

# Protokoli bodovanja težine ozljede kao prediktori ishoda za politraumatizirane pacijente

## Injury severity scoring protocols as predictors of outcome for polytrauma patients

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### Sažetak

**Uvod:** Težina ozljede kod politrauma procjenjuje se na temelju ljestvica koje se koriste zbrojem bodova (numerički sustavi), činjenica ozljede kao i na temelju iskustva u procjeni težine ozljeda. Skraćena ljestvica ozljeda (eng. *Abbreviated Injury Scale - AIS*) rangira ozljede od 1 do 6, s tim da 1 označava lakše ozljede, a 6 maksimalno teške ozljede. Ljestvica nije dizajnirana za predviđanje preživljavanja i koristi se rezultatima koji se temelje na konsenzusu. Ocjena ozbiljnosti ozljede (eng. *Injury Severity Score - ISS*) dodjeljuje bodove ozljedama traumatiziranog pacijenta s višestrukim ozljedama cijelog tijela. Cilj je ovog rada odrediti prediktivne vrijednosti postojeće ljestvice ozljeda na ISS ljestvici.

**Metode:** Uzorak je obuhvatio 84 pacijenta oba spola i svih dobnih skupina koji su praćeni tijekom jedne godine. Ispitanici su imali višestruke, prodorne i nepenetrantne ozljede, a uključivali su i one čiji su vitalni parametri stabilizirani te je dijagnostika provedena prema protokolu u Klinici za intenzivnu njegu bez obzira na konačni ishod. Primijenjena je formula koja se koristi za pretvaranje AIS-a u ISS rezultat protokola gradacije.

**Rezultati:** Ispitanici su bili prosječno u dobi od  $40 \pm 17,6$  godina, od kojih je većina bila muškaraca, a prometne su nesreće bile prevladavajući mehanizam ozljeđivanja. ISS se povećava s težinom ozljeda. Udio pacijenata s CCC bodom  $\leq 14$  imao je pozitivnu prediktivnu vrijednost različitu od ISS-a. Udio ispitanika s politraumom koji su imali CCC rezultat = 15 i ISS < 15 imao je negativnu prediktivnu vrijednost.

**Zaključak:** Utvrđeno je da postoji razlika u pouzdanosti između CCC-a i ISS sustava u određivanju stupnja ozbiljnosti stanja u bolesnika liječenih u Klinici za intenzivnu njegu.

**Glavne riječi:** politrauma, sustavi bodovanja traume, ISS, CCC

**Kratak naslov:** Usporedba protokola bodovanja politraumatiziranih pacijenata

### Abstract

**Introduction:** The severity of the injury is assessed against many scales, which use a sum of scores (numerical systems), injury facts, and experience to assess the severity of injuries. The AIS (Abbreviated Injury Scale) ranks injuries from 1 to 6, 1 being minor injuries and 6 being maximal injuries. It is not designed to predict survival and uses consensus-based scores determined by experts. The Injury Severity Score (ISS) assigns scores to the injuries of a trauma patient with whole-body multiple injuries. This paper aims to determine the predictive values of the existing scale of injuries on the ISS scale.

**Methods:** The sample included 84 patients of both sexes and from all age groups, who were monitored over one year. The subjects had multiple penetrating and non-penetrating injuries, and included those whose vital parameters were stabilized and whose diagnostics were conducted according to the protocol in the Emergency Medicine Clinic regardless of the outcome. The formula used to convert AIS to ISS gradation protocol score was applied.

**Results:** The subjects were aged  $40 \pm 17.6$  years on average, most of whom male; road accidents were the predominant mechanism of injury. The ISS increases with the severity of injuries. The proportion of patients with a CCC score  $\leq 14$  had a positive predictive value different from the ISS. The proportion of subjects with polytrauma who had a CCC score = 15 and an ISS < 15 had a negative predictive value.

**Conclusion:** It was found that there was a difference in reliability between the CCC and ISS systems in determining the levels of severity of conditions in patients treated at the Critical Care Clinic.

**Keywords:** polytrauma, trauma scoring systems, ISS, CCC

**Running head:** Comparison of polytrauma patients scoring protocols

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### Uvod

Trentza (2000) je definirao politraumu kao sindrom teških višestrukih ozljeda gdje skala težine ozljeda ili ISS (eng. *Injury Severity Score*) iznosi više od 17 bodova, sa sistemskim traumatskim odgovorom koji može prouzrokovati zakazivanje organa i vitalnih sistema koji nisu inicijalno bili trau-

### Introduction

Trentz (2000) defined polytrauma as a syndrome of multiple injuries exceeding a defined severity (ISS 17) with sequential systemic traumatic reactions that may lead to dysfunction or failure of remote organs and vital systems, which had not themselves been directly injured [1]. The pa-

matizirani [1]. Pacijent koji se prima u jedinicu intenzivnog liječenja nakon početnog oživljavanja i kirurškog zahvata može biti daleko od stabilnosti, s krvarenjem, potrebom reanimacije i ozljedama koje još uvijek zahtijevaju konačno zbrinjavanje [2]. Zastupljenost politraumatiziranih u ukupnom broju povrijeđenih iznosi 3 %, a stopa smrtnosti iznosi od 16 do 22 % [3]. Mehanizam traumatske bolesti predstavlja fiziološki odgovor organizma na stres, a potaknut je fizičkom i psihičkom percepcijom boli, traumatskom destrukcijom tkiva i šokom [4]. U liječenju bolesnika s politraumom zabilježen je značajan napredak kao rezultat boljeg razumijevanja fiziopatoloških mehanizama ozljeda, razvijanja mreže zdravstvenih ustanova i poboljšanja reanimacijskog postupka [5]. Za procjenu težine povrijeđivanja koristi se niz skala koje se temelje na brojčanom zbroju (numerički sistem) [4]. Skor sistem predstavlja pokušaj objektivizacije procjene stanja teško povrijeđenih i kritično oboljelih i sastoji se u bodovanju (kvantifikaciji) vitalnih funkcija [6]. Skraćena skala ozljeda – AIS (eng. *Abbreviated Injury Scale*) predstavljena je prvi put 1969. godine. Od tada je doživjela nekoliko revizija, a ona iz 1990. godine predstavlja pouzdan pokazatelj težine ozljede (Tablica 1.). Ozljede su rangirane na skali od 1 do 6, gdje su s 1 obilježene lake ozljede, a sa 6 ozljede koje se ne mogu preživjeti [7]. Nije dizajnirana za predikciju preživljavanja te je utvrđena na temelju stručnog konsenzusa [8].

**TABLICA/ TABLE 1.** AIS skala / Abbreviated Injury Scale

Skraćena skala ozljede AIS	
AIS scor	Kvalifikacija ozljede
1	Minorna ozljeda
2	Umjereno teška ozljeda
3	Srednje teška ozljeda
4	Teško ozbiljna ozljeda
5	Kritično teška ozljeda
6	Smrtonosna ozljeda

Skala težine ozljeda – ISS (eng. *Injury Severity Score*) formulirana je 1974. godine, a daje numerički opis ozljeda u sklopu politraume tijela kao cjeline. Ovaj sistem doživio je reviziju u formi novog, dopunjenog ISS skor sistema NISS (eng. *New Injury Severity Score*) [9]. Revizija je bila neophodna zbog manjkavosti u statističkim analizama politraume, gdje su se kod različitih ozljeda javljali isti rezultati (Tablica 2.) [10].

Od šest regija biraju se tri najozbiljnije povrijeđene regije i skor njihovih ozljeda (AIS) kvadrira se i potom dobije ISS.  $ISS = AIS1^2 + AIS2^2 + AIS3^2$ . Ovisno o broju bodova određuje se težina politraume koja je podijeljena na četiri stadija: I. stadij <19 bodova, II. od 24 do 34 boda, III. od 35 do 48 bodova, IV. > 49 bodova. Sve ove regije te starost pacijenta klasificiraju se prema bodovima koji označavaju težinu ozljede [11]. ISS sistem ocjene predstavlja procjenu anatomskeg sistema u kojem je ukupni rezultat izračunat na temelju skraćenih skala ozljeda (AIS) za svaku regiju tijela. ISS veći od 16 označava ozbiljnu politraumu [12].

tient presenting to the intensive care unit following initial resuscitation and damage control surgery may be far from stable with ongoing hemorrhage, resuscitation needs, and injuries still requiring definitive repair [2]. Patients with multiple injuries accounted for 3 percent of the total patients with injuries, while the mortality rate ranged from 16 to 22 percent [3]. The mechanism of trauma is an actual physiological response to stress caused by the physical and mental perception of pain, traumatic tissue destruction, and shock [4]. The treatment of polytrauma patients noted a significant development because of a better understanding of the physio-pathological mechanisms of injury, the development of a network of health care institutions, and improved resuscitation [5]. Various methods have been developed to score injury severity, which uses summation of scores (numerical systems) [4]. Scoring systems are an attempt to objectivize the assessment of the condition of injured and critically ill patients by way of scoring (quantification) vital functions [6]. The Abbreviated Injury Scale was first introduced in 1969. It has seen several revisions since, and the 1990 revisions are deemed a reliable indication of the severity of injuries (Table 1). Injuries are ranked according to a scale ranging from 1 to 6, where 1 is a minor injury, and 6 corresponds to an injury that is incompatible with life [7]. It is not designed to predict survival and uses consensus-based scores determined by experts [8].

The Injury Severity Score (ISS) was published for the first time in 1974 and assigns scores to the injuries of a trauma patient with whole-body multiple injuries. This system was revised and amended by a new injury severity score system NISS (*New Injury Severity Score*) [9]. The revision was necessary due to the weaknesses of the statistical analysis of polytrauma, as computation yielded identical results for different injuries (Table 2) [10].

**TABLICA/ TABLE 2.** ISS skala / Injury Severity Score

Injury Severity Score, (ISS)			
Tjelesna regija	Opis ozljede	AIS	Kvadrat vodeće tri ozljede
Glava i vrat	Kontuzija mozga	<b>3</b>	<b>9</b>
Lice	Bez ozljede	<b>0</b>	
Prsni koš	Flail chest	<b>4</b>	<b>16</b>
Trbuh	Kontuzije jetre, ruptura slezene	<b>25</b>	<b>25</b>
Ekstremiteti	Fraktura femura	<b>3</b>	
Vanjske ozljede	Bez ozljede	<b>0</b>	
Stupanj ozbiljnosti ozljeda prema ISS score:			<b>50</b>

The ISS score is a sum of the squared AIS scores from the three most severely injured regions.  $ISS = AIS1^2 + AIS2^2 + AIS3^2$ . The scores indicate the severity of polytrauma using four levels: **I** <19, **II** 24-34, **III** 35-48 and **IV** >49. These regions and the patient's age are scored to indicate the severity of the injury [11]. Therefore, the ISS is an anatomic sys-

## Materijali i metode

Uzorak istraživanja uključivao je 84 politraumatizirana bolesnika u jednogodišnjem periodu, svih dobnih skupina i oba spola. Ispitanici su bili s politraumom, penetrantnim i nepenetrantnim ozljedama te oni kod kojih je provedena stabilizacija vitalnih parametara i dijagnostika po protokolu Klinike za intenzivnu njegu [13] bez obzira na krajnji ishod. Izvor radnog materijala bili su obrasci – Protokol politraumatiziranih i multiplotraumatiziranih pacijenta u kojem su evidentirani svi značajni podaci o povrijeđenom, a koji se primjenjuje prilikom prijema povrijeđenog u Kliniku za intenzivnu njegu Kliničkog Centra Sarajevo. Primijenjena je formula kojom je pretvoren Trauma skor po postojećem protokolu u ISS skor gradacijskog protokola [14].

## Rezultati

Prosječna dob ispitanika je  $40 \pm 17,6$  godina. Kruskal-Wallis Test pokazao je da su razlike u dobi ispitanika prema mehanizmu ozljede statistički značajne,  $p = 0,003$ . Razlika u dobi ispitanika s ozljedama u prometnim nesrećama i ozljedama od pada s visine statistički je značajna  $p = 0,003$ . Ispitanici s ozljedama iz prometnih nesreća pripadnici su mlađe populacije. Razlika u dobi ispitanika s ozljedama nastalima od pada i ozljedama ostale etiologije nije statistički značajna,  $p = 0,529$ . Ispitanici s ozljedama od pada mlađe su starosne dobi, ali bez statističkog značaja (Tablica 3.).

**TABLICA/TABLE 3.** Mehanizam ozljede u odnosu na dob ispitanika / Mechanism of injury by patient age

	N	25.	50. (medijan)	75.
Prometne ozljede	49	22	32	44
Ozljede od pada	25	34	45	61
Ozljede oružjem	2	26	28	...
Ostale ozljede	8	39	57	70

U uzorku je dominirao muški spol (82 %). Mehanizam ozljede ne ovisi o spolu ispitanika,  $\chi^2 = 0,679$   $p = 0,41$ ; u objema kategorijama dominiraju prometne ozljede, a potom slijede ozljede od pada i ostale ozljede (Tablica 4.).

**TABLICA/TABLE 4.** Mehanizam ozljede u odnosu na spol ispitanika / Mechanism of injury by patient sex

		Mehanizam ozljede			Ukupno	
		Prometne ozljede	Ozljede od pada	Ostale ozljede		
Spol ispitanika	Muški	Count	39	21	9	69
		% within pol	56,5 %	30,4 %	13,0 %	100,0 %
	Ženski	Count	10	4	1	15
		% within pol	66,7 %	26,7 %	6,7 %	100,0 %
Ukupno		Count	49	25	10	84
% within pol			58,3 %	29,8 %	11,9 %	100,0 %

tem in which an overall score is calculated based an abbreviated injury scale (AIS) for each body region. An ISS higher than 16 indicates severe polytrauma [12].

## Material and methods

The study sample included 84 polytrauma patients of both sexes and from all age groups, who were monitored for one year. The subjects had multiple penetrating, and non-penetrating injuries. The study sample included those whose vital parameters were stabilized and whose diagnostics were conducted according to the protocol of the Critical Care Clinic ('CCC scoring system') [13], regardless of the outcome. The study used the forms ('Protocol for patients with polytrauma and multiple injuries') recording all key information on the (trauma) patient, as filled in at admission at the Sarajevo Clinical Centre, Critical Care Clinic ('CCC'). The CCC scores were converted to ISS according to a formula [14].

## Results

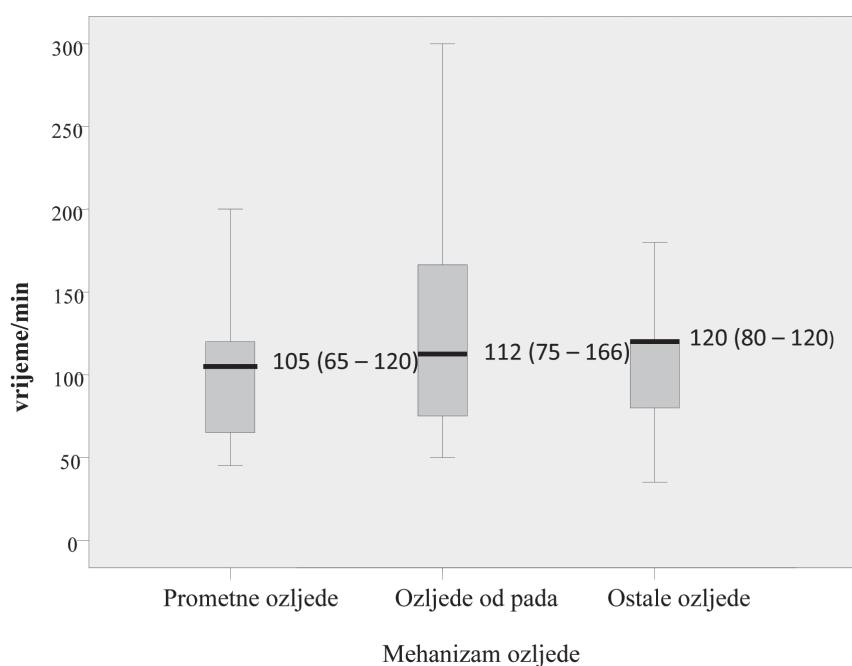
The average age of the study population was  $40 \pm 17,6$ . The Kruskal-Wallis test suggested that the correlation between age and the mechanism of injury was statistically significant ( $p=0.003$ ). Among the patients with injuries sustained in road traffic accidents and falls from height, the age difference was statistically significant ( $p=0.003$ ). Patients with injuries sustained in road traffic accidents were younger. The age difference between patients with injuries sustained due to falls from height and patients with other injuries was statistically insignificant ( $p=0.529$ ). The patients who sustained injuries due to falls were somewhat younger, but their age was statistically insignificant (Table 3).

Most of the patients were male (82 percent). The mechanism of injury did not correlate with the age,  $\chi^2=0.679$   $p=0.41$ ; prevailing MOIs in both groups included road accidents, falls, and other injuries (Table 4).

For patients with polytrauma caused by road traffic accidents, the average time-to-treatment was 105 minutes (65-120). For patients with polytrauma caused by falls, the average time-to-treatment was 112 minutes (75-166), while

Ispitanici s politraumom nastalom u prometnim nesrećama u prosjeku su zbrinuti za 105 (65 – 120) minuta. Ispitanici s politraumom nastalom padom u prosjeku su zbrinuti za 112 (75 – 166) minuta, dok su ispitanici s politraumom nastalom u ostalim okolnostima u prosjeku zbrinuti za 120 (80 – 120) minuta. Razlika u prosječnom vremenu zbrinjavanja među ispitanicima s različitom etiologijom ozljeda nije statistički značajna,  $p = 0,368$  (Grafikon 1.).

for patients with other mechanisms of injury, the average time-to-treatment was 120 minutes (80-120). The difference in the average time-to-treatment with different mechanisms of injury was statistically insignificant ( $P=0.368$ ) (Figure 1).



**GRAFIKON/FIGURE 1.** Vrijeme zbrinjavanja ispitanika u odnosu na mehanizam ozljede / Time-to-treatment by mechanism of injury

ISS je u korelacijama s AIS1 (težinom ozljeda glave i vrata)  $\rho = 0,326$ ,  $p = 0,003$ , AIS4 (težinom ozljede abdomena, pelvičnih organa i kralježnice)  $\rho = 0,526$ ,  $p = 0,0001$ , AIS5 (ozljedama ekstremiteta i karlice)  $\rho = 0,267$ ,  $p = 0,014$ . Korelacije su za sve tri kategorije pozitivne i srednje jake. ISS raste s porastom težine navedenih ozljeda (Tablica 5.).

Proporcija ispitanika koji su prema postojećoj skali imali manje od 14 ili jednako 14 bodova, u odnosu na ISS skalu gdje su bodovani s ( $\geq 15$ ) pozitivna je prediktivna vrijed-

The ISS correlated with the AIS1 (severity of head and neck injuries)  $\rho=0.326$   $p=0.003$ , AIS4 (severity of abdominal, pelvic organ, and spinal injuries)  $\rho=0.526$   $p=0.0001$ , AIS5 (extremities and pelvic injuries)  $\rho=0.267$   $p=0.014$ . In all three categories, the correlations were positive and moderately strong. The higher the ISS score, the higher the injury severity (Table 5).

The proportion of patients with a CCC score  $\leq 14$  or an ISS  $\geq 15$  is a positive predictor, with  $52/56=0.929$  or  $PPV = 93\%$  (in 93 percent of polytrauma patients, the CCC and ISS systems had corresponding scores). The proportion of polytrauma patients with a CCC score=15 or an ISS  $<15$  is a negative predictor, with  $6/28=0.214$  or  $NPV=21\%$  (in only 21 percent of polytrauma patients the CCC and ISS systems corresponded for minor injuries, or: 78 percent of polytrauma patients had a CCC score=15 (minor polytrauma); in reality, these were patients with serious multiple injuries and an ISS  $\geq 15$  (Table 6).

**TABLICA/TABLE 5.** Korelacije ISS (skor težine ozljeda) u odnosu na AIS (skraćenu skalu ozljeda) regija tijela / ISS vs. AIS correlations

	AIS1	AIS2	AIS3	AIS4	AIS5	AIS6
Koeficijent korelacije	,326	-,010	,174	,521	,267	-,067
Rho						
p	,003	,932	,113	,0001	,014	,543
N	84	84	84	84	84	84

## Discussion

Injuries are a major health problem and lead cause of death, especially among young adults and adolescents. The find-

**TABLICA/TABLE 6.** Prediktivne vrijednosti postojeće skale ozljeda u odnosu na ISS skalu / CCC scale vs. ISS predictors

		ISS skor		Ukupno	
		<15	=/>15		
KUM postojeća skala	<= 14 bodova	Count	4	52	56
		%	7,1 %	92,9 %	100,0 %
	15 bodova	Count	6	22	28
		%	21,4 %	78,6 %	100,0 %
Ukupno		Count	10	74	84
		%	11,9 %	88,1 %	100,0 %

nost i iznosi  $52/56 = 0,929$  ili  $PPV = 93\%$  (kod  $93\%$  politrauma postojeća i nova skala poklapaju se u procjeni težine). Proporcija ispitanika s politraumom koji su imali 15 bodova prema postojećoj skali i <15 prema ISS skali negativna je prediktivna vrijednost te iznosi  $6/28 = 0,214$  ili  $NPV = 21\%$  (samo kod  $21\%$  slučajeva politraume postojeća i nova skala poklapaju se u procjeni da se radi o lakšoj politraumi) ili  $78\%$  slučajeva politraume prema postojećoj skali imalo je 15 bodova (lakša politrauma) dok se zapravo radilo o teškim politraumama koje imaju  $ISS = />15$ ) (Tablica 6).

## Rasprava

Ozljede su značajan zdravstveni problem i vodeći uzrok smrti mlađih odraslih osoba i adolescenata. Rezultati provedenog istraživanja ukazuju na to da je učestalost povrjeđivanja daleko veća kod muškaraca,  $82\%$ , u odnosu na žene,  $18\%$ . U usporedbi sa svjetskom literaturom podudara se podatak da su muškarci češće izloženi politraumi. Budući da su prometne nesreće vodeći uzrok traume, smatra se da je muška populacija manje pažljiva u prometu od žena, pa su i prometne nesreće češće [15, 16]. Prosječna starosna dob ispitanika s politraumom u ovom istraživanju je  $40 \pm 17,6$  godina. Autori iz Velike Britanije prikazali su da su osobe starije od 50 godina bile s većim morbiditetom [17]. Ispitanici s politraumom nastalom u prometnoj nesreći bili su prosječne starosne dobi od 32 ( $22 - 44$ ) godine. Traume uslijed prometnih nesreća najčešći su uzrok politraume u ovom istraživanju ( $58\%$ ). Wigglesworth je u svojoj studiji izdvojio dvije grupe američkih država na osnovi učestalosti mortaliteta i morbiditeta u prometnim nesrećama. U svim državama prometni je traumatizam bio na prvom mjestu [18]. Hisamuddin i suradnici također su kod politraumatiziranih pacijenata prikazali najviši udio onih iz prometnih nesreća. Njihova se studija bavila udjelom smrtnog ishoda prema vrsti traumatizma za razliku od naše studije kojom smo analizirali predikciju skora težine tjelesnih ozljeda [19]. Međutim, Ribeiro dos Santos i suradnici (2015) prikazali su da je u Sjedinjenim Američkim Državama identificiran porast morbiditeta i mortaliteta kao posljedica traumatskih ozljeda među Amerikancima starijima od 65 godina. Shodno tome, stvorila se potreba za uspostavljanjem registra politraumatiziranih pacijenata uzimajući u obzir lokaciju prometne nesreće, godine te druge demografske podatke s ciljem uspostavljanja preventivnih mjera za kontrolu i sprječavanje takvih događaja [20].

ings of our study suggest that injuries are much more prevalent among men than women ( $82$  and  $18$  percent respectively). This compares to the literature suggesting that men are more exposed to polytrauma. Since the lead cause of polytrauma is road traffic collision, the male population is considered to be less cautious than women; hence the more frequent road accidents [15, 16]. The average age of polytrauma patients in this study was  $40 \pm 17.6$ . Authors from the UK demonstrated that persons aged  $50+$  had higher morbidity rates [17]. Patients with major trauma caused by a road traffic collision were aged 32 on average ( $22-44$ ). The most common causative mechanism in this study was road traffic collision accounting for  $58$  percent. In his study, Wigglesworth examined two groups of US states with above-average rates of road traffic mortality and morbidity. Road traffic deaths were highest in all states [18]. Hisamuddin et. al demonstrated that motor vehicle crashes were the most common cause among major trauma patients. Their study looked into deaths by type of trauma; however, in our study, we looked into ISS predictors [19]. However, in their review article from 2015, Ribeiro dos Santos and others showed higher morbidity and mortality rates due to trauma injuries among Americans aged  $65+$ . Consequently, a major trauma patient register was set up to record the site of the road traffic collision, age, and other demographic data to design measures to control and prevent such events [20].

The study looked into the injuries sustained due to a fall from height, which was the second lead mechanism of injury, in a sample of patients aged 45 ( $34-61$ ). Giannoudis described trauma in elderly patients from 1997 to 2002. Patients aged  $65+$  accounted for only  $13.8\%$  of the trauma population. The most common mechanism of injury was falling from height [21]. Although the findings of different studies showed higher rates of older patients diagnosed with or sustaining trauma, it is not quite clear whether they were due to an increased number of older patients sustaining multiple injuries or better diagnostics for those groups. Recently, efforts have been invested to introduce protocols for polytrauma patients. One example is increased use of CT and general adoption of guidelines and integration of whole-body CT as a standard diagnostic method [22]. In this study, the age of patients with other injuries was 57 ( $39-70$ ), which compares to the literature [23]. Time-to-treatment was different for geriatric and young patients [24]. Evidence explored in the studies suggests that among

Analiziranjem nesreća nastalih padom s visine, koji je bio drugi po učestalosti prema mehanizmu povrjeđivanja, u ovom su istraživanju bili ispitanici starosne dobi od 45 (34 – 61) godina. Giannoudis je opisao traume kod starijih osoba između 1997. i 2002. godine. U njegovu su radu bolesnici iznad 65 godina činili samo 13,8 % traumatske populacije. Pretežni mehanizam ozljede u ovoj studiji bio je pad s visine [21]. Iako podaci nekih studija potvrđuju povećanje broja starijih pacijenata s dijagnozom i evidentiranjem traumatskih ozljeda, nije u potpunosti jasno je li to tako zbog toga što više starijih pacijenata zapravo zadobije multiple ozljede ili zato što je dijagnosticiranje ozljeda u tim skupinama poboljšano. Tijekom posljednjih godina uloženi su veliki napor i trud u uspostavljanje protokola za politraumatizirane pacijente. Jedan od primjera je povećana upotreba kompjuterizirane tomografije (CT) sa široko rasprostranjenim usvajanjem smjernica za snimanje ozljeda glave i povećane uporabe CT-a cijelog tijela kao metode istraživanja [22].

Starosna je dob za ostale ozljede u ovoj studiji 57 (39 – 70) godina, što je u skladu s literaturom [23]. Patofiziološki odgovor na traumu kod starijih osoba razlikuje se od mladih [24]. Dokazi koji su analizirani u studijama upućuju na to da za određenu anatomske ozbiljnost traumatskih ozljeda mozga smanjenje *Glasgow Coma Scale* u starijih je osoba manje od onog kod mladih [25]. Prema rezultatima ove studije, razlika u prosječnom vremenu zbrinjavanja među ispitanicima s različitim mehanizmom ozljede nije statistički značajna ( $p = 0,368$ ). Markopoulou i suradnici prikazali su da je vrijeme zbrinjavanja politraumatiziranih pacijenata bilo pod utjecajem medicinskih stručnjaka koji su potrebni za konzultaciju svakom pacijentu, zajedno s vremenom potrebnim za dovršetak ovih postupaka, kao i duljinom trajanja dijagnostičkih testova. Preživljavanje je povezano sa saturacijom kisikom, sistoličkim krvnim tlakom, ISS-om, revidiranim trauma skorom (*Revised Trauma Score – RTS*) i trajanjem hospitalizacije [26]. U ovoj je studiji ISS u korelaciji sa sve tri kategorije: AIS1 ( $\rho = 0,326$ ,  $p = 0,003$ ), AIS4 ( $\rho = 0,526$ ,  $p = 0,0001$ ) i AIS5 ( $\rho = 0,267$ ,  $p = 0,014$ ) imao pozitivne i srednje jake korelacije. ISS je rastao s porastom težine ozljeda. Rezultati su usporedivi s rezultatima drugih studija. Prema istraživanju Rathore i suradnika, srednji ISS bio je  $5,14 \pm 0,77$ . Niži ISS rezultat pripisao se uključivanju manje ozbiljnih ozljeda u studiju, a znatno veći bio je kod onih koji su umrli ( $30,16 \pm 11,753$ ) u usporedbi s onima koji su preživjeli [27]. Koo i suradnici prikazali su prosječni ISS od 16,7 kod preživjelih i 16,9 za one koji su završili letalno. Naša je studija imala niži ISS. Kad su se ISS preživjelih i umrlih uspoređivali s ishodom, dobiven je značajan  $p < 0,001$ . Opći je trend da se s povećanjem ISS postotaka stopa preživljavanja smanjuje [28].

Prema ovom istraživanju, ISS klasifikacija ozljeda pokazala je da 88 % ispitanika s politraumom ima ISS  $\geq 15$ , dok ISS  $< 15$  ima 12 % ispitanika. Proporcija ispitanika koji prema AIS-u imaju manje  $\leq 14$  bodova, u odnosu na ISS skalu gdje su bodovani s  $\geq 15$  pozitivna je prediktivna vrijednost i iznosi  $52/56 = 0,929$  ili PPV = 93 %. Dakle, kod 93 % politrauma postojeća se Skor skala i nova skala poklapaju u procjeni težine. Proporcija ispitanika s politraumom koji su imali 15 bodova prema AIS-u i  $< 15$  prema ISS skali negativna je prediktivna vrijednost i iznosi  $6/28 = 0,214$  ili NPV = 21 %. Dakle, samo kod 21 % slučajeva politraume posto-

patients with traumatic brain injury, the Glasgow Coma Scale scores were lower in the young group than in the elderly group despite a higher burden of anatomical injury [25]. According to the study, the difference in the average time-to-treatment among patients with different mechanisms of injury was statistically insignificant ( $p=0.368$ ). Markopoulou and associates showed that time-to-treatment seemed to be affected by the number of medical specialists needed for each patient and the time needed for specialty consulting as well as the time needed for their diagnostic tests. It was concluded that polytrauma patients' saturation pulse oxygen, systolic blood pressure, ISS, RTS (*Revised Trauma Score*), and, of course, the length of stay reflected their chance of survival [26]. In this study, ISS correlated to all three categories: AIS1 ( $\rho=0.326$ ,  $p=0.003$ ), AIS4 ( $\rho=0.526$ ,  $p=0.0001$ ), and AIS5 ( $\rho=0.267$ ,  $p=0.014$ ) suggested strong and moderate correlations. The higher the ISS score, the higher the injury severity. These findings compare to other studies. According to the study conducted by Rathore and others, the mean ISS was  $5.14 \pm 0.77$ . The lower ISS score was attributed to the inclusion of less severe injuries in the study, whereas the mean ISS was significantly higher among those who died ( $30.16 \pm 11.753$ ) as compared to those who survived [27]. Koo and others showed that the average ISS among survivors and non-survivors was 16.7 and 16.9 respectively. The ISS in our study was lower. The outcome-based ISS among survivors and non-survivors had a significant  $P < 0.001$ . Overall trends indicated that the higher the ISS rate, the lower the survival rate [28].

According to this study, the ISS assessment of injuries showed that 88% of patients with polytrauma had an ISS  $\geq 15$ , whereas 12% of patients had an ISS  $< 15$ . The proportion of patients with a CCC score  $\leq 14$  and an ISS  $\geq 15$  is a positive predictor with  $52/56=0.929$  or PPV = 93%. Therefore, in 93% of polytrauma cases, the CCC and ISS systems correspond. The proportion of subjects with polytrauma with a CCC score=15, and an ISS  $< 15$  had a negative predictive value of  $6/28=0.214$  or NPV=21%. Therefore, in only 21% of polytrauma patients, the CCC and ISS systems correspond indicating minor injuries, whereas 78% of polytrauma patients had a CCC=15 (minor polytrauma) when in reality they had an ISS  $\geq 15$  (serious polytrauma). The findings showed that the CCC scoring system recognized 93% of patients with an ISS  $\geq 15$  (severe polytrauma) but is rather unreliable (21%) in assessing/scoring polytrauma with an ISS  $< 15$  (minor polytrauma). In their study, Gvozdenović and other male patients aged 40 on average accounted for 70.1% of major trauma patients and the most common mechanism of injury was road traffic collision accounting for 57%. Among survivors, the average ISS was 30 (22-50); among non-survivors, the average ISS was 53 (22-59). The differences in AIS among patients with different outcomes were significant only for the Head and Neck AIS (the average AIS was 3 among survivors and 4.4 among non-survivors) [29].

## Conclusion

The study found a difference in reliability between the CCC scoring system currently in use and the ISS in determin-

jeća se i nova skala poklapaju u procjeni da se radi o lakšoj politraumi, odnosno 78 % slučajeva politraume prema postojećoj skali imalo je 15 bodova (lakša politrauma) dok se zapravo radilo o teškim politraumama koje imaju ISS = /> 15). Prema navedenom može se zaključiti da AIS skala prepoznaje 93 % teške politraumatizirane pacijente koji imaju ISS = /> 15, ali je nepouzdana, (samo u 21 % je pouzdana) u procjeni/bodovanju politrauma koje prema ISS skali imaju manje od 15 bodova (lakše) politraume. Gvozdrenović i suradnici u svojoj su studiji došli do rezultata da je kod većine ispitanika koji su muškarci, njih 70,1 %, prosječne starosti 40 godina, promet bio vodeći uzrok povrjeđivanja s udjelom od 57 %. Vrijednost ISS skora kod preživjelih ispitanika bila je u prosjeku 30 (22 – 50), a kod bolesnika s letalnim ishodom 53 (22 – 59). Razlika u vrijednostima AIS skora između ispitanika s različitim ishodom bila je značajna samo za AIS glave i vrata (prosječni AIS kod preživjelih bio je 3, a kod preminulih 4,4) [29].

## Zaključak

Utvrđeno je da postoji razlika u pouzdanosti između postojećeg protokola i gradacijskog protokola jačine ozljede (ISS) na utvrđivanju stupnja životne ugroženosti kod pacijenata zbrinjanih u Klinici za intenzivnu njegu. Rezultati pokazuju da postojeća Skor skala prepoznaje 93 % teške politraumatizirane bolesnike koji imaju ISS = /> 15, ali je nepouzdana, (samo u 21 % je pouzdana) u procjeni/bodovanju politrauma koje prema ISS skali imaju manje od 15 bodova (lakše) politraume. Nameće se potreba za reorganizacijom prehospitalne skrbi izbjegavajući pretrpane bolnice i zauzimanje termina dijagnostičkim procedurama koje su neophodne za zbrinjavanje traumatiziranih pacijenata [30].

## Authors declare no conflict of interest

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