987;35:475A.

Knjige i druge monografije

∗ Jedan ili više autora

Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA. Medical microbiology. 4th ed. St. Louis: Mosby; 2002.

∗ Urednik (urednici) kao autor (autori)

Danset J, Colombani J, eds. Histocompatibility testing 1972. Copenhagen: Munksgaard, 1973:12-8.

∗ Poglavlje u knjizi

Weinstein L, Shwartz MN. Pathologic properties of invading microorganisms. In: Soderman WA Jr, Soderman WA, eds. Pathologic physiology: mechanisms of disease. Philadelphia: Saunders; 1974. p. 457-72.

∗ Zbornik radova sa kongresa

Christensen S, Oppacher F. An analysis of Koza's computational effort statistic for genetic programming. In: Foster JA, Lutton E, Miller J, Ryan C, Tettamanzi AG, editors. Genetic programming. EuroGP 2002: Proceedings of the 5th European Conference on Genetic Programming; 2002 Apr 3-5; Kinsdale, Ireland. Berlin: Springer; 2002. p. 182-91.

∗ Disertacija

Borkowski MM. Infant sleep and feeding: a telephone survey of Hispanic Americans [dissertation]. Mount Pleasant (MI): Central Michigan University; 2002.

Elektronski materijal

∗ Članak iz časopisa u elektronskom formatu

Abood S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. Am J Nurs [Internet]. 2002 Jun [cited 2002 Aug 12];102(6):[about 1 p.]. Available from: http://www.nursingworld.org/AJN/2002/june/Wawatch.htmArticle

∗ Monografija u elektronskom formatu

CDI, clinical dermatology illustrated [monograph on CD-ROM]. Reevs JRT, Maibach H. CMEA Multimedia Group, producers. 2nd ed. Version 2.0. San Diego:CMEA;1995.

∗ Kompjuterska datoteka

Hemodynamics III: the ups and downs of hemodynamics [computer program]. Version 2.2. Orlando (FL): Computerized Educational Systems; 1993.

5. Prilozi (tabele, grafikoni, sheme i slike)

BROJ PRILOGA NE SME BITI VEĆI OD ŠEST!

Tabele, grafikoni, sheme i slike se postavljaju kao posebni dokumenti.

– Tabele i grafikone bi trebalo pripremiti u formatu koji je kompatibilan programu u kojem je napisan tekst rada. Slike bi trebalo poslati u jednom od sledećih oblika: *JPG*, *GIF*, *TIFF*, *EPS*.

– Svaki prilog mora biti obeležen arapskim brojem prema redosledu po kojem se navodi u tekstu rada.

– Naslovi, tekst u tabelama, grafikonima, shemama i legende slika bi trebalo da budu napisani na srpskom i engleskom jeziku.

– Nestandardne priloge označiti u fusnoti uz korišćenje sledećih simbola: *, †, ‡, §, | |, ¶, **, † †, ‡ ‡ .

– U legendi slika trebalo bi napisati korišćeno uveličanje okulara i objektiva mikroskopa. Svaka fotografija treba da ima vidljivu skalu.

– Ako su tabele, grafikoni, sheme ili slike već objavljene, navesti originalni izvor i priložiti pisano odobrenje autora za njihovo korišćenje.

– Svi prilozi će biti štampani kao crno-bele slike. Ukoliko autori žele da se prilozi štampaju u boji, obavezno treba da plate dodatne troškove.

6. Dodatne obaveze

AUTORI I SVI KOAUTORI RADA OBAVEZNO TREBA DA PLATE GODIŠNJU PRETPLATU ZA ČASOPIS *MEDICINSKI PREGLED*. U PROTIVNOM, RAD NEĆE BITI ŠTAMPAN U ČASOPISU.

INFORMATION FOR AUTHORS

Medical Review publishes papers (previously neither published in nor submitted to any other journals) from various fields of biomedicine intended for broad circles of doctors.

Since January 1th, 2013 the Medical Review has been using the service e-Ur: Electronic Journal Editing. All users of the Registration system, i.e. authors, reviewers, and editors have to be registered users with only one e-mail address. Registration should be made on the web address:

http://aseestant.ceon.rs/index.php/medpreg/user/register.

Manuscript submission should be made on the web address:

http://aseestant.ceon.rs/index.php/medpreg/

A SUPPLEMENTARY FILE, WITH THE STATEMENT THAT THE PAPER HAS NOT BEEN SUBMITTED OR ACCEPTED FOR PUBLICATION ELSEWHERE AND A CONSENT SIGNED BY ALL AUTHORS, HAVE TO BE ENCLOSED WITH THE MANUSCRIPT.

Authors may not send the same manuscript to more than one journal concurrently. If this occurs, the Editor may return the paper without reviewing it, reject the paper, contact the Editor of the other journal(s) in question and/or contact the author's employers.

Papers should be written in English language, with an abstract and title page in English, as well as in Serbian language.

All papers submitted to ***Medical Review*** are seen by one or more members of the Editorial Board. Suitable articles are sent to at least two experts to be reviewed, thier reports are returned to the assigned member of the Editorial Board and the Editor. Revision of an article gives no guarantee of acceptance and in some cases revised articles are rejected if the improvements are not sufficient or new issues have arisen. Material submitted to *the Journal* remains confidential while being reviewed and peer-reviewers' identities are protected unless they elect to lose anonymity.

Medical Review publishes the following types of articles: editorials, original studies, preliminary reports, review articles, professional articles, case reports, articles from history of medicine and other types of publications.

1. Editorials – up to 5 pages – convey opinions or discussions on a subject relevant for the Journal. Editorials are commonly written by one author by invitation.

2. Original studies – up to 12 pages – present the authors' own investigations and their interpretations. They should contain data which could be the basis to check the obtained results and reproduce the investigative procedure.

3. Review articles – up to 10 pages – provide a condensed, comprehensive and critical review of a problem on the basis of the published material being analyzed and discussed, reflecting the current situation in one area of research. Papers of this type will be accepted for publication provided that the authors confirm their expertise in the relevant area by citing at least 5 self-citations.

4. Preliminary reports – up to 4 pages – contain scientific results of significant importance requiring urgent publishing; however, it need not provide detailed description for repeating the obtained results. It presents new scientific data without a detailed explanation of methods and results. It contains all parts of an original study in an abridged form.

5. Professional articles – up to 10 pages – examine or reproduce previous investigation and represent a valuable source of knowledge and adaption of original investigations for the needs of current science and practice.

6. Case reports – up to 6 pages – deal with rare casuistry from practice important for doctors in direct charge of patients and are similar to professional articles. They emphasize unusual characteristics and course of a disease, unexpected reactions to a therapy, application of new diagnostic procedures and describe a rare or new disease.

7. History of medicine – up to 10 pages – deals with history with the aim of providing continuity of medical and health care culture. They have the character of professional articles.

8. Other types of publications – The journal also publishes feuilletons, book reviews, extracts from foreign literature, reports from congresses and professional meetings, communications on activities of certain medical institutions, branches and sections, announcements of the Editorial Board, letters to the Editorial Board, novelties in medicine, questions and answers, professional and vocational news and In memoriam.

Preparation of the manuscript

The complete manuscript, including the text, all supplementary material and covering letter, is to be sent to the web address above.

The covering letter:

– It must contain the proof given by the author that the paper represents an original work that it has neither been previously published in other journals nor is under consideration to be published in other journals.

– It must confirm that all the authors meet criteria set for the authorship of the paper, that they agree completely with the text and that there is no conflict of interest.

– It must state the type of the paper submitted (an original study, a review article, a preliminary report, a professional article, a case report, history of medicine).

The manuscript:

General instructions.

Use Microsoft Word for Windows to type the text. The text must be typed in font *Times New Roman*, page format A4, space 1.5 (for tables as well), margins set to 2.5 cm and font size 12pt. All measurements should be reported in the metric system of the International System of Units – SI. Temperature should be expressed in Celsius degrees (°C) and pressure in mmHg.

The manuscript should contain the following elements:

1. The title page.

The title page should contain a concise and clear title of the paper, without abbreviations, then a short title (up to 40 characters), full names and surnames of the authors (not more than 6) indexed by numbers corresponding to those given in the heading along with the full name and place of the institutions they work for. Contact information including the academic degree(s), full address, e-mail and number of phone or fax of the corresponding author (the author responsible for correspondence) are to be given at the bottom of this page.

2. Summary.

The summary should contain up to 250 words, without abbreviations, with the precise review of problems, objectives, methods, important results and conclusions. It should be structured into the paragraphs as follows:

– Original and professional papers should have the introduction (with the objective of the paper), materials and methods, results and conclusion

– Case reports should have the introduction, case report and conclusion

– Review papers should have the introduction, subtitles corresponding to those in the paper and conclusion.

The authors should provide up to 10 keywords below the summary. These keywords will assist indexers in cross-indexing the article and will be published with the summary, but the authors' keywords could be changed in accordance with the list of Medical Subject Headings, MeSH of the American National Medical Library.

The summary should be written in both languages, English as well as Serbian. The summary in Serbian language should be the translation of the summary in English; therefore, it has to contain the same paragraphs.

3. The text of the paper.

The text of original studies must contain the following: introduction (with the clearly defined objective of the study), materials and methods, results, discussion, conclusion, list of abbreviations (if used in the text) and not necessarily, the acknowledgment mentioning those who have helped in the investigation and preparation of the paper.

The text of a case report should contain the following: introduction (with clearly defined objective of the study), case report, discussion and conclusion.

Introduction contains clearly defined problem dealt with in the study (its nature and importance), with the relevant references and clearly defined objective of the investigation and hypothesis.

Materials and methods should contain data on design of the study (prospective/retrospective, eligibility and exclusion criteria, duration, demographic data, follow-up period). Statistical methods applied should be clear and described in details.

Results give a detailed review of data obtained during the study. All tables, graphs, schemes and figures must be cited in the text and numbered consecutively in the order of their first citation in the text.

Discussion should be concise and clear, interpreting the basic findings of the study in comparison with the results of relevant studies published in international and national literature. It should be stated whether the hypothesis has been confirmed or denied. Merits and demerits of the study should be mentioned.

Conclusion must deny or confirm the attitude towards the 0based solely on the author's own results, corroborating them. Avoid generalized and unnecessary conclusions. Conclusions in the text must be in accordance with those given in the summary.

4. References are to be given in the text under Arabic numerals in parentheses consecutively in the order of their first citation. Avoid a large number of citations in the text. The title of journals should be abbreviated according to the style used in Index Medicus (http://www.nlm.nih.gov/tsd/serials/lji.html). Apply Vancouver Group's Criteria, which define the order of data and punctuation marks separating them. Examples of correct forms of references are given below. List all authors, but if the number exceeds six, give the names of six authors followed by 'et al'.

Articles in journals

∗ *A standard article*

Ginsberg JS, Bates SM. Management of venous thromboembolism during pregnancy. J Thromb Haemost 2003;1:1435-42.

∗ *An organization as the author*

Diabetes Prevention Program Research Group. Hypertension, insulin, and proinsulin in participants with impaired glucose tolerance. Hypertension 2002;40(5):679-86.

∗ *No author given*

21st century heart solution may have a sting in the tail. BMJ. 2002;325(7357):184.

∗ *A volume with supplement*

Magni F, Rossoni G, Berti F. BN-52021 protects guinea pig from heart anaphylaxix. Pharmacol Res Commun 1988;20 Suppl 5:75-8.

∗ *An issue with supplement*

Gardos G, Cole JO, Haskell D, Marby D, Pame SS, Moore P. The natural history of tardive dyskinesia. J Clin Psychopharmacol 1988;8(4 Suppl):31S-37S.

∗ *A summary in a journal*

Fuhrman SA, Joiner KA. Binding of the third component of complement C3 by Toxoplasma gondi [abstract]. Clin Res 1987;35:475A.

Books and other monographs

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∗ *A computer file*

Hemodynamics III: the ups and downs of hemodynamics [computer program]. Version 2.2. Orlando (FL): Computerized Educational Systems; 1993.

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THE MAXIMUM NUMBER OF ATTACHMENTS ALLOWED IS SIX!

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