UTICAJ PERIOPERATIVNIH FAKTORA NA ISHOD KOD PACIJENATA SA RUPTURIRANOM ANEURIZMOM ABDOMINALNE AORTE

THE IMPACT OF PERIOPERATIVE FACTORS ON THE OUTCOME IN PATIENTS WITH RUPTURED ABDOMINAL AORTIC ANEURYSM

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SAŽETAK

Uvod: Aneurizma je permanentno, lokalizovano proširenje dijametra arterije za minimum 50% u odnosu na njen fiziološki promer. Njena najčešća lokalizacija je na abdominalnoj aorti. Ruptura, kao najčešća komplikacija aneurizme, klinički je značajna jer je odlikuje visok stepen smrtnosti. Pacijenti sa rupturom aneurizme abdominalne aorte podvrgavaju se hitnom operativnom tretmanu gde su, uprkos naporima hirurga i ekspanzivnom napretku medicine i tehnologije, intraoperativni i postoperativni mortalitet i dalje zastupljeni u visokom procentu.

Cilj rada: Ispitati na koji način različiti perioperativni faktori utiču na ishod kod pacijenata sa rupturom aneurizme abdominalne aorte.

Materijal i metode: Retrospektivna studija zasnovana na medicinskoj dokumentaciji za dvogodišnji period, u okviru koje su deskriptivnim statističkim metodama obrađeni i analizirani perioperativni klinički parametri i njihov uticaj na ishod kod 57 pacijenata operisanih zbog rupture aneurizme abdominalne aorte.

Rezultati: Preoperativne vrednosti hemoglobina i komponenti hemostaznog sistema, intraoperativna nadoknada krvi i intraoperativni pH, kao i postoperativne vrednosti kalijuma, laktata i količina diureze u prva 24 sata nakon operacije, pokazali su statistički značajan uticaj na ishod kod pacijenata operisanih u Kliničkom centru Vojvodine zbog rupture aneurizme abdominalne aorte.

Zaključak: Operativni ishod kod rAAA je, uprkos dugogodišnjim istraživanjima perioperativnih faktora i pokušajem nalaženja idealnog skoring-sistema, i dalje nepredvidiv.

Ključne reči: aneurizma, ruptura, abdominalna aorta

ABSTRACT

Introduction: An aneurysm is a permanent, localized extension of an artery diameter by at least 50% relative to its physiological diameter. Its most common localization is on the abdominal aorta. Rupture, the most common complication of an aneurysm, is clinically significant because of the high mortality rate. Patients with ruptured aneurysm of the abdominal aorta undergo urgent surgical treatment, where despite the efforts of surgeons and expansive progress in both medicine and technology, intraoperative and postoperative mortality is still present in a high percentage.

Aim: To examine how different perioperative factors affect the outcome in patients with ruptured aneurysms of the abdominal aorta.

Material and methods: A retrospective study based on medical records for a two-year period, in which descriptive statistical methods processed and analyzed perioperative clinical parameters and their impact on outcome in 57 patients operated on for rupture of abdominal aortic aneurysm.

Results: Preoperative values of hemoglobin and components of the hemostasis system, intraoperative blood replenishment and intraoperative pH, and postoperative values of potassium, lactate, and the amount of diuresis in the first 24 hours after surgery showed a statistically significant effect on the outcome in patients operated at the Clinical Center of Vojvodina due to rupture of abdominal aortic aneurysm.

Conclusion: The operative outcome in rAAA is still unpredictable despite many years of research into perioperative factors and attempts to find an ideal scoring system.

Keywords: aneurysm, rupture, abdominal aorta

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UVOD

Aneurizma predstavlja trajnu lokalizovanu dilataciju dijametra arterije za bar 50% u odnosu na normalni promer za datu lokalizaciju [1]. Može da se formira na bilo kom arterijskom krvnom sudu, ali je najčešća lokalizacija abdominalna aorta, i to njen infrarenalni segment. Aneurizme se mogu iskomplikovati rupturom, trombozom, i distalnim embolizacijama, a klinički najbitnija i potencijalno fatalna komplikacija jeste ruptura [2]. Na infrarenalnoj lokalizaciji najznačajnija komplikacija je ruptura. U čak 50% slučajeva, ruptura je prva manifestacija aneurizme [3]. Rizik rupture je povezan sa apsolutnom veličinom aneurizme, polom (češće se javlja kod žena), oblikom aneurizme i prisustvom parijetalnih trombotičnih masa. Pušenje i hronična opstruktivna bolest pluća su takođe nezavisni prediktori rupture aneurizme abdominalne aorte [2]. Ruptura aneurizme abdominalne aorte (u daljem tekstu rAAA) se može manifestovati u vidu retroperitonealnog krvarenja, intraperitonealnog krvarenja, hronične rupture, aorto-enterične fistule i aorto-kavalne fistule. Najčešće su rupture u retroperitonealnom i intraperitonealnom prostoru. Dijagnoza rAAA se postavlja klinički, ultrazvučno ili CT angiografijom [1]. Ovo stanje zahteva hitan hirurški tretman u cilju spašavanja života. Tretman može biti otvoreni hirurški ili endovaskularni. Otvoreni hirurški pristup se sastoji od ksifopubične laparotomije, evisceracije creva, proksimalne i distalne vaskularne kontrole i rekonstrukcije aneurizmatski izmenjene aorte, uz ili bez evakuacije hematoma.

Ruptura aneurizme je odgovorna za približno 1,5% smrti kod muškaraca preko 55 godina starosti i trinaesti je uzrok smrti po učestalosti u zapadnom svetu. Autopsione studije ukazuju na ukupan mortalitet ovih bolesnika od 90%, ukoliko se uzmu u obzir pacijenti koji ne stignu živi do bolnice. Intrahospitalno preživljavanje preostalih bolesnika, prema podacima objavljenim u literaturi, kreće se u širokom rasponu od 25 do 70% [2].

Preživljavanje ovih pacijenata zavisi od vrste rupture, vremena koje je proteklo od inicijalnih simptoma do ukazivanja prve medicinske pomoći, kao i stizanja u odgovarajuću hiruršku ustanovu koja se bavi aortnom hirurgijom. Smrt u prvih 30 dana nakon operacije uglavnom nastaje zbog disfunkcije nekog vitalnog organa, izolovanog organskog sistema ili, veoma često, zbog multiorganske sistemske disfunkcije [2].

Višedecenijskim analiziranjem velikog broja perioperativnih faktora i pridruženih komorbiditeta, proučavanjem njihove kako pojedinačne, tako i međusobno zavisne povezanosti sa ishodom operacionog tretmana pacijenata sa rAAA, oformljeni su standardizovani skoring-sistemi za procenu perioperativnog rizika. U upotrebi je nekoliko skoring sistema, od kojih se u lite-

INTRODUCTION

An aneurysm is a permanent localized dilation of an artery diameter of at least 50% compared to the normal diameter for a given localization [1]. It can be formed on any arterial blood vessel, but the most common localization is the abdominal aorta, namely its infrarenal segment. Aneurysms can be complicated by rupture, thrombosis, and distal embolization, and the most clinically important and potentially fatal complication is rupture [2]. At infrarenal localization, the most significant complication is rupture. In even 50% of cases, rupture is the first manifestation of an aneurysm [3]. The risk of rupture is related to the size of the aneurysm, gender (it occurs more often in women), the form of the aneurysm, and the presence of parietal thrombotic masses. Smoking and chronic obstructive pulmonary disease are also independent predictors of abdominal aortic aneurysm rupture [2]. Rupture of abdominal aortic aneurysm (hereinafter referred to as rAAA) can manifest itself in the form of retroperitoneal bleeding, intraperitoneal hemorrhage, chronic rupture, aorto-enteric fistula, and aorto-caval fistula. The most common are ruptures into the retroperitoneal and intraperitoneal space. Diagnosis of rAAA is made clinically, with ultrasound or CT angiography [1]. This condition requires urgent surgical treatment to save lives. Treatment can be open surgical or endovascular. The open surgical approach consists of xenophobic laparotomy, intestinal evisceration, proximal and distal vascular control, and reconstruction of the aneurysmatically altered aorta, with or without evacuation of the hematoma.

Aneurysm rupture is responsible for approximately 1.5% of deaths in men over the age of 55 and is the thirteenth leading cause of death in the Western world. Autopsy studies indicate a total mortality rate of 90% if patients who do not make it to the hospital alive are taken into account. Intrahospital survival of the remaining patients, according to data published in the literature, ranges from 25 to 70% [2].

The survival of these patients depends on the type of rupture, the time that elapsed from the initial symptoms to the first medical treatment, as well as, the arrival at the appropriate surgical institution dealing with aortic surgery. Death in the first 30 days after surgery is mainly due to dysfunction of a vital organ, an isolated organ system, or very often, due to multiorgan systemic dysfunction [2].

Decades of analyzing a large number of perioperative factors and associated comorbidities, and studying their individual and interdependent relationships with the outcome of operational treatment of patients with rAAA, standardized scoring systems for perioperative risk assessment have been established. Several

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raturi najčešće navode *Vascular-Physiological and Operative Severity score for emUmeration of Mortality and Morbidity (V-POSSUM)*, *Ruptured Abdominal Aortic Aneurysm RAAA-POSSUM* [4], *Hardman index* [4], *Glasgow Aneurysm score* [5], *Dutch aneurysm score* [6], i u novije doba – *Edinburg Ruptured Aneurysm score* [7] i *Vancouver Scoring System* [7]. Svaki od ovih skoring sistema koristi se različitom kombinacijom hemodinamskih, biohemijskih i kliničkih varijabli. Cilj ovih skoring sistema jeste da se pokuša kvantifikovati rizik za svakog pacijenta sa rAAA.

CILJ RADA

Cilj ovog rada jeste da se ispita da li su pojedini perioperativni (preoperativni, intraoperativni, i postoperativni) klinički parametri uticali na ishod hirurškog tretmana pacijenata sa rupturiranom aneurizmom abdominalne aorte.

MATERIJAL I METODE

Sprovedena je retrospektivna studija na osnovu prikupljene medicinske dokumentacije iz arhive Klinike za vaskularnu i transplantacionu hirurgiju i arhive Urgentnog centra Kliničkog centra Vojvodine. Ispitivanje je obuhvatilo dvogodišnji period (01.01.2016.-31.12.2017.). Analizirali smo podatke za sve pacijente koji su zbog rAAA operisani u operativnom bloku Urgentnog centra Kliničkog centra Vojvodine. Kriterijumi za uključivanje u studiju podrazumevali su sledeće: lokalizaciju aneurizme na abdominalnoj aorti i intraoperativno preživljavanje pacijenta, a kriterijumi za isključivanje iz studije su bili lokalizacija aneurizme na torakoabdominalnoj aorti i intraoperativni mortalitet. U posmatranom periodu ukupno je operisano 82 pacijenta sa rAAA. Od toga, za 21 pacijenta, uvidom u njihovu medicinsku dokumentaciju, nisu bili pronađeni adekvatni klinički parametri koji bi odgovarali studiji, te su ovi pacijenti bili izostavljeni iz istraživanja. Od preostalog 61 pacijenta, 4 su preminula intraoperativno što je, uvidom u kriterijume za uključivanje i isključivanje i sledstvenim izuzimanjem ovih pacijenata iz dalje studije, svelo broj uzorka na 57.

Na osnovu praćenja ishoda operacije u prvih 30 postoperativnih dana, sve pacijente podelili smo u dve grupe:

1. pacijenti koji su preživeli 30 dana od operacije
2. pacijenti koji su preminuli u roku od 30 dana od operacije.

Kod pacijenata smo pratili ukupno 22 perioperativna parametra: 9 preoperativnih, 4 intraoperativna i 9 postoperativnih parametara (Tabela 1).

scoring systems are in use, the most commonly cited in the literature *are the Vascular-Physiological and Operative Severity score for emUmeration of Mortality and Morbidity (V)-POSSUM*, *Ruptured Abdominal Aortic Aneurysm RAAA-POSSUM* [4], *Hardman index* [4], *Glasgow Aneurysm score* [5], *Dutch aneurysm score* [6], and more recently – *Edinburgh Ruptured Aneurysm score* [7] and *Vancouver Scoring System* [7]. Each of these scoring systems is used by a different combination of hemodynamic, biochemical, and clinical variables. The goal of these scoring systems is to try to quantify the risk for each patient with rAAA.

THE AIM OF THE WORK

This study aims to examine whether certain perioperative (preoperative, intraoperative, and postoperative) clinical parameters affected the outcome of surgical treatment of patients with ruptured abdominal aortic aneurysm.

MATERIAL AND METHODS

A retrospective study was conducted based on the collected medical records from the archives of the Clinic for Vascular and Transplant Surgery and the archives of the Emergency Center of the Clinical Center of Vojvodina. The study included a two-year period (01.01.2016.-31.12.2017). We analyzed the data for all patients who were due to rAAA operated in the operational block of the Emergency Center of the Clinical Center of Vojvodina. The inclusion criteria in the study involved the following: localization of aneurysms on the abdominal aorta and intraoperative survival of the patient, and the criteria for exclusion from the study were the localization of the aneurysm on the thoracoabdominal aorta and intraoperative mortality. During the study, a total of 82 patients with rAAA were operated on. Of these, for 21 patients, adequate clinical parameters corresponding to the study were not found by examining their medical records, and these patients were omitted from the research. Of the remaining 61 patients, 4 died intraoperatively, which, by examining the inclusion and exclusion criteria, and consequently excluding these patients from further study, reduced the sample to 57.

Based on the monitoring of the outcome of surgery in the first 30 postoperative days, we divided all patients into two groups:

1. Patients who survived 30 days of surgery
2. Patients who died within 30 days of surgery.

In patients, we monitored a total of 22 perioperative parameters: 9 preoperative, 4 intraoperative, and 9 postoperative parameters (Table 1).

Kod svakog pacijenta kod kojeg je na osnovu anamnestičkih i/ili heteroanamnestičkih podataka i kliničkog pregleda i eventualnih dodatnih dijagnostičkih procedura (ultrazvuk, CT angiografija) u sklopu prijemnog odeljenja Urgentnog centra Kliničkog centra Vojvodine postavljena dijagnoza rAAA, hitno su sprovođeni laboratorijski nalazi, te je indikovana hitna hirurška procedura od strane dežurnog vaskularnog hirurga. Ti nalazi obavezno su podrazumevali sledeće kliničke parametre koje smo i obuhvatili našom studijom: hemoglobin (Hgb), hematokrit (Hct), broj trombocita (Tr), serumska urea (Ur), serumski kreatinin (Kr), aktivirano parcijalno tromboplastinsko vreme (APTT), protrombinsko vreme (PT), kalijum (K) i broj eritrocita (Er). Istovremeno je vršeno otvaranje istorije bolesti, obezbeđivanje disajnog puta po potrebi, rezervacija krvi i krvnih derivata, postavljanje periferne i centralne venske linije, arterijske linije, urinarnog katetera, zatim brz transport u operacionu salu.

Indikovana hitna aneurizmektomija je sprovođena od strane vaskularnih hirurga Klinike za vaskularnu i transplantacionu hirurgiju Kliničkog centra Vojvodine, uz saradnju i asistenciju odgovarajućeg medicinskog osoblja. Tokom ove operacione procedure praćene su različite intraoperativne kliničke varijable koje su kumulativno sadržane i evidentirane u protokolu anestezije. Neke od njih koristili smo za potrebe studije, a to su: izmereni intraoperativni gubitak krvi, nadoknada krvi (resuspendovani eritrociti, sveža smrznuta plazma i autologno vraćena krv iz *Cell saver*-a), diureza i intraoperativni pH. Postoperativno, pacijenti su smeštani u jedinice intenzivne terapije Urgentnog centra Kliničkog centra Vojvodine, gde su im tokom boravka svakodnevno, i u više navrata, mereni postoperativni parametri čije smo vrednosti koristili za istraživanje: dvadesetčetvoročasovna diureza, dvadesetčetvoročasovni unos tečnosti, serumska urea (Ur), serumski kreatinin (Kr), kao i sledeće varijable gasnih analiza: pH, kalijum (K), laktati, parcijalni pritisak kiseonika (pO2) i saturacija kiseonikom (sO2). Parametri sa definisanim referentnim vrednostima, kao i klinički promenljive varijable, tabelarno su prikazani (Tabela 1). Referentne vrednosti primenjene u studiji uzete su iz laboratorije Urgentnog centra Kliničkog centra Vojvodine, gde se koriste u svakodnevnoj kliničkoj praksi kao zvanične referentne vrednosti. Koristili smo se podacima koji su obuhvatili prva 24 sata nakon operacije. Preživeli pacijenti bili su premešteni na odeljenje Klinike za vaskularnu i transplantacionu hirurgiju Kliničkog centra Vojvodine. Nakon otpusta pacijenata sa odeljenja, procena o daljem preživljavanju donosila se na osnovu obavezne prve ambulantne kontrole na Specijalističkoj poliklinici Klinike za vaskularnu i transplantacionu hirurgiju Kliničkog centra Vojvodine.

Each patient diagnosed with rAAA, based on anamnestic and/or heteroanamnestic data and clinical examination, and possible additional diagnostic procedures (ultrasound, CT angiography) within the reception department of the Emergency Center of the Clinical Center of Vojvodina, rAAA was diagnosed, had laboratory findings urgently carried out, and urgent surgical procedure was indicated by the on-call vascular surgeon. These findings necessarily implied the following clinical parameters that we included in our study: hemoglobin (Hgb), hematocrit (Hct), platelet count (Tr), serum urea (Ur), serum creatinine (Kr), activated partial thromboplastin time (APTT), prothrombin time (PT), potassium (K), and erythrocyte count (Er). At the same time, the opening of the medical history, provision of the airway as needed, provision of blood and blood derivatives, placement of peripheral and central venous lines, arterial line, urinary catheter, and rapid transport to the operating room were performed.

The indicated emergency aneurysmectomy was performed by vascular surgeons of the Clinic for Vascular and Transplant Surgery of the Clinical Center of Vojvodina, with the cooperation and assistance of appropriate medical staff. During this operational procedure, various intraoperative clinical variables were monitored, which are cumulatively contained and recorded in the anesthesia protocol. Some of them were used for the study, namely: measured intraoperative blood loss, blood compensation (resuspended erythrocytes, fresh frozen plasma, and autologously restored blood from *Cell saver*), diuresis, and intraoperative pH. Postoperatively, patients were placed in intensive care units of the Emergency Center of the Clinical Center of Vojvodina, where postoperative parameters were measured daily and on several occasions whose values we used for research: twenty-four-hour diuresis, twenty-four-hour fluid intake, serum urea (Ur), serum creatinine (Kr), as well as the following variables of gas analysis: pH, potassium (K), lactates, partial oxygen pressure (pO2), and oxygen saturation (sO2). Parameters with defined reference values as well as clinically changeable variables are tabularly presented (Table 1). The reference values applied in the study were taken from the laboratory of the Emergency Center of the Clinical Center of Vojvodina, where they are used in everyday clinical practice as official reference values. We used data that covered the first 24 hours after surgery. The surviving patients were transferred to the Department of the Clinic for Vascular and Transplant Surgery of the Clinical Centre of Vojvodina. After the discharge of patients from the department, the court on further survival was made on the basis of the mandatory first outpatient control at the specialist polyclinic of the Clinic for Vas-

Tabela 1. Klasifikacija posmatranih parametara sa definisanim referentnim vrednostima i varijabli koje su individualno zavisne

Table 1. Classification of observed parameters with defined reference values and variables that are individually dependent

Parametar / *Parameter*	Referentna vrednost / *Reference value*
Preoperativni / *Preoperative*	
Hemoglobin (g/L) / *Hemoglobin (g/L)*	120-160
Hematokrit (L/L) / *Hematocrit (L/L)*	0.37-0.5
Broj trombocita (10X9/l) / *Platelet count (10X9/l)*	140-400
APTT	< 1.3
PT	< 1.3
Serumska urea (mmol/L) / *Serum urea (mmol/L)*	2.2-7.1
Serumski kreatinin (nmol/l) / *Serum creatinine (nmol/l)*	49-115
Kalijum (mmol/L) / *Potassium(mmol/L)*	3.5-5.5
Broj eritrocita(10x12/L) / *Number of erythrocytes(10x12/L)*	3.9-6.0
Intraoperativni / *Intraoperative*	
pH	7.34-7.45
Postoperativni / *Postoperative*	
Diureza (ml) / *Diuresis (ml)*	500-2000
Serumska urea (mmol/L) / *Serum urea (mmol/L)*	2.2-7.1
Serumski kreatinin (nmol/l) / *Serum creatinine (nmol/l)*	49-115
pH	7.34-7.45
Kalijum (mmol/L) / *Potassium (mmol/L)*	3.5-5.5
Laktati / *Elbows*	0.5-1
pO2 (mmHg)	66-100
Saturacija kiseonikom (%) / *Oxygen saturation (%)*	>96%
Intraoperativne varijable / *Intraoperative variables*	
Gubitak krvi (ml) / *Blood loss (ml)*	
Nadoknada krvi (ml) / *Blood compensation (ml)*	
Diureza(ml) / *Diuresis(ml)*	
Postoperativne varijable / *Postoperative variables*	
Unos tečnosti (ml) / *Fluid intake (ml)*	

U sklopu statističke obrade podataka koristili smo se deskriptivnom statistikom kako za obe grupe zajedno, tako i za svaku posebno, te na kraju komparativnom statistikom jedne grupe u odnosu na drugu. Analiza podataka bila je zasnovana na rezultatima testova statističke značajnosti (t-test i ANOVA), korelacii i x^2 testa i na merama centralne tendencije (aritmetička sredina, medijana i raspon minimalnih i maksimalnih vrednosti). Deskriptivna i komparativna statistika odrađene su u programu Microsoft Office Excel 2007.

cular and Transplant Surgery of the Clinical Center of Vojvodina.

As part of the statistical data processing, we used descriptive statistics for both groups together and for each separately, and finally comparative statistics of one group with the other. The analysis of the data was based on the results of statistical significance tests (t-test and ANOVA), correlations and χ2 tests, and measures of central tendency (arithmetic mean, median, and range of minimum and maximum values). Descriptive and comparative statistics were done in Microsoft Office Excel 2007.

The research was approved by the Ethics Committee of the Clinical Centre of Vojvodina.

RESULTS

In a total sample of 57, the number of men was 50 (87.72%), while the number of women was 7 (12.28%). Within the age structure where the average age was 69.9 years, the youngest person was 54 years old, while the oldest person was 85. The group of survivors counted 30 patients – 4 women and 26 men, while in the second group, there were 27 patients – 3 women and 24 men (Table 2). By group, the median age was 68.6 for survivors (range 55-85) and deceased 71.3 (range 54-85). The descriptive statistics for both of these groups are presented in a tabular manner (Table 3).

Tabela 2. Demografski podaci ispitivanog uzorka

Table 2. Demographic data of the sample examined

Pol/Grupa	Broj preživelih	Broj preminulih	Ukupno
Muškarci	26	24	50
Žene	4	3	7
Ukupno	30	27	57

Based on the data, it follows that in most patients with rAAA (regardless of their subsequent outcome), just before surgery, hemoglobin, hematocrit, and erythrocyte counts were reduced, while serum urea and creatinine were elevated. It was also found that in patients prothrombin time was prolonged. During the operation, most of the patients were in acidosis. In the first 24 hours after surgery, regardless of the subsequent outcome, urea and creatinine, as well as preoperatively were elevated in most cases. Lactate values were also postoperatively elevated in patients of both study groups. In the conducted research within the preoperative parameters, we obtained the following results (Table 4).

Tabela 3. Deskriptivna statistika za sve pacijente

Table 3. Descriptive statistics for all patients

Varijabla / *Variable*	Srednja vrednost / *Mean*	Medijana / *Median*	Minimum / *Minimum*	Maksimum / *Maximum*
Hgb(g/L)	105.6	105	44	171
HCT(L/L)	0.36	0.318	0.148	0.396
Tr(10x9/L)	186	171	13.7	398
APTT	1.13	1.05	0.76	2.42
PT	1.42	1.27	0.98	3.93
Ur(mmol/L) / *your(mmol/L)*	9.23	8.1	3.9	18.1
Kr(nmol/L)	144.7	133	59	574
K(mmol/l)	4.31	4.3	1.02	6.80
Er(10x12/L)	3.57	3.8	1.63	6.02
Gubitak krvi(ml) / *Blood loss(ml)*	1914.6	1700	300	5500
Nadoknada krvi(ml) / *Blood compensation(ml)*	2006	1980	765	4500
Diureza(ml) / *Diuresis(ml)*	563	420	0	4125
pH	7.21	7.24	6.8	7.44
Diureza(ml) / *Diuresis(ml)*	1551	1700	0	3370
Unos tečnosti(ml) / *Fluid intake(ml)*	6012	5840	0	14665
Ur(mmol/l) / *your(mmol/l)*	9.07	8.4	3.9	19.2
Kr(nmol/l)	154	128	49	569
pH	7.2	7.3	6.84	7.43
K(mmol/l)	4.89	4.75	2.4	7.14
Laktati / *Elbows*	3.95	2.09	21.32	21.32
p02(mmHg)	116	107.1	247.7	247.7
s02(%)	92.4	96.5	47.3	100

Istraživanje je bilo odobreno od strane Etičkog odbora Kliničkog centra Vojvodine.

REZULTATI

U ukupnom uzorku od 57, broj muškaraca iznosio je 50 (87,72%), dok je broj žena bio 7 (12,28%). U okviru starosne strukture gde je prosečna starost iznosila 69,9

The mean hemoglobin and hematocrit values in both groups were lower than the reference values, but in the group of deceased, these deviations were more pronounced. Platelet counts in both study groups ranged at reference intervals. The APTT in both groups was in the range of reference values, while the PT in the group of deceased was extended. Serum urea was

Tabela 4. Preoperativni parametri za obe grupe

Table 4. Preoperative parameters for both groups

Parametar / *Parameter*	Preživeli / *Survived*			Preminuli / *Deceased*		
	Srednja vrednost / *Mean*	Medijana / *Median*	Opseg / *Range*	Srednja vrednost / *Mean*	Medijana / *Median*	Opseg / *Range*
Hgb	115.5	116.5	65-155	94.5	88	44-171
HCT	0.34	0.36	0.15-0.46	0.26	0.30	0.14-0.56
Tr	196.95	188	13.7-387	173.92	163	22-398
APTT	1.02	0.98	0.78-1.84	1.26	1.22	0.76-2.42
PT	1.25	1.23	0.98-1.97	1.61	1.40	1.02-3.93
Ur	8.45	7.75	3.9-18.1	10.1	8.7	4.9-17.5
Kr	127.56	113.5	59-333	163.77	143	69-574
K	4.13	4.2	2.4-5.3	4.52	4.6	1.02-6.8
Er	3.76	3.8	2.44-5.04	3.37	3.36	1.63-6.02

UTICAJ PERIOPERATIVNIH FAKTORA NA ISHOD KOD PACIJENATA SA RUPTURIRANOM ANEURIZMOM ABDOMINALNE AORTE
THE IMPACT OF PERIOPERATIVE FACTORS ON THE OUTCOME IN PATIENTS WITH RUPTURED ABDOMINAL AORTIC ANEURYSM

Čović D. et al.

godina, najmlađa osoba je imala 54 godine, dok je najstarija osoba imala 85 godina. Grupa preživelih brojala je 30 pacijenata – 4 žene i 26 muškaraca, dok je u drugoj grupi bilo 27 pacijenata – 3 žene i 24 muškarca (Tabela 2). Gledano po grupama, srednja vrednost godina iznosila je 68,6 za preživele (opseg 55-85), a za preminule 71,3 (opseg 54-85). Deskriptivna statistika za obe navedene grupe prikazana je tabelarno (Tabela 3).

Na osnovu podataka proizilazi da su kod većine pacijenata sa rAAA (nezavisno od njihovog kasnijeg ishoda) neposredno pred operaciju vrednosti hemoglobina, hematokrita i broja eritrocita bile snižene, dok su serumska urea i kreatinin bili povišeni. Takođe, ustanovljeno je da je kod pacijenata protrombinsko vreme bilo produženo. Tokom same operacije većina pacijenata bila je u acidozi. U prva 24 časa nakon operacije, nezavisno od kasnijeg ishoda, urea i kreatinin su, kao i preoperativno, bili povišeni u većini slučajeva. Takođe, vrednosti laktata postoperativno su bile povišene kod pacijenata obe studijske grupe. U sprovedenom istraživanju u okviru preoperativnih parametara dobili smo sledeće rezultate (Tabela 4).

Srednja vrednost hemoglobina i hematokrita u obe posmatrane grupe bile su nižih vrednosti u odnosu na referentne vrednosti, s tim da su u grupi preminulih ova odstupanja bila izraženija. Broj trombocita se u obe studijske grupe kretao u referentnim intervalima. APTT je u obe posmatrane grupe bilo u opsegu referentnih vrednosti, dok je PT u grupi preminulih bilo produženo. Serumska urea je bila viša u odnosu na referentne vrednosti u obe grupe, s tim da je u grupi preživelih imala neznatnije odstupanje u odnosu na grupu preminulih. Serumski kreatinin je u grupi preminulih bio znatnije povišen nego kod preživelih pacijenata. Preoperativno izmereni kalijum se u obe studijske grupe pokazao kao parametar koji nije odstupao od fizioloških vrednosti. Broj eritrocita je u obe posmatrane grupe bio snižen, s tim da je u grupi pacijenata sa boljim ishodom bio bliži granici referentnih vrednosti u odnosu na grupu sa letalnim ishodom. Sumarno, svi preoperativni parametri

higher than the reference values in both groups, but in the group of survivors, it had a slight deviation from the group of deceased. Serum creatinine was significantly elevated in the group of deceased than in surviving patients. Preoperatively measured potassium in both study groups proved to be a parameter that did not deviate from physiological values. The number of erythrocytes in both groups was lowered, but in the group of patients with better outcomes, it was closer to the benchmark limit compared to the group with lethal outcomes. In sum, all preoperative parameters that deviated from the reference range had a more pronounced deviation in the group with a subsequent lethal outcome.

The collected intraoperative variables for the given patient groups are presented in a tabular manner (Table 5).

Intraoperative blood loss was higher in patients with lethal outcomes, as was blood compensation. Diuresis during the operation had slightly more value in the survivors than in the deceased but without any major differences in these two groups. The intraoperatively measured pH proved to be a parameter that was lowered in both groups, with a greater deviation in later deceased patients.

The collected and statistically processed data for postoperative parameters and variables for both study groups are presented in a tabular manner (Table 6).

The values of diuresis measured in the first 24 hours after surgery in both groups were within physiological values, but with values lower in patients who subsequently died. Fluid intake in both study groups was without any major differences in quantity. Serum urea, as well as serum creatinine in both groups, were above the upper limits of their reference values, with a slightly higher deviation in the group of deceased. The mean postoperatively measured potassium in both groups showed no deviation from the reference values. Lactates were elevated in both groups, with higher values predominant in the group of deceased.

Tabela 5. Intraoperativne vrednosti različitih paramatera i varijabli za obe grupe

Table 5. Intraoperative values of different pairs of amateurs and variables for both groups

Parametar / *Parameter*	Preživeli / *Survived*			Preminuli / *Deceased*		
	Srednja vrednost / *Mean*	Medijana / *Median*	Opseg / *Range*	Srednja vrednost / *Mean*	Medijana / *Median*	Opseg / *Range*
Gubitak krvi(ml) / *Blood loss(ml)*	1706	1425	300-3800	2147	1700	500-5500
Nadoknada krvi(ml) / *Blood compensation(ml)*	1728	1665	765-4125	2315	2183	900-3880
Diureza(ml) / *Diuresis(ml)*	575	510	0-2800	549	350	0-4500
pH	7.29	7.32	6.94-7.44	7.13	7.15	6.8-7.42

Tabela 6. Postoperativne vrednosti kliničkih parametara i varijabli za obe grupe

Table 6. Postoperative values of clinical parameters and variables for both groups

Parametar / *Parameter*	Preživeli / *Survived*			Preminuli / *Deceased*		
	Srednja vrednost / *Mean*	Medijana / *Median*	Opseg / *Range*	Srednja vrednost / *Mean*	Medijana / *Median*	Opseg / *Range*
Diureza(ml) / *Diuresis(ml)*	1980	1925	150-3370	1074	1150	0-3050
Unos tečnosti (ml) / *Fluid intake (ml)*	5735	5452	0-14665	6319	6775	0-13650
Ur(mmol/L) / *your(mmol/L)*	8.58	7.9	4.0-17	9.62	9.0	3.9-19.2
Kreatinin(nmol/L) / *Creatinine(nmol/L)*	134.36	129	59-303	175.85	128	49-569
pH	7.3	7.34	7.2-7.49	7.08	7.18	6.84-7.32
Kalijum(mmol/L) / *Potassium(mmol/L)*	4.45	4.4	2.4-6.52	5.39	5.5	3.29-7.14
Laktati / *Elbows*	1.62	1.27	0.6-5.56	6.55	4.39	1.7-21.32
pO2(mmHg)	110.27	113.6	32.3-203	122.5	97.3	31.4-247.7
sO2(%)	93.08	96.6	57.8-100	91.8	96	47.3-99.2

metri koji su odstupali od referentnog opsega imali su izraženije odstupanje u grupi sa naknadnim letalnim ishodom.

Prikupljene intraoperativne varijable za date grupe pacijenata prikazane su tabelarno (Tabela 5).

Intraoperativni gubitak krvi bio je veći kod pacijenata sa letalnim ishodom, kao i nadoknada krvi. Diureza u toku operacije je kod preživelih imala nešto više vrednosti nego kod preminulih, ali bez nekih većih razlika u ove dve grupe. Intraoperativno izmereni pH pokazao se kao parametar koji je u obe grupe bio snižen, s tim da je veće odstupanje bilo kod kasnije preminulih pacijenata.

Prikupljeni i statistički obrađeni podaci za postoperativne parametre i varijable za obe studijske grupe prikazane su tabelarno (Tabela 6).

Vrednosti diureze izmerene u prva 24 sata nakon operacije su u obe grupe bile u okviru fizioloških vrednosti, s tim da su ove vrednosti bile niže kod pacijenata koji su naknadno preminuli. Unos tečnosti je u obe studijske grupe bio bez nekih većih međusobnih razlika u količini. Serumska urea, kao i serumski kreatinin su u obe grupe bili iznad gornjih granica svojih referentnih vrednosti, s nešto većim odstupanjem u grupi preminulih. Srednje vrednosti postoperativno izmerenog kalijuma u obe grupe nisu pokazale nikakvo odstupanje od referentnih vrednosti. Laktati su bili povišeni u obe grupe, s predominacijom viših vrednosti u grupi preminulih. Srednje vrednosti pO2 su bile povišene u obe grupe, dok je saturacija bila snižena u obe grupe.

Na osnovu primenjenih statističkih metoda, došlo se do zaključka da su se kao statistički značajni za ishod kod pacijenata sa rAAA pokazali sledeći parametri: hemoglobin, APTT, PT pre operacije; zapremina intraoperativno nadoknađene krvi i vrednost pH tokom operacije; zatim vrednosti kalijuma, laktata i količina diureze nakon operacije.

Mean pO2 levels were elevated in both groups, while saturation was lowered in both groups.

Based on the applied statistical methods, it was concluded that the following parameters were shown as statistically significant for the outcome in patients with rAAA: hemoglobin, APTT, PT before surgery; the volume of intraoperatively compensated blood and the pH value during surgery; and the values of potassium, lactate, and the amount of diuresis after surgery.

DISCUSSION

Treatment of patients with rupture aneurysm is still one of the greatest challenges for both vascular surgeons and anesthesiologists because it is a life-threatening condition, where most of them are elderly patients, with one or more associated comorbidities associate (which, in our region, are often inadequately treated or even before rupture of the aneurysm and admission to a health institution unknown to the patient himself) [2].

The median age of all patients in our study was 69.9, which is slightly lower than in other studies that analyzed age as an outcome prediction factor in patients with rAAA, while male predominance in our study followed the representation of men in other studies of this type. In the study from the Netherlands, the average age was 76 for Amsterdam, and 73 years for Gröningen and Rotterdam, with male predominance by more than 80% for all three cities observed [8]. The average age closer to ours was recorded in Padua, where in a seventeen-year study it was 71.1 years [9]. In a 2004 paper published by Markovic and co-authors, which covered a ten-year period, the average age was 67 years, and the male representation was 83% [10], which is relatively close to our percentage of 87.7% for male patients. In our country, the average age of sur-

DISKUSIJA

Tretman bolesnika sa rupturiranom aneurizmom i dalje je jedan od najvećih izazova, kako za vaskularne hirurge, tako i za anesteziologe iz razloga što se radi o životno ugrožavajućem stanju gde se većinom radi o pacijentima starijeg životnog doba, sa pridruženim jednim ili više komorbiditeta (koji su u našim krajevima često neadekvatno lečeni, ili čak pre rupture aneurizme i prijema u zdravstvenu ustanovu nepoznati samom pacijentu) [2].

Srednja vrednost godina svih pacijenata u našoj studiji iznosila je 69,9, što je za nijansu niže nego u drugim studijama koje su godine starosti analizirale kao faktor predikcije ishoda kod pacijenata sa rAAA, dok je predominacija muškog pola u našoj studiji ispratila zastupljenost muškaraca u drugim studijama ovog tipa. U studiji iz Holandije, prosečna starost iznosila je 76 godina za Amsterdam i 73 godine za Groningen i Roterdam, s predominacijom muškog pola za više od 80% za sva tri posmatrana grada [8]. Prosečna starost bliža našoj zabeležena je u Padovi, gde je u sedamnaestogodišnjoj studiji ona iznosila 71,1 godina [9]. U radu iz 2004., koji su objavili Marković i saradnici, a koja je obuhvatila desetogodišnji period, zabeležena prosečna starost iznosila je 67 godina i zastupljenost muškog pola od 83% [10], što je relativno blizu našem procentu od 87,7% za pacijente muškog pola. Kod nas, prosečna starost preživelih bila je 68,6, a u grupi preminulih iznosila je 71,3. Naučnici iz Finske izneli su podatke koji takođe ne odstupaju mnogo od naših; 70 godina je bila srednja vrednost godina kod preživelih, a 74 kod preminulih [11]. U našoj studiji, starost se nije dokazala kao statistički značajna za ishod.

Nilson (Neilson) i saradnici su za potrebe svoje studije *The Rapid Ruptured Abdominal Aortic Aneurysm score* pratili smrtnost u 30 dana nakon operacije. Kod njih je taj procenat iznosio 32,9% [12]. U već navedenoj holandskoj studiji, smrtnost u prvih 30 dana posle operacije kretala se u rasponu od 26-36%, u zavisnosti od posmatranog grada [8]. Obe ove studije u obzir su uzimale kako pacijente operisane klasičnom aneurizmektomijom, tako i pacijente operisane endovaskularnim tretmanom.

S druge strane, u studiji sprovedenoj u Švajcarskoj koja se bavila isključivo pacijentima operisanim otvorenim hirurškim tretmanom, smrtnost u prvih 30 dana bila je 30% [13]. U devetogodišnjoj studiji koju su sproveli Hili (Healey) i saradnici, smrtnost u prvih 30 dana od operacije iznosila je 33,4%, takođe za otvorenu aneurizmektomiju [14]. Za razliku od studija sprovedenih u zemljama Zapada, studija sličnog karaktera sprovedena u Beogradu (u kojoj su, kao i u našoj studiji, pacijenti bili operisani otvorenom hirurškom tehnikom) imala

vivors was 68.6, and in the group of deceased, it was 71.3. Scientists from Finland have presented data that also do not deviate much from ours; the age of 70 was the mean of the years in survivors, and 74 in the deceased [11]. In our study, age did not prove to be statistically significant for the outcome.

Neilson and co-authors, for the purpose of their study on *The Rapid Ruptured Abdominal Aortic Aneurysm score*, tracked mortality for 30 days after surgery. This percentage was 32.9% [12]. In the Dutch study, mortality in the first 30 days after surgery ranged from 26-36%, depending on the city observed [8]. Both of these studies took into account both patients operated on for classical aneurysmurectomy, as well as patients operated on endovascular treatment.

On the other hand, in a study conducted in Switzerland, which looked exclusively at patients with open-label surgical treatment, mortality in the first 30 days was 30% [13]. In a nine-year study conducted by Healey and co-authors mortality in the first 30 days of surgery was 33.4%, also for open aneurysmatomy [14]. Unlike studies conducted in Western countries, a study of a similar character was conducted in Belgrade (in which, as in our study, patients were operated on with an open surgical technique) had a mortality rate similar to ours [15]. In their case, this number was 48.3% while in our study it was 47.3%. Since scientists in countries with higher standards of living have proven that it is not impossible to reduce mortality to below 40% unrelated to the method of surgical approach, and the outcome in our patients is similar to that of the Belgrade study, we can conclude that the quality of health care and health services has a major impact on outcomes in patients with rAAA. More modern technology and a more modern operational approach contribute to a better outcome.

Hemoglobin, which is shown as statistically significant in our study, is a parameter most commonly used in studies of a similar character to assess its correlation with the outcome after surgery. The mean hemoglobin values in our study were 115.5 for survivors, and 94.5 for deceased patients. Davidović and his co-authors proved it as statistically significant for the outcome, in whose work the values in survivors were 111.4, and in the deceased 99.4 [15]. The study was conducted in Switzerland, which had the same number of subjects as ours, for the mean hemoglobin values in survivors were 122.7, and 91.8 in the group of deceased, and was also proven to be statistically significant [13].

The components of the hemostasis system in the preoperative period (APTT, PT) in our study proved to be statistically significant for the outcome. Kawatani and co-authors in their study studied the effect of the

je procenat smrtnosti sličan našem [15]. Kod njih je taj broj iznosio 48,3%, dok je u našoj studiji bio 47,3%. Pošto su naučnici u zemljama sa višim životnim standardom dokazali da nije nemoguće smrtnost svesti na ispod 40% nevezano za način hirurškog pristupa, a ishod kod naših pacijenata je sličan kao u beogradskoj studiji, možemo doći do zaključka da kvalitet zdravstvene zaštite i zdravstvenih usluga ima veliki uticaj na ishod kod pacijenata sa rAAA. Savremenija tehnologija i savremeniji operativni pristup doprinose i boljem ishodu.

Hemoglobin, koji se pokazao kao statistički značajan u okviru našeg ispitivanja, jeste parametar koji se najčešće koristi u studijama sličnog karaktera za procenu njegove korelacije sa ishodom nakon operacije. Srednje vrednosti hemoglobina u našoj studiji iznose 115,5 za preživele, i 94,5 za preminule pacijente. Kao statistički značajnog za ishod dokazali su ga i Davidović i saradnici, u čijem su radu vrednosti kod preživelih iznosile 111,4, a kod preminulih 99,4 [15]. Studija koja je imala isti broj ispitanika kao i naša, a sprovedena u Švajcarskoj, kao srednju vrednost hemoglobina imala je 122,7 kod preživelih i 91,8 u grupi preminulih, i takođe je bila dokazana kao statistički značajna [13].

Komponente hemostaznog sistema u preoperativnom periodu (APTT, PT) su se u našoj studiji pokazale kao statistički značajne za ishod. Kavatani (Kawatani) i saradnici u sklopu svoje studije proučavali su uticaj istih ovih parametara na pacijente operisane endovaskularnom metodom, gde se ovi parametri nisu dokazali kao statistički značajni za ishod [16].

Količina intraoperativno nadoknađene krvi u većini radova je opisana kroz jedinice, to jest kao minimalni broj jedinica transfundovane krvi. U našoj studiji napravljena je mala metodološka razlika. Intraoperativna nadoknada krvi koja se dokazala kao značajna u našoj studiji, bila je izražena u mililitrima, podrazumevajući kako zapreminu jedinice resuspendovanih eritrocita i sveže smrznute plazme, tako i zapreminu autologno vraćene krvi Cell saver-om.

Intraoperativno izmerene vrednosti pH u obe naše studijske grupe najvećim delom su se kretale oko 7,29 kod preživelih, i 7,13 kod preminulih. Postoperativno smo mogli primetiti sličnu situaciju – pH je kod najvećeg broja preživelih bio bliži referentnim vrednostima u odnosu na pH preminulih pacijenata.

Brojni radovi se više bave vrednostima uree i kreatinina postoperativno, nego što se baziraju na postoperativnu diurezu. Svakako, na osnovu prikupljenih podataka u okviru naše studije, koji su diurezu nakon operacije pokazali kao statistički značajnu za ishod, možemo reći da su u našem radu pacijenti sa boljim ishodom postoperativno imali više vrednosti diureze u

same parameters on patients operated on endovascular methods, where these parameters were not proven to be statistically significant for the outcome [16].

The amount of intraoperatively compensated blood in most papers is described through units, or the minimum number of units of transfused blood. In our study, a small methodological difference was made. Intraoperative blood compensation, which proved to be significant in our study, was expressed in milliliters, implying both the volume of a unit of resuspended erythrocytes and fresh frozen plasma, as well as the volume of autologously returned blood by Cell saver.

Intraoperatively measured pH values in both of our study groups were largely around 7.29 in survivors, and 7.13 in the deceased. Postoperatively, we were able to observe a similar situation – the pH of most survivors was closer to the reference values compared to the pH of deceased patients.

Several papers deal more with the values of urea and creatinine postoperatively, than they are based on postoperative diuresis. Certainly, based on the collected data within our study, which showed diuresis after surgery as statistically significant for the outcome, we can say that in our work patients with a better outcome postoperatively had higher values of diuresis compared to those with a later lethal outcome. The difference in mean values for both observed groups was over 900ml. The maximum values were also higher in the group of survivors, while in the group of deceased, there was even anuria.

Postoperatively measured lactates in our study proved to be statistically significant for the outcome. In a study conducted by Singhal and associates [17], lactates were also statistically significant, with mean values of 1.9 for survivors, and 7 for the deceased. In our country, these values were 1.62 for survivors, and 6.55 in the group of deceased patients. However, they used the first lactate values measured after surgery for the study, while we used values obtained between 20 and 24 hours after surgery. Lieberg and colleagues pointed out that perioperatively elevated lactate values proved to be determinants of mortality after surgery in patients with rAAA [18].

Combining different clinical, biochemical, and laboratory parameters, numerous studies have been carried out around the world for decades to find the ideal scoring system for assessing outcomes in patients with rAAA. Some of the scores that have previously been applied extensively are *POSSUM, Hardman index,* and *Glasgow Aneurysm score*, with the *Glasgow Aneurysm score* proven to be reliable in predicting outcomes but in elective operations rAAA [19]. *The POSSUM* score consists of two components; physiological variables

odnosu na one sa kasnijim letalnim ishodom. Razlika u srednjim vrednostima za obe posmatrane grupe iznosila je preko 900ml. Maksimalne vrednosti su takođe bile više u grupi preživelih, dok je u grupi preminulih bila prisutna čak i anurija.

Postoperativno izmereni laktati su se u našoj studiji pokazali kao statistički značajni za ishod. U studiji koju su sproveli Singal (Singhal) i saradnici [17] laktati su takođe bili statistički značajni, sa srednjim vrednostima od 1,9 za preživele, i 7 za preminule. Kod nas su te vrednosti iznosile 1,62 za preživele i 6,55 u grupi preminulih pacijenata. Međutim, oni su za studiju koristili prve vrednosti laktata izmerene nakon operacije, dok smo se mi koristili vrednostima dobijenim između 20. i 24. časa nakon operacije. Liberg (Lieberg) i saradnici istakli su da su se perioperativno povišene vrednosti laktata pokazale kao determinante mortaliteta nakon operacije pacijenata sa rAAA [18].

Kombinujući različite kliničke, biohemijske i laboratorijske parametre, u svetu se već decenijama unazad vrše brojna istraživanja u cilju pronalaženja idealnog skoring-sistema za procenu ishoda kod pacijenata sa rAAA. Neki od skorova koji su ranije primenjivani intenzivno jesu *POSSUM, Hardman index* i *Glasgow Aneurysm score*, pri čemu je *Glasgow Aneurysm score* dokazan kao pouzdan u predikciji ishoda samo kod elektivnih operacija rAAA [19]. *POSSUM* skor sastoji se od dve komponente: fizioloških varijabli (godine, prisustvo kardiomiopatije i/ili respiratornih oboljenja, krvni pritisak, puls, *Glasgow coma score*, količina hemoglobina, broj leukocita, urea, natrijum, kalijum, EKG) i 6 operativnih parametara. *Hardman index* sadrži pet parametara – godine, vrednost hemoglobina, koncentraciju serumskog kreatinina, ishemične promene na EKG i prisutnost gubitka svesti [20].

U novije doba pokušava se dobiti skor koji bi imao minimalni broj varijabli koje su brzo i lako dostupne. Skoring-sistem takvog tipa je *Vancouver score* koji se računa na osnovu samo tri podatka – prosečne starosti pacijenta, da li je prisutan gubitak svesti i da li je došlo do zastoja srca. Sličan je i *Edinburgh Ruptured Aneurysm score* čija se vrednost dobija na osnovu procene stanja svesti, vrednosti sistolnog pritiska i hemoglobina preoperativno [7]. U skoring-sisteme novije generacije, sa redukovanim brojem parametara dodaje se i *Dutch Aneurysm score* za čije je računanje bitno razmatrati godine pacijenta, sistolni krvni pritisak, koncentracije hemoglobina, i da li je kod navedenog bolesnika bila potrebna kardiopulmonalna resuscitacija [6].

U poslednjih nekoliko godina rade se i studije na temu upoređivanja različitih skoring-sistema u cilju pronalaženja najboljeg. Iako se ovi skoring-sistemi primenjuju u kliničkoj praksi, ipak nijedan od njih se

(age, presence of cardiomyopathy and/or respiratory diseases, blood pressure, pulse, *Glasgow coma score*, hemoglobin amount, leukocyte count, urea, sodium, potassium, ECG), and 6 operating parameters. *The Hardman index* contains five parameters – years, hemoglobin value, serum creatinine concentration, ischemic changes in ECG, and the presence of loss of consciousness [20].

In recent times, an attempt has been made to obtain a score that would have a minimum number of variables, which are quickly and easily accessible. The scoring system of this type is *the Vancouver score*, which is calculated based on only three data – the average age of the patient, whether there is a loss of consciousness, and whether there was a cardiac arrest. Similar is *the Edinburgh Ruptured Aneurysm score*, whose value is obtained from the assessment of the state of consciousness, and the values of systolic pressure and hemoglobin preoperatively [7]. In scoring systems of the new generation, with a reduced number of parameters, the *Dutch Aneurysm score* is added, for which it is important to consider the patient's age, systolic blood pressure, hemoglobin concentrations, and whether cardiopulmonary resuscitation was required in this patient [6].

In recent years, studies have been done on the topic of comparing different scoring systems, in order to find the best. Although these scoring systems are applied in clinical practice, none of them can be used independently as the only criterion for decisions about whether or not to operate on a patient, as well as what the subsequent outcome will be. Certainly, it would not be ethical to treat patients solely based on a scoring system. Our study does not contain data that would fully correspond to any of the above scoring systems (state of consciousness, systolic blood pressure, comorbidities, leukocyte count, sodium concentration, and cardiological parameters – cardiac arrest, ECG record, and cardiopulmonary resuscitation data), because we could not find data relevant to each of the above parameters in the medical records. The only one of the observed parameters contained in both the scoring systems and our study, that had statistical significance in our study, was hemoglobin. Serum creatinine concentration preoperatively used in the *Hardman index* is not statistically significant. Also, the study did not prove a significant impact of preoperative values of potassium and urea, which are used in calculating the value *of the POSSUM score*.

CONCLUSION

Based on the applied statistical methods, it was concluded that the following parameters were shown as

ne može koristiti samostalno, tj. kao jedini kriterijum za odluke o tome da li pacijenta operisati ili ne, kao i kakav će kasniji ishod biti. Svakako, ne bi bilo ni etički pacijente tretirati samo na osnovu skoring-sistema. Naša studija ne sadrži podatke koji bi u potpunosti odgovarali nekom od navedenih skoring-sistema (stanje svesti, sistolni krvni pritisak, komorbiditeti, broj leukocita, koncentracija natrijuma i kardiološki paramteri – zastoj srca, EKG zapis, i podatak o kardiopulmonalnoj resuscitaciji) iz razloga što u medicinskoj dokumentaciji nismo mogli pronaći podatke relevantne za svaki od navedenih parametara. Jedini od posmatranih parametara sadržan i u skoring-sistemima i u našoj studiji, a koji je imao statistički značaj u našoj studiji bio je hemoglobin. Koncentracija serumskog kreatinina preoperativno, koja se koristi u sklopu *Hardman index*-a, kod nas nije zabeležena kao statistički značajna. Takođe, studijom nismo dokazali značajan uticaj preoperativnih vrednosti kalijuma i uree koji se koriste u računanju vrednosti *POSSUM score*.

ZAKLJUČAK

Na osnovu primenjenih statističkih metoda došlo se do zaključka da su se, kao statistički značajni za ishod kod pacijenata sa rAAA, pokazali sledeći parametri: hemoglobin, APTT, PT pre operacije; zapremina intraoperativno nadoknađene krvi i vrednost pH tokom operacije; kao i vrednosti kalijuma, laktata i količina diureze nakon operacije.

Sukob interesa: Nije prijavljen.

statistically significant for the outcome in patients with rAAA: hemoglobin, APTT, PT before surgery; the volume of intraoperatively compensated blood and the pH value during surgery; and the values of potassium, lactate, and the amount of diuresis after surgery.

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