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UPOREDNA ANALIZA PROCENTUALNOG ODNOSA BROJA PRIRODNIH POROĐAJA, VAGINALNO ASISTIRANIH I POROĐAJA DOVRŠENIH CARSKIM REZOM KAO I NJIHOVIH INDIKACIJA

NUMBER OF SPONTANEOUS VAGINAL DELIVERIES, VAGINAL-ASSISTED DELIVERIES AND DELIVERIES COMPLETED BY CAESAREAN SECTION AND THEIR INDICATIONS

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Sažetak: UVOD: Tokom poslednjih decenija globalni je trend porasta broja carskih rezova prevazilazeći idealni prihvatljivi procenat carskih rezova od 5 do 15 % u skladu sa saopštenjem Svetske Zdravstvene Organizacije. Uprkos značajno promenjenih stavova u praćenju toka i dovršavanju porođaja u poslednjih nekoliko decenija, operativno vaginalno dovršavanje porođaja ostaje značajna komponenta savremenog tretiranja porođaja. CILJ:Prikazivanje procentualnog odnosa između broja porođaja završenih prirodnim putem, vaginalnih asistiranih porođaja i carskih rezova, kao i učešće pojedinih indikacija na Odeljenju Opšte bolnice u Pirotu. PACIJENTI I METODE: Ispitivanje perioda od pet godina od 2019. do 2023. godine. Podaci koji su korišćeni dobijeni su iz protokola porođaja. Uzete su u obzir sve dijagnoze koje su napisane u indikacijama za operativno dovršavanje porođaja ili asistirani vaginalni porođaj. REZULTATI: Upoređivanjem broja carskih rezova došlo se do zaključka da ne postoji statistički značajna razlika u broju carskih rezova po ispitivanim godinama X2=4,110; p=0,39. Upoređivanjem broja vakuum asistiranih porođaja došlo se do zaključka da je 2021. godine statistički značajno više vakuum ekstrakcija nego ostalih godina X2=13.048, p=0.011. ZAKLJUČAK: Povećanje stope carskog reza je univerzalni trend kako u našoj bolnici tako i u zemlji i svetu. Procenat vacuum asistiranih vaginalnih porođaja ne odstupa značajno od preporučene vrednosti. Izuzetak čini 2021. godina. Povećanje procenta carskog reza u poređenju sa vaginalnim porođajem nosi veće rizike od kraktkoročnog i dugoročnog morbiditeta i nosi veće rizike za naredne trudnoće.

***Ključne reči*:** porođaj, carski rez, vakuum asistirani porođaj

UVOD

Tokom poslednjih decenija globalni je trend porasta broja carskih rezova (SC) od 7% u 1990.toj godini do 21% danas, prevazilazeći idealni prihvatljivi procenat carskih rezova od 5 do 15 % u skladu sa saopštenjem Svetske Zdravstvene Organizacije (SZO) [1]. I broj prvih i iterativnih (ponovnih) carskih rezova je u porastu. Porast je takodje uočljiv kod žena svih etničkih grupacija, godina starosti, gestacione starosti ploda i u svim zemljama [2]. Imajući u vidu distribuciju procenata operativno dovršenih porođaja u svetu uprkos stavu SZO, danas u literaturi nailazimo na radove poput: Epidemic cesarean delivery: What to do?, Caesarean section epidemic: Tackling the rise of unnecessary cuts, Global increased cesarean section rates and public health implications: A call to action, Operative vaginal delivery: a lost art. The disappearing art of instrumental delivery: Time to reverse the trend. Uprkos značajno promenjenih stavova u praćenju toka i dovršavanju porođaja u poslednjih nekoliko decenija, operativno vaginalno dovršavanje porođaja ostaje značajna komponenta savremenog tretiranja porođaja i prema ACOG izveštaju iz 2013 godine čini oko 3.3% [3]. Najčešće indikacije za vakuum asistirani porođaj su produženo drugo porođajno doba, „loš " CTG zapis, nedovršena rotacija fetusa, maternalna iscpljenost i epiduralna analgezija, kao i potreba za skraćenjem drugog porođajnog doba kod nekih kardiovaskularnih ili neuroloških oboljenja majke [4-6]. Indikacije za carski rez mogu biti apsolutne, relativne i proširene, carski rez se može raditi iz maternalnih i fetalnih indikacija. Može biti planiran (elektivan, kada je i udružen sa mnogo manjim procentom komplikacija) i hitan. Najčešće indikacije od strane majke su: sužena karlica i druge prepreke u porođajnom putu (veliki miomi, placenta previja, sakralni tumori, virusne infekcije - aktivni herpes simplex i dr.) kao i carski rez na lični zahtev koji je u pojedinim zemljama dozvoljen. Indikacije od strane ploda su najčešće: preteća ili započeta asfiksija, malpozicija fetusa, blizanačka trudnoća, karlična prezentacija, nenapredovanje porođaja i dr [7-9].

CILJ

Cilj ovog rada je prikazivanje procentualnog odnosa između broja porođaja završenih prirodnim putem, vaginalnih asistiranih porođaja i carskih rezova, kao i učešće pojedinih indikacija za vaginalni asistirani porođaj i carski rez na Odeljenju ginekologije i akušerstva Opšte bolnice Pirot u poslednjih pet godina.

PACIJENTI I METODE

U ispitivanje je uključen period od pet godina od 2019. do 2023. godine. Podaci koji su korišćeni dobijeni su iz protokola porođaja. Uzete su u obzir sve dijagnoze koje su napisane u indikacijama za operativno dovršavanje porođaja ili asistirani vaginalni porođaj. Za statističku obradu podataka korišćen je program Microsoft Exel 2016. Za tabelarni i grafički prikaz podataka korišćen je Microsoft Excel 2016 i Microsoft Word 2016. Za upoređivanje statističke razlike među dobijenim rezultatima korišćen je Pearsonov X^2 test.

REZULTATI

Imajući u vidu Pirotski okrug, uporedo sa smanjenjem broja porođaja u poslednje tri decenije, beleži se i porast carskih rezova od 3,74% 1995 godine od ukupnog broja porođaja koji je iznosio 936, do 34.9% 2023. godine kada je broj porođaja bio 438, sa pikom 2015. godine kada je procenat carskih rezova iznosio 42,4%. (Grafikon 1.)

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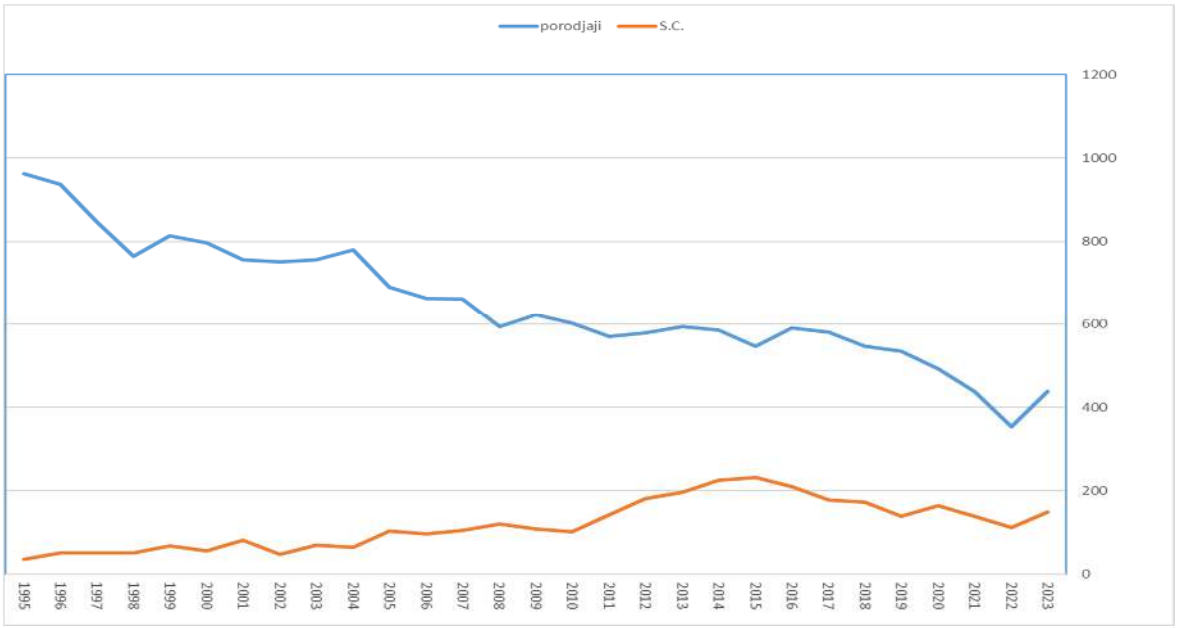

Grafikon 1. Broj porođaja i carskih rezova u periodu od 1995 do 2023. godine.
Number of deliveries and cesarean deliveries in period from 1995 to 2023

GODINA	Br porođaja	Broj VE	Broj S.C.	%porođaja	% VE	% S.C.
2019	536	18	134	71.64	3.36	25.00
2020	493	19	155	64.71	3.85	31.44
2021	438	35	147	58.45	7.99	33.56
2022	354	13	125	61.02	3.67	35.31
2023	427	20	148	60.66	4.68	34.66

Tabela 1. Broj porođaja, vaginalnih asistiranih porođaja i carskih rezova po godinama
(Number of deliveries, number of cesarean sections or vacuum extractions, and their rate)

U tabeli br 1 dati su ukupan broj porođaja, broj porođaja dovršenih carskim rezom ili vakuum ekstrakcijom, kao i njihov procentualni odnos. Upoređivanjem broja carskih rezova došlo se do zaključka da ne postoji statistički značajna razlika u broju carskih rezova po ispitivanim godinama X2= 4,110; p= 0,39. Upoređivanjem broja vakuum asistiranih porođaja došlo se do zaključka da je 2021. godine statistički značajno više vakuum ekstrakcija nego ostalih godina X2=13.048, p= 0.011.

Učešće pojedinih dijagnoza za carski rez dat je u tabeli br 2.

Učestalost pojedinih indikacija za carski rez po godinama	2019	%	2020	%	2021	%	2022	%	2023	%
Iterativni	60	44.78	72	46.45	48	29.26	37	29.60	70	47.29
Fetalna asfiksija	41	30.59	65	41.90	39	23.78	64	51.20	31	20.94
Malrotacija fetusa	22	16.42	7	4.52	52	31.70	28	22.40	32	21.62
Distocija	24	14.63	16	10.32	9	5.48	9	7.20	12	8.10
Disproporcija	35	26.12	56	36.13	38	23.17	23	18.40	33	22.29
Blizanačka trudnoća	1	1.50	3	1.94	2	1.21	0	0.00	0	0.00
Karlična prezentacija	9	6.70	7	4.52	11	6.70	6	4.80	9	6.08
IVF	12	8.90	7	4.52	6	3.66	4	3.20	3	2.02
Ostalo	9	6.70	5	3.22	9	5.48	1	0.80	4	4.05
UKUPNO S.C.	134		155		147		125		148	

Tabela 2. Učešće pojedinih dijagnoza za carski rez (Rate of certain diagnosis as an indication for a Cesarean section)

Indikacije za VE po godinama	2019	%	2020	%	2021	%	2022	%	2023	%
prolongirana druga faza porodjaja	12	38.7	16	64	31	91.2	11	84.61	14	70
suspektna fetalna asfiksija ili nemogućnost praćenja tonova	12	38.7	2	8	3	8.82	1	7.69	5	25
skraćivanje druge faze u cilju maternalnog benefita	1	3.22	1	4	0	0	0	0	0	0
malrotacija	6	19.35	6	24	1	2.94	1	7.69	1	5
UKUPNO	31		25		34		13		20	

Tabela 3. Učešće pojedinih dijagnoza za vakuum asistirani porođaj (Rate of certain diagnosis as an indication for a vacuum assisted delivery)

Upoređivanjem broja iterativnih carskih rezova, zapaža se statistički značajna razlika u 2021. i 2022. godini u smislu smanjenja broja ($X2=15.483, p=0.0038$).

Učešće pojedinih dijagnoza za vakuum asistirani porođaj dat je u tabeli br 3.

DISKUSIJA

Carski rez je jedna od najčešće izvođenih operacija u hirurškoj praksi [10]. Procenat SC-a u svetu je dupliran u poslednjih deset godina na 21% sa godišnjom stopom porasta od 4%. Procenjuje se da će 2030. godine broj carskih rezova u svetu dostići procenat od 29% [1,9]. Carski rez redukuje i maternalni fetalni morbiditet i mortalitet kada se uradi iz ispravnih indikacija, i obrnuto [1]. Neki faktori koji doprinose povećanju upotrebe SC su: unapređenje hirurških i anesteziooloških tehnika, smanjenje postoperativnih komplikacija i percepcije veće bezbednosti tokom samog postupka [2]. Dok je u pojedinim zemljama kao što je Sub Saharski region Afrike procenat carskih rezova 5% (što se smatra lošom zdravstvenom zaštitom [10]), u drugim zemljama poput Latinske Amerike i na Karibima taj procenat iznosi skoro 42.2% [11]. U Sjedinjenim Američkim Državama je 2013 godine sprovedena velika kohortna studija koja se bavila ispitivanjem indikacija za prvi carski rez koja je uključivala 228562 porođaja u tercijarnim centrima u periodu od 2002 do 2008. godine. Prvi carski rez imao je učestalost 30,8% kod primipara i 11.5% kod multipara. Najčešće indikacije za prvi carski rez bile su nenapredovanje porođaja i suspektna fetalna asfiksija registrovana kardiotokografskim zapisom. Na trećem mestu je fetalna malprezentacija [12]. U saopštenju ACOG-a jedan od tri porodjaja u Americi se dovrši carski rezom (od 20.7% u 1996. do 31.1% u 2006. toj godini) [3]. U Nordijskim zemljama, s obzirom na kvalitet zdravstvene zaštite beleži se manja stopa porasta i manji broj ukupnih carskih rezova u desetogodišnjem periodu od 2000 do 2011. U Danskoj (16.4 do 20.7%), Norveškoj (14.4 do 16.5%) i Švedskoj (15.5 do 17.1%) [13]. U Norveškoj najveći broj carskih rezova je urađen zbog fetalnog distresa 21,9%, nenapredovanja porodjaja 20,7%, predhodnog carskog reza 8,9%, karlične prezentacije 8,4%, na majčin zahtev 7,6%. 64,3% carskih rezova je urađeno u vidu hitne hirurške operacije [14]. Što se tiče podataka iz srpskih porodilišta, najveći broj carskih rezova u 2020 godini imali su Borski okrug sa 51.93%, Zapadno Bački (46.10%), Sremski (45%), Mačvanski (44,35%), dok najniže stope carskih rezova imaju Nišavski (19,69%), Raški (24,51%), Moravički (25,95%), Pčinjski okrug (24,53%) i Šumadijski okrug (19,17%), ali su to vrednosti koje su i dalje

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daleko više nego što je preporuka SZO. (saopštenje sa 66. Ginekološko akušerske sekcije SLD). Ono što carski rez izdvaja od ostalih hirurških intervencija je što se radi na uterusu koji je u trudnoći pretrpeo određene morfološke i funkcionalne promene pa njegove osobine i ponašanje u toku i nakon operacije nisu iste kao van trudnoće. S tim u vezi i komplikacije u toku i nakon operacije su češće, pa samim tim i kratkoročne i dugoročne sekvele i uticaj na kasnije trudnoće, njihov tok i ishod sa ozbiljnim rizicima i kratkoročnim i dugoročnim komplikacijama [15,16]. Kako smo u uvodu već rekli operativno vaginalno dovršavanje porođaja ostaje značajna komponenta savremenog tretiranja porođaja i prema ACOG izveštaju iz 2013 godine čini oko 3.3% [3]. RCOG je 2020. godine izdao protokole sa detaljnim indikacijama i kontraindikacijama za asistirani vaginalni porođaj [17]. Što se tiče podataka za asistirani vaginalni porođaj oni su oskudniji. Vakuum asistirani vaginalni porođaji čine oko 80% asistiranih porođaja u Americi, 3.6% svih vaginalnih porođaja i 2.5% svih porođaja u 2022. godini u komparaciji sa 1990 godinom kada je taj procenat bio 5.1% [18]. Za razliku od Sjedinjenih Američkih država upotreba vakuum ekstrakcije u Švedskoj je u porastu i 2007. godine je iznosila ukupno 8 %, odnosno 15% kod prvorotki [19]. U poređenju sa brojem carskih rezova u Sub Saharskoj Africi broj operativno dovršenih vaginalnih porođaja iznosi 7.98% [20]. Produženo drugo porodjajno doba više nije indikacija za upotrebu vakuuma ili forcepsa. Za majku produženo drugo porođajno doba znači i ozbiljna oštećenja mišića dna male karlice, postpartalnu hemoragiju, što se pripisuje samom instrumentu. Vakuum ekstrakcija se ne sme raditi kod neangažovane fetalne glavice, kefalopelvične disproporcije, fetusa pre 34 nedelje gestacije, makrozomije, kao i kod fetusa manih od 2500gr zbog rizika od intrakranijalne hemoragije [6]. U komparaciji sa carskim rezom oporavak od asistiranog vaginalnog porodjaja je kraći od oporavka od carskog reza, traji kraće i podrazumeva kratkotrajni morbiditet majki [21].

ZAKLJUČAK

Imajući u vidu da je Opšta bolnica Pirot ustanova sekundarnog nivoa u pirotskom okrugu sa svim problemima koje se tiču organizacione i kadrovske strukture, može se doći do zaključka da broj urađenih carskih rezova u okrugu ne odstupa značajno od broja carskih rezova u drugim regionima širom zemlje. Indikacija za operativno dovršavanje porođaja postavlja se u skladu sa važećim protokolima dobre kliničke prakse od strane ordinirajućeg lekara, a, kada je moguće i konzilijarno. Ograničavajući faktor predstavljaju pacijentkinje koje imaju u anamnezi predhodni carski rez i koje se javljaju na Odeljenje ginekologije pre očekivanog termina za porođaj kako bi se odlučilo o načinu dovršavanja trudnoće. Takve trudnoće se u najvećem broju slučajeva dovršavaju ponovnim carskim rezom iako predhodni carski rez nije apsolutna indikacija za ponovno dovršavanje trudnoće carskim rezom. Što se tiče vaginalno asistiranih porođaja, tu je situacija nešto drugačija i beleži se veći procenat vakuum ekstrakcija u odnosu na najnovije preporuke. Najčešća indikacija je staza u fazi ekspulzije odnosno produžena druga faza porođaja i fetalna asfiksija. Povećanje procenta carskog reza u poređenju sa vaginalnim porođajem nosi veće rizike od kratkoročnog i dugoročnog morbiditeta i nosi veće rizike za naredne trudnoće.

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NUMBER OF SPONTANEOUS VAGINAL DELIVERIES, VAGINAL-ASSISTED DELIVERIES AND DELIVERIES COMPLETED BY CAESAREAN SECTION AND THEIR INDICATION

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Summary: INTRODUCTION: There is a global trend of increasing rate of cesarean sections (SC), from 7% in 1990. to 21% today, surpassing the ideal percentage of cesarean sections, that is 5 to 15%, according to the World health organization proclamation. Both the number of first and iterative cesarean sections is on the rise. The increase is present in all ethnicities, across all age groups, all gestation ages and in all countries. Despite the changes to the approach to following the course and finishing the delivery over previous decades, operative vaginal delivery remains an important component of contemporary delivery and makes 3.3% of all deliveries, according to a ACOG report in 2013. The most common indications for a vacuum assisted delivery are: prolonged second stage of the delivery, a "bad" CTG, malrotation of the fetus, maternal exertion and epidural analgesia, also a need to shorten the second delivery phase in some cardiovascular and neurological diseases of the mother. Indications for a cesarean section are absolute, relative and extended, cesarean section may be performed cause of maternal or fetal reasons. It can be elective, when complications are much less frequent, and urgent. Most common maternal indications are: small pelvis and other obstacles in the birth canal (large myomas, placenta previa, sacral tumors, viral infections like active herpes simplex and others), and a cesarean section on mothers request, which is allowed in some countries. Fetal indications are: imminent asphyxia, fetal malposition, twin pregnancy, pelvic presentation, stagnant delivery and other.
AIM: Aim of our study is to evaluate the percentage of deliveries completed vaginally, operative vaginal deliveries and cesarean sections, and the rate of particular indications for vaginal assisted deliveries and cesarean section in General hospital Pirot over the last five years. PATIENTS AND METHODS: A period of five years, between 2019. and 2023., was included in the study. Data was extracted from a delivery protocol. All the diagnosis written in the protocol were considered as indications for operative completion of pregnancy or an assisted vaginal delivery. Microsoft Excel 2016. was used for statistical analysis. Microsoft Excel 2016. And Microsoft Word 2016. were used for tabular and graphic presentation. Pearson X2 test was used for determining statistical difference. RESULTS: By comparing the number of caesarean sections, it was concluded that there is no statistically significant difference in the number of caesarean sections in the examined years X2= 4,110; p = 0.39. Comparison of numbers of iterative cesarean sections show a statistically significant decrese between 2021. and 2022. (X2 15.483, p=0.0038).By comparing the number of vacuum-assisted births, it was concluded that in 2021 there were statistically significantly more vacuum extractions than in other years X2=13,048, p= 0.011.
CONCLUSION: Increasing cesarean section rates are a universal trend, in our hospital and across the world. Percentage of vacuum extraction does not differ significantly from recommended values, with the exception of 2021. Increased rates of cesarean section compared to vaginal deliveries carries larger, short and long term morbidity and a greater risk in subsequent pregnancies.

Key words: delivery, caesarean section, vacuum assisted deliver

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PRESENTATION OF DE NOVO CASES AND CASES WITH PRE-EXISTING CHRONIC HYPERTENSION IN DIFFERENT TYPES OF HYPERTENSIVE CRISES

PREZENTACIJA DE NOVO I SLUČAJEVA SA PRETHODNOM HRONIČNOM HIPERTENZIJOM KOD RAZLIČITIH TIPOVA HIPERTENZIVNIH KRIZA

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Summary: INTRODUCTION: Hypertensive urgencies typically manifest with nonspecific symptoms since there is no damage to vital organs, in contrast to hypertensive emergencies, where organ damage causes specific symptoms. Exceptions can pose problems during triage. The aim of this study was to present the differences in clinical presentation between de novo cases and those with pre-existing chronic hypertension. MATERIAL AND METHODS: The retrospective analysis included 305 consecutive patients with hypertensive crises who presented to the Emergency Medicine Clinic of the Clinical Center of the University of Sarajevo over a period of six months. RESULTS: Patients with pre-existing chronic hypertension were more numerous (85.57%) than de novo cases (14.43%). De novo cases did not statistically differ from patients with a history of hypertensive crisis in the frequency of presentation with specific symptoms in the hypertensive urgency group (p=0.35). There were no asymptomatic patients with de novo disease, while approximately one-fifth of patients with pre-existing chronic hypertension were asymptomatic (20.1%). De novo patients statistically presented more frequently with nonspecific symptoms in hypertensive emergencies compared to other group (p=0.018). CONCLUSION: Patients with de novo hypertensive crisis more often present with milder symptoms, but never without symptoms. In hypertensive emergencies, they more frequently present with nonspecific symptoms, which can lead to misdiagnosis, especially in prehospital conditions where complete diagnostic assessment is not possible.

***Key words*:** de novo, previous hypertension, symptoms

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INTRODUCTION

A hypertensive crisis is a condition characterized by acutely elevated blood pressure: systolic ≥180 mmHg and/or diastolic ≥120 mmHg [1]. There are two types of hypertensive crises: hypertensive urgency and hypertensive emergency. Hypertensive urgency (HU) is a milder form, characterized by elevated blood pressure and accompanying non-specific symptoms, as opposed to hypertensive emergency (HE), in which elevated blood pressure has caused what is known as Hypertensive-Mediated Organ Damage (HMOD) with symptoms specific to the affected organ. The therapeutic approach also differs between these types. HU is treated on an outpatient basis and does not require intravenous therapy, unlike HE, which requires hospitalization and intravenous medication administration [2,3]. HU usually presents with a milder clinical picture and nonspecific symptoms such as headache, dizziness, vomits, palpitations etc. HE presents with a more severe clinical picture and specific symptoms depends on localisation of HMOD-a (eyes, heart, brain, kidneys) [4]. However, reverse cases do exist, so clinical presentation alone is insufficient to distinguish these two types. HE can only be reliably diagnosed after performing the necessary diagnostics and confirming HMOD.

The above highlights that the triage of hypertensive crises can present a challenge for emergency medicine physicians, especially at the pre-hospital level, due to the lack of necessary diagnostic tools and the absence of clear guidelines to facilitate this process [5]. Therefore, research is needed to identify factors that could potentially aid in recognizing the types of hypertensive crises.

A hypertensive crisis may occur in individuals who already have chronic hypertension, but it can also occur de novo in previously healthy individuals, or at least those without verified chronic hypertension [6]. This raises the question of whether there are differences in the presentation and severity of hypertensive crises between these groups and whether the presence or absence of chronic hypertension could assist in triage at the pre-hospital level. The aim of this study was to address this question to facilitate the management of such cases in the emergency department.

MATERIAL AND METHODS

A retrospective analysis was conducted on 305 patients with hypertensive crises, consecutively included, who presented to the Emergency Medicine Clinic of the Clinical Center of the University of Sarajevo over a 6-month period. Patient data were collected from the hospital's electronic BIS system.

Inclusion criteria: age ≥18 years, both male and female, systolic blood pressure ≥180 mmHg or diastolic ≥120 mmHg, and complete medical documentation.

Exclusion criteria: age ≤18 years, pregnancy, incomplete medical documentation, and death before completing the diagnostics required for determining organ damage.

Collected data included: gender, age, history of prior chronic hypertension, presenting symptoms, data on diagnostic procedures performed, and their outcome in terms of the presence of organ damage.

Data processing was performed using the IBM SPSS system, employing the Chi-square test as well as descriptive statistics (percentage, mean value). A p-value <0.05 was considered statistically significant. The data were presented in tables and graphs.

RESULTS

The proportion of men and women is approximately equal (51.1% vs. 48.9%), with a predominance of middle-aged and elderly patients. The mean age is 64.68 years (±13.84). (Table 1)

Patients with a history of chronic hypertension are more prevalent (85.57%) compared to de novo cases (14.43%). (Figure 1)

Hypertensive urgencies were significantly more prevalent (73.77%) compared to hypertensive emergencies (26.23%) (Figure 2).

Table 1. Demographic Data of Patients with Hypertensive Crises (N=305)			
Gender			
Men N(%)		Women N(%)	
156 (51.1)		149 (48.9)	
Age (y)			
Minimum	Maximum	Mean	St. dev.
18	92	64.68	13.84

Table 1. Demographic Data of Patients with Hypertensive Crises (N=305)

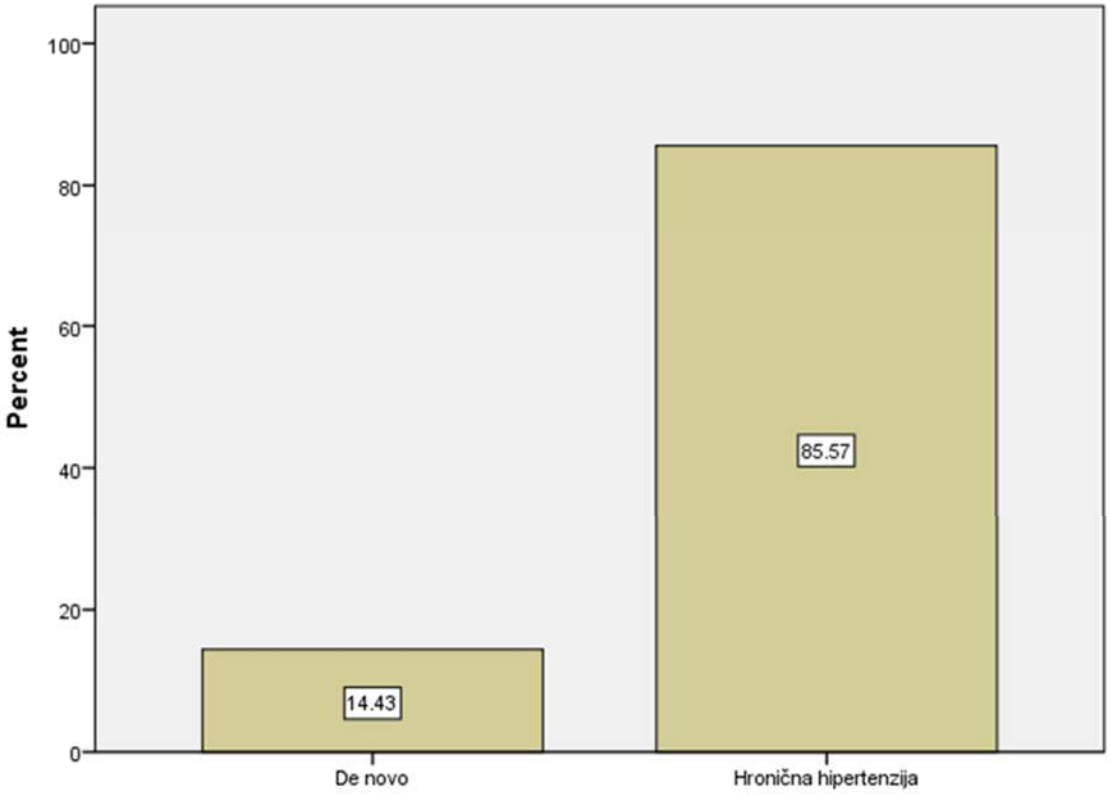

Figure 1. Distribution of de novo cases and patients with a history of chronic hypertension

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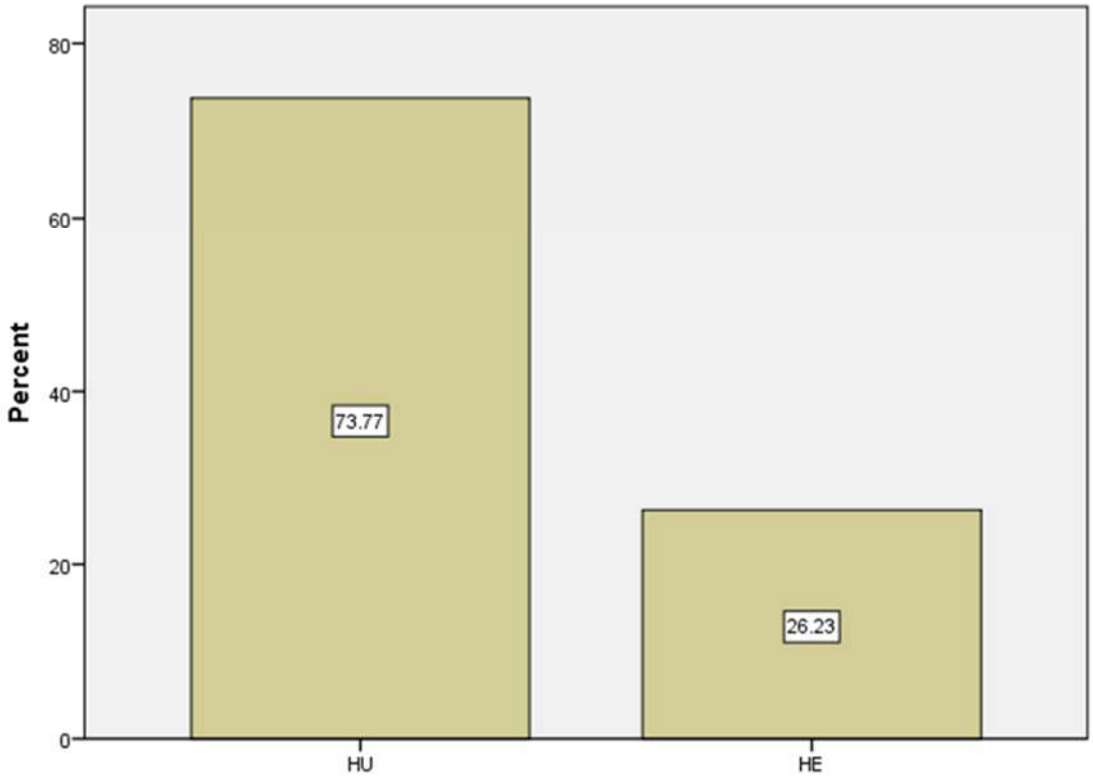

Figure 2. Distribution of Types of Hypertensive Crises

The analysis of the group of patients with hypertensive urgencies revealed that the subgroup with pre-existing chronic hypertension had a significantly higher proportion of patients with specific symptoms (40.2%) compared to the de novo subgroup (30.8%). Conversely, the de novo subgroup had a higher proportion of patients with non-specific symptoms (69.2%) compared to the other subgroup (39.7%). However, the de novo subgroup had no asymptomatic patients (0.0%), in contrast to the subgroup with pre-existing chronic hypertension, which had a significant proportion of asymptomatic patients (20.1%) (p=0.006) (Table 2).

Table 2. Types of Symptoms in De Novo Patients and Those with Previous Chronic Hypertension in the Hypertensive Urgencies Group (N=225)

Variable	Specific symptoms N(%)	Non-specific symptoms N(%)	Asymptomatic N(%)	Total	p-value*
De novo	8 (30.8%)	18 (69.2%)	0 (0.0%)	26	0.006
Chronic hypertension	80 (40.2%)	79 (39.7%)	40 (20.1%)	199	

**P-value Chi-Square test*

Table 2. Types of Symptoms in De Novo Patients and Those with Previous Chronic Hypertension in the Hypertensive Urgencies Group (N=225)

Table 3: Types of Symptoms in De Novo Patients and Those with Previous Chronic Hypertension in the Hypertensive Emergencies Group (N=80)					
Group	**Specific symptoms N(%)**	**Nonspecific symptoms N(%)**	**Asimptomatic N(%)**	**Total**	**p-value***
De novo	8 (44.4%)	10 (55.6%)	0 (0.0%)	18	0.018
Chronic hypertension	46 (74.2%)	16 (25.8%)	0 (0.0%)	62	
**P-value Chi-Square test*					

Table 3: Types of Symptoms in De Novo Patients and Those with Previous Chronic Hypertension in the Hypertensive Emergencies Group (N=80)

DISCUSSION

The sample of 305 patients analyzed in this study had a nearly equal gender distribution, consistent with findings from a recent study on hypertensive crises [7], although some studies reported a slight predominance of either women [8] or men [9]. The age of participants in these studies was comparable to that of this sample.

Patients with pre-existing chronic hypertension predominated, which was expected and aligns with other studies' findings. However, the proportion of de novo cases (14.43%) was lower than in other studies, although the available literature on this subject is limited. For comparison, an Italian study reported 23% [10], and a South African study reported 36% [11]. These variations in de novo cases may stem from genetic predispositions, lifestyle differences, healthcare advancements, or study design and participant selection. Notably, this study focused on patients presenting to the Clinic of Emergency Medicine at the Clinical Center University of Sarajevo, which may be a limiting factor, as other prehospital and hospital facilities in the same region might also treat hypertensive crises.

The sample demonstrated a predominance of hypertensive urgencies (73.77%) over hypertensive emergencies (26.23%), consistent with similar studies investigating the prevalence of hypertensive crisis types [12,13]. Despite extensive research on the presentation and management of hypertensive crises, there is limited literature on the determinants of organ damage. The pathophysiological mechanisms underlying hypertensive crises primarily involve dysfunction of the renin-angiotensin-aldosterone system, endothelial dysfunction, and oxidative stress, which contribute to the sudden rise in blood pressure that may lead to organ damage [14]. However, the role of other, unexplored factors remains unclear. Moreover, there is no evidence in the literature of differences in the pathophysiology of blood pressure elevation or organ damage between patients with chronic hypertension and those previously normotensive. Other factors, such as cardiovascular comorbidities, diabetes, gender, and age, may also influence the occurrence of hypertensive crises [15].

Identifying hypertensive crisis types is challenging, particularly in prehospital settings, where diagnosis and triage depend on clinical presentation and available diagnostic tools. The absence of CT imaging complicates the detection of organ damage [16]. While the literature suggests that hypertensive emergencies often present with specific symptoms and hypertensive urgencies with

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non-specific symptoms [4], this is not always the case, as demonstrated in this study.

To identify potential triage aids, this study analyzed differences in the clinical presentation of hypertensive crisis types concerning the presence or absence of pre-existing chronic hypertension. Among patients with hypertensive urgencies, those with chronic hypertension were more likely to present with specific symptoms and even asymptomatic episodes. The latter finding lacks explanation in the literature. Conversely, all de novo patients were symptomatic, primarily with non-specific symptoms, likely due to heightened sensitivity to a sudden rise in previously normal blood pressure. The milder symptoms observed in this group may reflect the absence of chronic organ damage, which is common in long-standing hypertension [17].

In the hypertensive emergency group, a significant proportion of patients exhibited non-specific symptoms, particularly de novo patients. Asymptomatic presentations were absent, consistent with other studies on hypertensive emergency presentations [18], likely because organ damage invariably causes symptoms.

These findings suggest that patients with de novo hypertensive crises tend to have milder clinical presentations, both in hypertensive urgencies and emergencies, but are never asymptomatic. The milder symptoms may result from the absence of prior chronic organ damage, while the lack of asymptomatic cases could be due to the organism's reaction to a sudden and unfamiliar rise in blood pressure in previously normotensive individuals.

CONCLUSION

De novo patients more frequently present with non-specific symptoms compared to those with chronic hypertension but are never asymptomatic. Attention is required when determining the type of hypertensive crisis in such patients due to the frequent presentation of non-specific symptoms in cases of hypertensive emergencies. This can lead to misdiagnosis, missed organ damage, administration of outpatient treatment, and discharge, potentially resulting in fatal outcomes.

Patients with pre-existing chronic hypertension more often present with specific symptoms in cases of hypertensive urgencies, which can also lead to misdiagnosis. However, the consequences in this scenario are less severe, as these patients will typically be referred to a hospital setting where further diagnostics will rule out organ damage, preventing inappropriate treatment.

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PREZENTACIJA DE NOVO I SLUČAJEVA SA PRETHODNOM HRONIČNOM HIPERTENZIJOM KOD RAZLIČITIH TIPOVA HIPERTENZIVNIH KRIZA

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Sažetak: UVOD: Hipertenzivne urgencije se najčešće prezentuju nespecifičnim simptomima jer nema oštećenja vitalnih organa za razliku od hipertenzivnih emergencija gdje oštećenje organa uzrokuje specifične simptome. Postoje izuzeci što može predstavljati problem prilikom trijaže. Cilj ove studije je bio prikazati razlike u kliničkoj prezentaciji de novo slučajeva i onih sa prethodnom hroničnom hipertenzijom. MATERIJAL I METODE: Retrospektivna analiza je uključila 305 konsekutivnih pacijenata koji su se javili na Kliniku urgentne medicine, Kliničkog centra Univerziteta u Sarajevu u šestomjesečnom periodu. Pacijenti sa prethodnom hroničnom hipertenzijom su bili znatno brojniji (85.57%) od de novo slučajeva (14.43%). De novo slučajevi se nisu statistički signifikantno razlikovali od onih sa hroničnom hipertenzijom u učestalosti prezentacije specifičnim simptomima u grupi hipertenzivnih urgencija (p=0.35). U ovoj grupi nije bilo asimptomatskih de novo slučajeva dok je približno petina pacijenata sa hroničnom hipertenzijom bila asimptomatska (20.1%). De novo pacijenti su se signifikantno češće prezentovali nespecifičnim simptomina u grupi hipertenzivnih emergencija u odnosu na one sa hroničnom hipertenzijom (p=0.018). ZAKLJUČAK: Pacijenti sa de novo hipertenzivnim krizama se češće prezentuju blažim simptomima ali nikad asimptomatski. U slučajevima hipertenzivnih emergencija de novo pacijenti se češće prezentuju nespecifičnim simptomima što može dovesti do pogrešne dijagnoze pogotovo u prehospitalnim uslovima gdje nije moguća potpuna dijagnostička obrada.

Ključne reči: de novo, prethodna hipertenzija, simptomi

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MANAGING HAZARDOUS MATERIAL INCIDENTS: INSIGHTS FROM THE AMMONIA SPILL

POSTUPANJE U INCIDENTIMA SA IZLIVANJEM OPASNIH MATERIJA PRIKAZ SITUACIJE IZLIVANJA AMONIJAKA IZ CISTERNE

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Summary: In December 2022, a significant train derailment incident occurred near Pirot, Serbia, involving a 20-car freight train en route from Bulgaria, which resulted in a substantial ammonia release. This event resulted in over 50 cases of ammonia poisoning, with seven individuals needing hospital care and two fatalities. Furthermore, the released ammonia formed a dense ammonia vapor cloud upon interaction with environmental water, triggering a collision on a nearby highway. Follow-up environmental assessments revealed no residual ammonia in the air or in nearby water sources. This case exemplifies the potential risk of transporting hazardous materials and underscores the importance of adequate management and response mechanisms in such incidents, as detailed in the case analysis and management proposal based on current recommendations and guidelines

***Key words*:** ammonia, accident, intoxication, emergency medicine

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INTRODUCTION

Annually, over 1.5 million tons of ammonia are transported by rail across Europe, including approximately 250,000 tons within Southeast Europe alone. Despite improvements, the rail transport infrastructure in this region remains varied and continues to pose significant risks for accidents [1].

On December 25, 2022, a significant incident occurred near Pirot, Serbia, when a 20-car freight train traveling from Bulgaria derailed, resulting in a major ammonia release. Out of the 800 tons of ammonia being transported, only 20 tons were released due to damage to one cistern, narrowly avoiding a more extensive ecological and humanitarian disaster [2]. Pirot is a city in southeastern Serbia, located in the Nišava valley, with an urban population of around 35,000. The Nišava River, which flows through this region, serves as a crucial water source for more than 350,000 people in South and Southeast Serbia. Parallel to the river run an international highway and a railway line, both critical for transportation and commerce [3].

The proximity of these infrastructures poses a significant risk in the event of a train derailment incidents, which could lead to severe contamination of the river and endanger the lives and health of the local population.

AIMS

This aims to delve into the nuances of ammonia poisoning, focusing on the protocols and management strategies critical for addressing such incidents effectively. By examining this incident, this work seeks to underscore the importance of proper emergency preparedness and response mechanisms. To introduce the fundamental chemical properties of ammonia, the potential risks associated with its exposure, and the urgent need for accurate, swift responses during such emergencies. Through this exploration, the paper endeavors to contribute valuable insights into optimizing management strategies for hazardous material incidents, particularly those involving ammonia.

MATERIAL AND METHODS

Case Analysis

This study investigates the incident of the train derailment near Pirot, Serbia, which resulted in a significant ammonia release. The methodology encompasses the following key components:

Incident Documentation and Data Collection:

- **Primary Data:** Data was collected from incident reports, emergency response logs, and hospital records to understand the extent of ammonia exposure and the immediate health effects on the affected population.
- **Secondary Data:** Secondary data sources include publications from the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), and the Agency for Toxic Substances and Disease Registry (ATSDR). These sources provide context on ammonia toxicity and emergency response protocols.

DISCUSSION:

On December 25, 2022, at approximately 17:30 CET, a freight train carrying ammonia derailed near Staničenje, close to Pirot, Serbia. The derailment caused four wagons to overturn, releasing around 20 tons of ammonia. The release of pressurized ammonia reacted with air and water, forming a dense vapor cloud. This reaction severely reduced visibility on the nearby highway to less than 10 meters, leading to multiple vehicle collisions.

Emergency Response

Local units from Pirot and Bela Palanka were the first to arrive at the scene. Niš units were dispatched promptly once the scale of the incident was understood. The Pirot Fire Brigade and EMS arrived within 20 minutes of the derailment report, while units from Bela Palanka and Niš arrived within 40-60 minutes due to distance and road conditions. A 72-hour state of emergency was declared, prompting immediate advisories for residents to stay indoors and secure their homes against ammonia exposure. The A4 highway section

between Pirot and Bela Palanka was closed until December 28 due to potential contamination.

Evacuation and Public Safety Measures

Immediate evacuations were carried out, removing 56 individuals from the affected area. Air quality monitoring was initiated with two mobile stations deployed in Pirot on December 26. Elevated ammonia levels were detected initially but decreased over time. Although the levels remained below critical limits, strong ammonia odors persisted throughout the city. Water contamination was monitored in the Nišava River. Initial water samples collected on December 26 showed serious pollution, with ammonia concentrations reaching the category V (1.95 mg/l) by December 27 near Prosek village. Residents were advised to avoid using well water for drinking and irrigation. By December 28, ammonia levels had dropped, allowing partial lifting of water restrictions.

Medical Response

Over 50 individuals presented with symptoms related to ammonia exposure. At Niš Clinical Center (UKC Niš), 15 patients were admitted; 11 were discharged after treatment, and 4 remained under observation. Pirot General Hospital (OB Pirot) treated 51 individuals, all of whom were discharged after treatment. Most patients experienced respiratory issues, eye irritation, and skin burns. Four patients at Niš had severe symptoms requiring prolonged observation. Tragically, two fatalities occurred due to high ammonia inhalation among individuals trapped in the vapor cloud on the highway, confirmed by autopsies as severe respiratory damage.

Environmental and Public Health Impact

The ammonia spill contaminated local water sources, including the Nišava River. Elevated concentrations of ammonia caused strong odors throughout the city, leading to health advisories for residents to stay indoors. Schools and kindergartens were closed to protect children from exposure.

Economic Impact

The state of emergency and necessary evacuations caused significant disruptions to local businesses and key transport routes, impacting logistics and supply chains. Substantial resources were required for emergency response, cleanup operations, and environmental remediation. The incident highlighted the need for better infrastructure maintenance and safety protocols for handling hazardous materials.

Initial response - positive aspects

1. Quick Response of Emergency Services: Firefighters, police, and medical teams were immediately dispatched to the scene in order to asses and control the situation. Firefighters, EMS and police form Pirot and Nis were dispatched to the site.
2. Evacuation of Residents: Emergency services successfully evacuated residents from the immediate vicinity of the accident, reducing the number of potentially affected people.

Initial response - negative aspects

1. Poor Coordination and Communication: There was a lack of effective communication and coordination between different emergency response units, leading to delays in response and ineffective crisis management.
2. Lack of Adequate Training and Protective Equipment. Some responders like EMS did not have adequate protective equipment for working with hazardous materials, which compromised their safety and the efficiency of the intervention. It is even noted that two firefighters needed medical help.
3. Insufficient Hazardous Material Training: The most of the responding teams were not adequately trained in handling hazardous material incidents of this magnitude. There was a noticeable uncertainty in executing the containment and decontamination procedures, which are critical in ammonia exposure scenarios.
4. Absence of a Unified Emergency Number: The lack of a unified emergency number (such as 112} hindered the quick and coordinated action of all relevant services in the emergency situation.

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5. In the Ministry of Internal Affairs' Disaster Risk Assessment, it is stated that analyses and detailed investigations of chemical accidents have shown that the population and state authorities are partially prepared for such incidents.

What is ammonia?

Ammonia (NH3) is a simple, stable compound of nitrogen and hydrogen. It is produced via the Haber-Bosch process, which combines these two elements, under high pressure and temperature.

As a colorless gas, it is notable for its strong, pungent odor and is lighter than air, dissolving easily in water. Primarily, ammonia is crucial in the production of fertilizers, which consume about 80% of its output. It also serves as a precursor for various commercially important nitrogen compounds, including explosives, synthetic fibers, and plastics. Beyond its industrial applications, ammonia acts as a refrigerant in cooling systems and plays a significant role in water purification and as a corrosion inhibitor. It is also a key component in many household cleaning products and is used across diverse industries, from pharmaceuticals to food and beverage [4].

Chemical Behavior of Ammonia in Environmental Incidents

When ammonia is pressurized and released into the atmosphere, it rapidly expands and cools, transforming into a dense, white cloud of fine liquid ammonia droplets. This visible manifestation occurs due to the high concentration of droplets.

Upon contact with water, ammonia undergoes an exothermic reaction, forming ammonium (NH_4^+) and hydroxide (OH^-) ions, commonly known as ammonium hydroxide (NH_4OH). This heat-releasing reaction can cause the water to evaporate, contributing to the development of a vapor cloud. Additionally, when ammonia gas interacts with air, it reacts to form nitrogen monoxide and water vapor. The water vapor may condense around air particles, further leading to cloud formation.

The generation of a dense vapor cloud is a critical concern, as it can disperse ammonia across a broader area, significantly increasing the risk of exposure. Understanding these reactions is crucial for emergency response and mitigation strategies in ammonia release incidents [5].

Global Ammonia Demand and Production Forecast

Currently, global production of ammonia stands at approximately 180 million metric tons annually, primarily driven by its critical role in the fertilizer industry. This demand is projected to rise by 10 million metric tons each year, fueled by its expanding use in the hydrogen economy alongside traditional applications. By 2050, it is expected that the global production rate of ammonia will escalate to about 500 million metric tons—nearly tripling today's figures. This significant increase underscores the challenges ahead, emphasizing the urgent need for continued research and the implementation of lessons learned from past incidents to enhance safety measures and prevent future accidents [6].

Most Common Sources of Ammonia Exposure to Large Quantities and High Concentrations Transportation Incidents:

Transportation and storage of ammonia are the most common sources for exposure to large quantities and high concentrations. These activities pose significant risks due to potential spills or leaks during handling, transit, and storage. Emergency responders often face these dangers during incidents involving the transportation of ammonia.

Industrial Settings:

Industrial facilities involved in chemical manufacturing, refrigeration, and fertilizer production also present substantial risks. Workers may encounter high concentrations of ammonia during accidental releases or through maintenance activities where ammonia is prevalent. (A notable example is the largest ammonia-related incident in Dakar, Senegal, in 1992, the worst ammonia industrial catastrophe ever. High pressure inside the tank led to releasing 22 metric tons of pressurized ammonia. This incident claimed 129 lives and

injured over 1000 workers and citizens. For comparison, that is equivalent of only one cistern involved in Pirot accident [7].

Routes of Ammonia Exposure and Associated Health Risks: [8-10]

Ammonia exposure can occur through various routes, each presenting unique health implications:

Inhalation: The primary exposure route for the general population. Inhalation of ammonia can cause severe respiratory effects including nasopharyngeal and tracheal burns, bronchiolar and alveolar edema, and potential airway destruction. This may lead to respiratory distress or failure, with symptoms such as a burning sensation in the throat, coughing, difficulty breathing, chest tightness, altered mental state, a runny nose, and eye irritation. The severity of these effects varies with the ammonia concentration, exposure duration, and depth of inhalation.

Oral Exposure: Though less common, ingestion typically occurs through contaminated drinking water. Ammonia ingestion generally results in rapid conversion to urea, minimizing harm, but high levels can irritate the mouth, throat, and stomach, causing pain, excessive salivation, and potentially severe alkali burns to the aerodigestive tract.

Dermal Exposure: Contact with ammonia through skin exposure to cleaning products can vary in severity. Depending on the ammonia concentration, it can cause skin irritation, redness, swelling, or more severe reactions such as burns, blisters, or dry, flaking skin that may crack.

Ocular Exposure: Direct contact with ammonia can irritate or burn the eyes. Severe exposures may lead to temporary or permanent vision loss, underscoring the need for protective eyewear when handling ammonia.

SIGNS AND SYMPTOMS OF ACUTE AMMONIA EXPOSURE:

Acute exposure to ammonia can lead to a range of immediate and severe symptoms affecting various body systems:

Rapid Onset of Burning Sensation: A primary indicator of ammonia exposure is an intense burning sensation affecting the eyes, nose, throat, and respiratory tract. This irritation can cause significant discomfort and distress.

Lacrimation (Excessive Tearing): Ammonia vapor stimulates the lacrimal glands, resulting in excessive tearing. High exposure levels can lead to profuse tearing, blurred vision, and increased eye irritation, intensifying ocular discomfort.

Upper Airway Swelling: Inhalation can irritate and inflame the upper airway mucosa, causing swelling in the throat, larynx, and pharynx. Symptoms may include difficulty swallowing, hoarseness, and stridor. The presence of throat tightness or constriction signals a significant airway compromise that requires immediate medical attention.

Respiratory Symptoms: Beyond affecting the upper airway, ammonia can provoke other respiratory symptoms such as coughing, wheezing, and shortness of breath. These symptoms can escalate quickly, especially in individuals with existing respiratory issues or impaired lung function. Severe cases may require supplemental oxygen and mechanical ventilation to ensure adequate breathing.

Olfactory Disturbances: Even at low concentrations, ammonia's pungent odor can disrupt normal olfactory function, leading to a temporary loss of smell or altered odor perception, adding to the discomfort of exposure.

Nausea and Vomiting: Exposure can also activate the chemoreceptor trigger zone in the brain, causing nausea and vomiting. This can exacerbate issues like dehydration and electrolyte imbalances, particularly when combined with excessive tearing and respiratory difficulties.

Altered Mental Status: In severe exposure scenarios, systemic absorption of ammonia may result in neurological symptoms, including confusion, agitation, and seizures. These symptoms develop quickly and are indicative of significant toxicity, necessitating urgent medical evaluation and intervention.

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Exposure (ppm)	Signs and Symptoms
50	Irritation to eyes, nose and throat (2 hours' exposure)
100	Rapid eye and respiratory tract irritation
250	Tolerable by most people (30–60 minutes' exposure)
700	Immediately irritating to eyes and throat
>1,500	Pulmonary oedema, coughing, laryngospasm
2,500–4,500	Fatal (30 minutes' exposure)
5,000–10,000	Rapidly fatal due to airway obstruction

Table 1: Summary of toxic effects following acute exposure to ammonia by inhalation
(Public Health England. (2015). Ammonia: Toxicological overview. Public Health England. https://assets.publishing.service.gov.uk/media/5a81a887e5274a2e8ab552a6/Ammonia_TO_PHE_240815.pdf)

KINETICS AND METABOLISM OF AMMONIA [8,9,11,12]

Absorption and Distribution: Ammonia is highly soluble in water and rapidly dissolves in the mucus of the respiratory system, forming ammonium hydroxide. Upon short-term inhalation, a significant amount of ammonia is retained in the upper nasal mucosa. At higher concentrations, it can overwhelm the mucosal barrier and enter systemic circulation through the lungs. Although ammonia quickly contacts the eyes, systemic absorption from ocular exposure is minimal. Similarly, acute skin exposure typically results in limited systemic absorption, whereas absorption through mucous membranes and the gastrointestinal tract is more substantial. Once in the system, ammonia reacts with hydrogen ions to form ammonium ions, which are largely confined within body compartments due to their charged nature.

Toxicokinetic: Ammonia's pungent odor is detectable at concentrations as low as 5 ppm, making unaware exposure rare. Tolerable ambient levels can reach up to 100 ppm without adverse effects, but exposure to 1700 ppm can cause symptoms like coughing, laryngospasm, and glottic edema. Fatalities have occurred at concentrations between 2500 and 4500 ppm within 30 minutes, and exposures above 5000 ppm often result in rapid respiratory failure. NIOSH stipulates a maximum time-weighted average (TWA) exposure limit of 25 ppm during an 8-hour workday, with a short-term exposure limit (STEL) of 35 ppm. The immediate danger to life and health (IDLH) threshold is set at 300 ppm.

Metabolic Pathways: Inhalation exposures under 120 seconds cause minimal systemic absorption, whereas prolonged exposure enhances systemic uptake. About 70% to 80% of the inhaled ammonia is absorbed by the upper respiratory tract mucus and later exhaled. Oral ingestion leads to rapid absorption and significant hepatic processing; in rodents, most ingested ammonia is converted to glutamate and urea within half an hour. Nearly all orally administered ammonia is metabolized in the liver to urea, which is then excreted in the urine. About 25% is eliminated within six hours, and 72% within three days. Oral ingestion typically does not lead to systemic toxicity due to the insufficient elevation of blood ammonia levels. Currently, there is no evidence to suggest that dermal exposure to ammonia results in systemic absorption.

MECHANISM OF AMMONIA TOXICITY [8,9,12]

The toxic effects of ammonia are primarily attributed to its ability to disrupt cellular homeostasis and induce oxidative stress. Upon

exposure, ammonia diffuses rapidly across biological membranes, including the respiratory epithelium, gaining entry into the systemic circulation where it causes several harmful effects:

Respiratory Irritation: Ammonia vapor irritates the respiratory mucosa, leading to symptoms such as coughing, dyspnea (shortness of breath), and bronchospasm. High concentrations can cause chemical burns to both upper and lower airways, significantly worsening respiratory conditions.

Disruption of Acid-Base Balance: Ammonia reacts with water to produce ammonium hydroxide, a strong base, which can lead to systemic alkalosis. This condition results from the accumulation of ammonium ions in the bloodstream, disrupting the body's normal acid-base balance and affecting essential physiological functions.

Neurological Effects: Ammonia can cross the blood-brain barrier and accumulate in the central nervous system, where it disrupts normal neurotransmission. This interference is particularly detrimental to the glutamatergic system, leading to neurotoxic effects such as confusion, lethargy, seizures, and in severe cases, coma. These symptoms are typical of hepatic encephalopathy, which can develop with high levels of ammonia.

Hepatotoxicity: Within the liver, ammonia is processed through the urea cycle. Excessive levels of ammonia can overwhelm this pathway, leading to hepatic dysfunction and reduced efficiency in ammonia clearance. This can cause hepatocellular injury and hepatic encephalopathy, compounding the systemic toxicity.

GUIDELINES AND RECOMMENDATIONS FOR MANAGING AMMONIA DISASTERS [9-11]

Initial Response: The initial response to an ammonia disaster involves a critical and immediate assessment of the scene by first responders. Key actions include identifying the source and extent of the ammonia release. To protect against the corrosive and caustic nature of ammonia, which can cause severe irritation and chemical burns to the eyes, skin, respiratory tract, and alimentary canal, responders must wear appropriate personal protective equipment (PPE). Essential PPE includes:

Respiratory Protection: Positive-pressure, self-contained breathing apparatus (SCBA) is essential when dealing with potentially unsafe levels of ammonia to prevent inhalation of harmful gases.

Chemical-Resistant Clothing and Eye Protection: To safeguard the skin and eyes from ammonia burns and irritation, the use of chemical-protective clothing and eye protection is mandatory.

The effective use of PPE, coupled with ensuring adequate ventilation, forms the cornerstone of safety measures in ammonia disaster scenarios. Immediate decontamination procedures are crucial to minimize the risk of ammonia exposure. Emergency medical responses should prioritize rapid decontamination and provide symptomatic treatment to address both immediate and potential long-term health effects of ammonia exposure. These steps are vital for mitigating the impact on affected individuals and ensuring the safety of emergency response personnel.

Creation of Zones: To manage the disaster effectively, the area should be divided into three primary zones: Hot Zone, Decontamination Zone, and Support Zone.

Hot Zone (Exclusion Zone): The Hot Zone is the area immediately surrounding the ammonia release, where the concentration of ammonia poses direct and significant health risks. Only personnel with appropriate PPE and specific training should enter this zone. Their main tasks include stopping the source of the leak (if possible) and beginning the evacuation of any victims.

In the Hot Zone, where the concentration of hazardous substances like ammonia is the highest and the risk of exposure is greatest, the PPE requirements are much more stringent to ensure maximum protection for the responders. Here's a detailed overview of the appropriate PPE for personnel operating in the Hot Zone during an ammonia disaster:

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PPE for the Hot Zone

1. ***Full Body Protection:***

•***Encapsulating Chemical Protective Suit (Level A protection):*** This suit provides the highest level of protection against vapors, gases, mists, and particles. It is completely sealed, encapsulating the wearer to prevent any contact with ammonia.

•***Chemical-Resistant Material:*** The suit should be made of materials that resist the corrosive nature of ammonia, such as Teflon, Viton, or other specialized laminates.

2.Respiratory Protection:

•***Self-Contained Breathing Apparatus (SCBA):*** This is essential in the Hot Zone as it provides the most reliable protection. SCBA units supply clean air from a compressed air tank, allowing responders to breathe safely in highly contaminated environments where ammonia levels may exceed the IDLH level of 300 ppm.

3.Gloves and Boots:

•***Double-Gloving:*** Wearing two layers of gloves, usually with a highly chemical-resistant outer glove over a more dexterous inner glove, can provide both protection and dexterity.

•***Chemical-Resistant Boots:*** These should be sturdy, providing not only chemical resistance but also adequate grip and comfort for potentially prolonged operations.

4.Eye and Face Protection:

•***Full Facepiece:*** SCBA typically includes a full facepiece which provides eye and face protection from chemical splashes and harmful vapors.

•***Face Shield:*** An additional face shield can be worn over the SCBA mask for extra protection against unexpected splashes.

ABC REMINDERS FOR INITIAL RESPONSE

1. **Airway:** Quickly assess and ensure that the patient has a patent airway. If trauma is suspected, take precautions to maintain cervical immobilization manually. Apply a cervical collar and use a backboard when feasible to prevent potential spinal injuries.
2. **Breathing**: Confirm that the patient has adequate respiration. Monitor breathing patterns and be prepared to assist ventilations if necessary.
3. **Circulation:** Check for a pulse and signs of effective circulation. Address any conditions like bleeding or shock that could compromise circulation.

Victim Removal Protocols

Ambulatory Victims: If victims are capable of walking, guide them immediately out of the Hot Zone to the Decontamination Zone. It's crucial to minimize their exposure time and begin decontamination procedures quickly.

Non-Ambulatory Victims: Victims unable to walk should be carefully removed using backboards or gurneys to ensure their stability and safety. If these are not available, it may be necessary to carry or drag them to a safer area. When moving victims, always prioritize spinal integrity, especially if trauma is suspected.

Medical practitioners usually do not enter the Hot Zone but must be prepared to provide remote guidance on first aid and emergency care to responders in this area via communication devices. They advise on the handling and triage of severely affected victims until they can be moved to a safer area for treatment.

Decontamination Zone (Warm Zone):

Positioned outside the Hot Zone, the Decontamination Zone is where individuals exposed to ammonia undergo decontamination to prevent further contamination and health issues. Decontamination procedures depend on the type of exposure but typically involve removing contaminated clothing and flushing exposed skin and eyes with copious amounts of water. This zone serves as a buffer to prevent any spread of contamination to cleaner areas. Decontamination procedures typically involve removing contaminated clothing and flushing the skin and eyes with water. Emergency medical treatment can also begin here for those showing symptoms of exposure. After decontamination, individuals move to the Support Zone for further care and evaluation.

Here, medical practitioners supervise the decontamination process. They provide specific instructions on decontamination procedures, ensuring that it is done thoroughly to prevent chemical burns and inhalation effects from

worsening. They also assess and prioritize victims for medical treatment based on the severity of their symptoms.

Decontamination Zone is where direct contact with ammonia-contaminated victims or materials is likely. The PPE requirements here are more stringent than in the Support Zone but may be less than those required in the Hot Zone if the ammonia concentration is confirmed to be low:

1.Protective Suits: Chemical-resistant suits (such as Level B or C protective clothing) should be worn to prevent any contact with ammonia liquid or contaminated water.

2.Gloves and Boots: Chemical-resistant gloves and boots are essential to protect skin from chemical burns and exposure.

3.Respiratory Protection: At a minimum, a full-face air-purifying respirator with cartridges suitable for ammonia should be used. If the concentration of ammonia is unknown or if it is above the IDLH (Immediately Dangerous to Life or Health) level of 300 ppm, a more protective approach using a self-contained breathing apparatus (SCBA) is warranted.

4.Eye Protection: If not already integrated into the respiratory protection, tight-fitting chemical goggles should be worn to protect against splashes and vapors.

Exposure assessment and immediate actions:

- Victims exposed solely to ammonia gas without any signs of skin or eye irritation do not require decontamination and can be directly moved to the Support Zone.
- Those with any contamination or symptoms must undergo decontamination. If ammonia levels are under 20 ppm, decontamination can be performed by personnel in less protective gear than required in the Hot Zone.

ABC REMINDERS FOR EMERGENCY CARE:

•***Airway***: Quickly assess and secure a patent airway. Use a cervical collar and backboard if trauma is suspected.

•***Breathing:*** Ensure adequate respiration and administer supplemental oxygen if needed. Assist ventilation with a bag-valve-mask device as required.

•***Circulation:*** Check pulse and address any circulation issues promptly.

Basic Decontamination Procedures:

•***Skin and Eye Decontamination***: Urgently remove contaminated clothing and flush exposed skin and eyes. Victims capable of assisting should do so under guidance.

•***Clothing:*** Double-bag contaminated clothing and personal items to prevent secondary exposure.

•***Skin Washing:*** Flush any liquid-exposed skin and hair with water for at least 5 minutes. If possible, wash thoroughly with soap and water, being mindful to prevent hypothermia, particularly in vulnerable populations like children or the elderly. Provide blankets for warmth if necessary.

•***Eye Irrigation:*** Irrigate exposed or irritated eyes with water or saline for at least 15 minutes. Remove contact lenses if it can be done without causing additional trauma. Continue irrigation during transport to the Support Zone.

•***Ingestion:*** Do not induce vomiting or perform gastric lavage. Do not administer activated charcoal. If the victim is conscious and able to swallow, provide 4 to 8 ounces of water or milk to dilute the ingested substance.

Transport to Support Zone:

•Once basic decontamination is complete, promptly transfer victims to the Support Zone for further medical evaluation and care.

Support Zone (Cold Zone):

The Support Zone is a safe area where operational support takes place. This zone hosts incident command, medical triage and treatment, and support services. It should be upwind and uphill from the disaster site to avoid contamination. All strategic decision-making, support, and media communication occur here to manage the incident effectively without compromising the safety of additional personnel.

This area serves as the primary base for medical triage, treatment, and coordination. Emergency medical practitioners set up triage stations to categorize victims based on the urgency of their medical needs. They manage resources such as

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medical supplies, personnel, and patient transport vehicles. They also ensure that medical teams are well-equipped with appropriate PPE and are trained to handle the unique challenges of chemical exposure.

The Support Zone is generally considered a safe area where the risk of ammonia exposure is minimal. The PPE requirements here are primarily for precautionary measures and comfort:

1.Standard Precautions: Depending on proximity to the Decontamination and Hot Zones, basic PPE such as gloves and surgical masks might be advisable.

2.Protective Clothing: While full chemical suits are not necessary, wearing coveralls or other disposable garments can help prevent accidental contact with residues that might have been missed during decontamination.

3.Eye Protection: Safety glasses or face shields should be worn if there is any risk of encountering airborne irritants from nearby zones.

4.Respiratory Protection: Generally, respiratory protection is not required in the Support Zone. However, if there is any possibility of ammonia drift due to wind or other factors, a respirator may be appropriate.

SUPPORT ZONE PROTOCOLS

Victim Management:

Ensure that all victims have been properly decontaminated before entering the Support Zone. Victims who have been exposed only to ammonia vapor and have undergone necessary decontamination pose no significant risk of secondary contamination. Thus, Support Zone personnel generally do not require specialized protective gear in such cases.

ABC Reminders:

•***Airway:*** Quickly assess and secure a patent airway. Apply a cervical collar and use a backboard if trauma is suspected.

•***Breathing:*** Ensure that the victim has adequate respiration. Administer supplemental oxygen if needed.

•***Circulation:*** Check pulse, establish intravenous access if necessary, and place the victim on a cardiac monitor to continuously assess their condition.

Additional Decontamination:

•Continue rinsing exposed skin and eyes as needed. For cases of ingestion, do not induce vomiting or administer activated charcoal. Avoid neutralizing with weak acids. If the patient is conscious and able to swallow, give 4 to 8 ounces of water or milk to help dilute the ingested substances.

Advanced Treatment:

•***Respiratory Support:*** For respiratory compromise, secure the airway with endotracheal intubation or perform a cricothyroidotomy if trained to do so.

•***Seizures and Hypotension:*** Follow advanced life support (ALS) protocols for patients presenting with seizures, hypotension, or cardiac arrhythmias.

•***Bronchospasm:*** Treat with aerosolized bronchodilators, carefully considering the use of cardiac sensitizing agents based on the patient's overall exposure and health status.

•***Pediatric Care:*** For children with stridor, consider administering 0.25–0.75 mL of 2.25% racemic epinephrine solution in water, repeating every 20 minutes as needed, while monitoring for myocardial effects.

Monitoring and Support:

•***Monitor fluid and electrolyte balance,*** especially in patients with pulmonary edema. Administer fluids cautiously, and adjust based on the patient's respiratory status.

Transport to Medical Facility:

•Ensure that only decontaminated patients, or those not requiring decontamination, are transported to medical facilities. Utilize body bags only when absolutely necessary to prevent contamination during transport.

•Report the patient's condition, treatments administered, and estimated time of arrival to the base station and receiving medical facility.

•Prepare for possible complications en route, such as vomiting from ingested ammonia. Equip ambulances with towels and plastic bags to safely manage and contain vomitus.

CONCLUSION

The Pirot derailment case serves as a critical learning point for emergency management and response teams. It underscores the necessity for rapid response capabilities, specialized training, and appropriate protective equipment to manage hazardous materials effectively. The delayed response time exacerbated the situation, allowing the ammonia gas to disperse further, increasing the risk and exposure to the surrounding communities. The lack of specialized protective gear and inadequate hazardous material training among the first responders hampered the containment efforts, illustrating a clear gap in preparedness for chemical spill incidents.

By reflecting on this event and implementing the recommended changes, we can aim to mitigate the effects of similar incidents in the future, protecting both human lives and environmental health. This calls for a concerted effort to reforge the links in our emergency response chain, making them stronger, more flexible, and better equipped to handle the unexpected, yet inevitable challenges posed by hazardous material accidents.

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POSTUPANJE U INCIDENTIMA SA IZLIVANJEM OPASNIH MATERIJA PRIKAZ SITUACIJE IZLIVANJA AMONIJAKA IZ CISTERNE

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Sažetak: U decembru 2022. godine, u blizini Pirota u Srbiji dogodio se značajan incident sa iskliznućem voza, u kojem je učestvovao teretni voz od 20 vagona na putu iz Bugarske, što je rezultiralo značajnim ispuštanjem amonijaka. Ovaj događaj je rezultirao sa preko 50 slučajeva trovanja amonijakom, sa sedam osoba kojima je potrebna bolnička nega i dva smrtna slučaja. Osim toga, oslobođeni amonijak formirao gusti oblak pare amonijaka nakon interakcije sa vodom iz životne sredine, što je izazvalo sudar na obližnjem autoputu. Naknadne procene životne sredine otkrile su da nema zaostalog amonijaka u vazduhu ili u obližnjim izvorima vode. Ovaj slučaj ilustruje potencijalni rizik od transporta opasnih materija i naglašava važnost adekvatnih mehanizama upravljanja i reagovanja u takvim incidentima, kao što je detaljno opisano u analizi slučaja i predlogu upravljanja na osnovu aktuelnih preporuka i smernica

Ključne reči amonijak, nesreća, trovanje, urgentna medicina

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IgA VASCULITIS AND ABDOMINAL PAIN – CASE REPORT AND REVIEW

IgA VASKULITIS I ABDOMINALNI BOL – PRIKAZ SLUČAJA I PREGLED LITERATURE

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Summary: INTRODUCTION Acute abdominal pain is one of the most common complaints in the pediatric population. There are various causes of abdominal pain. IgA vasculitis is characterized by purpura, abdominal pain, arthritis or arthralgias, and kidney problems. Atypical forms of this disease have been proven difficult to diagnose and treat. Here we present a case of atypical IgA vasculitis in a child who first presented with an episode of hematochezia. CASE REPORT: A 6-year-old boy presented with abdominal pain, vomiting, diarrhea and hematochezia, pale and dry skin, and dry mucus membranes. He was adynamic on admission but vital signs were normal. Initially, the patient was treated at his hometown hospital due to dehydration which was thought to be caused by viral gastroenteritis. Due to the persistence of symptoms and worsening of abdominal pain, he was then transferred to the Pediatric Surgery Clinic. Just after purpuric skin changes were noted, a pediatrician was called for a consultation, and IgA vasculitis was diagnosed. CONCLUSION Abdominal pain in children, although mostly caused by common pathology and conditions, can present a significant diagnostic problem, especially in pediatric patients presenting with atypical forms of IgA vasculitis. Physicians must be aware of rare causes of abdominal pain and include them in differential diagnosis.
***Key words*:** ultrasound; purpura; gastrointestinal symptoms; diagnostic dilemma.

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INTRODUCTION

Acute abdominal pain is one of the most common complaints in pediatric population. The key to distinguishing underlying causes is a detailed history, full clinical examination, and carefully selected investigations. Common causes of abdominal pain (viral gastroenteritis, constipation, etc.) are usually self-limiting [1]. Surgical causes of abdominal pain, such as acute appendicitis, acute intestinal obstruction, acute cholecystitis, appendicular abscess, volvulus, etc. are usually not self-limiting and must be included in differential diagnosis [2, 3]. IgA vasculitis (formerly Henoch-Schönlein purpura) is the most common form of systemic vasculitis in children. It is a self-limiting disease that presents as a tetrad of clinical manifestations: palpable purpura, arthritis/arthralgia, abdominal pain, and kidney disease. Abdominal pain in IgA vasculitis (IgAV) is usually acute, diffuse, and may be colicky. It is caused by submucosal hemorrhage and edema [4]. Common, rare, and life-threatening diseases in children presenting with abdominal pain along with ultrasound presentation and management are shown in Table 1. Here we present an atypical case of IgAV in a male child who first presented with acute abdominal pain and gastrointestinal symptomatology.

CASE REPORT

A 6-year-old male presented with abdominal pain, vomiting, diarrhea and hematochezia, pale and dry skin, and dry mucus membranes. He was adynamic on admission. Vital signs were normal: HR 132/min, BP 90/60 mmHg, RR 24/min, SaO2 98%. Height and weight were at the 52nd percentile. Symptoms began 7 days before admission with diarrhea, vomiting, and abdominal pain. He was treated at a local hospital with intravenous rehydration due to suspicious viral gastroenteritis. However, due to the persistence of symptoms, and especially the worsening of abdominal pain along with the development of hematochezia, the patient was transferred to Pediatric Surgical Clinic, Clinical Center Niš, for further evaluation. Due to suspicion of Meckel diverticulum, a radionuclide scan was done, but the results came back inconclusive. On a 2nd hospital day, the child developed periocular edema, and right knee swelling, followed by limited and painful joint movement. On the 3rd hospital day, an urticarial diffuse skin rash occurred. After pediatric consultation, a diagnosis of IgA vasculitis was suspected and the patient was transferred to the nephrology department of the Pediatric Clinic. On admission, the patient was hypertensive (TA 135/96 mmHg). The initial laboratory has shown leukocytosis, thrombocytosis, proteinuria, hypoalbuminemia, and IgA immunoglobulin elevation. The skin rash prograded to skin lesions noted in Figure 1. Treatment was induced with methylprednisolone, enalapril, and a short course of diuretics. The patient was discharged ten days later with tapering doses of corticosteroids and enalapril. A nephrologist did the follow-up, and the patient had fully recovered with no relapses.

Figure 1. Skin changes in upper extremities of our patient

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DISCUSSION

IgA vasculitis is triggered by an abnormal immunologic response possibly linked to HLA-B35 and HLA-DRB1*01 [5]. Gastrointestinal symptoms may precede skin changes. This can present a diagnostic dilemma, due to many conditions that could mimic IgAV (table 1). A wide range of diagnostic procedures and thinking outside the box need to be used to differentiate this condition from other diseases.

IgAV therefore may be considered as a diagnosis of exclusion. In acute settings (child presenting with hematochezia), an emergency physician's way of thinking (thinking of rare, dangerous causes, and excluding them toward more common, benign conditions) has to be implemented. We have tried to simplify and illustrate the pathway for diagnosing abdominal pain in Figure 2.

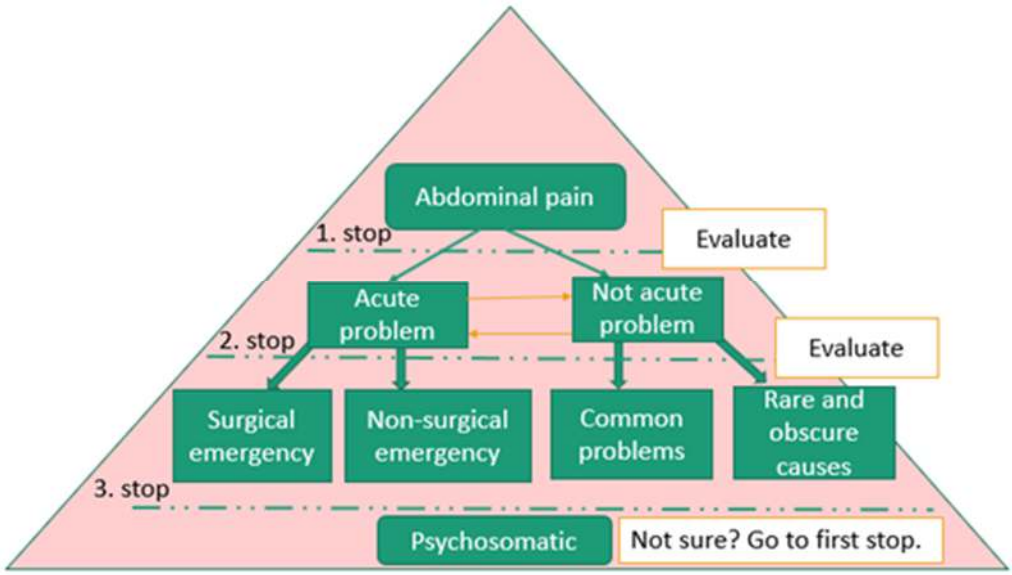

Figure 2. Pyramid of abdominal pain.

Viral gastroenteritis is a common complaint at primary care and presents as diarrhea, abdominal pain, and vomiting [6]. Acute appendicitis presents with positive Rovsing (severe RLQ pain with palpation of LLQ), and psoas sign (because the cecum acts as a cushion that blocks the examiner's hand). These patients need to be thoroughly clinically examined. Ultrasound is a valuable method in the diagnosis of appendicitis [7]. Contrast CT of the abdomen with fine-tuning to lessen radiation dosage and MRI (although not widely available) can also be used [8]. Ultrasound may also be useful in excluding causes such as testicular and ovarian torsion that present as sudden severe pain and swelling in the scrotum, abdominal pain, nausea and vomiting, and severe pelvic pain with nausea and vomiting respectively. Testicular torsion can be accessed with cremasteric reflex and TWIST score where a cutoff of 5 out of 7 has a positive predictive value and specificity of 100% [9]. In our case, unilateral scrotal pain, erythema, and swelling mimicked testicular torsion. Ultrasound in IgAV shows testis with normal morphology, epididymal enlargement, scrotal skin thickening, and hydrocele [10]. Hematemesis and hematochezia may be a sign

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of coagulopathy disorders. Sometimes, hematemesis in IgAV can precede other symptoms and may appear dramatic and require gastroenterologist consult [11]. Physicians may also think of renal colic. Point of care ultrasound (PoCUS) may provide early detection of lithiasis in renal colic and faster clinical decision-making with possible surgical referral and lower radiology (CT) referral [12].

Duodenal hematoma is a rare condition in children, that can present with acute abdominal pain. It may occur after a diagnostic procedure, but also after blunt abdominal trauma, coagulopathy disorders, and leukemia [13]. Another condition that should be considered is gastric ulcer with or without perforation [14]. Gastric ulcers in children may occur with H. pylori infection, but detecting H. Pylori alone without peptic ulcer disease (PUD) in children shouldn't be a reason for antibiotic treatment. In addition, there may even be a not-yet well-understood role of H. pylori's beneficial effect on children's immune system development [15]. Malrotation and volvulus are described in infants, and therefore early diagnosed. Rarely they occur in older children and as such may clinically look like pancreatitis (author's personal experience), gastroenteritis, or diabetic ketoacidosis. Developing ultrasound diagnostic algorithms in order to speed up diagnosis and treatment is very important [16, 17]. In females of reproductive age, ruling out ectopic pregnancy must be considered in any case where a definitive cause of acute abdominal pain is still unknown. Severe lower abdominal pain, accompanied by elevated hCG and ultrasound may point to diagnosis [18]. In patients with IgAV, there may be a risk for intussusception. Children with age at onset of IgAV below 6 years, children not receiving glucocorticoid therapy within 72 h of onset of gastrointestinal (GI) symptoms such as hematochezia, and patients with increased D-dimer levels are at risk for intussusception [19].

Acute non-calculous cholecystitis may co-occur with IgAV and other immune-related disorders (Systemic lupus erythematosus, Kawasaki disease, Juvenile dermatomyositis), but also occurs in critically ill patients, post-surgically, and may be triggered by viral (Epstein-Barr virus) and other infectious pathogens [20]. Acute and chronic pancreatitis are rare in children. They may occur in congenital (pancreas divisum, pancreaticobiliary maljunction), genetic predisposition (PRSS1, SPINK1 mutations, CFTR in cystic fibrosis, etc.), autoimmunity, infections, and toxic-metabolic risk factors (alcohol, chronic renal failure, hypercalcemia, hyperlipidemia) [21].

Paroxysmal nocturnal hemoglobinuria (PNH) is a rare life-threatening disease mostly caused by phosphatidylinositol glycan anchor biosynthesis class A (PIGA) somatic mutation leading to GPI-anchor deficiency for the decay-accelerating factor (DAF/CD55) and membrane inhibitor of reactive lysis (MIRL/CD59). With the lack of GPI-anchor proteins erythrocytes are prone to lysis by membrane attack complex [22]. These patients may suffer from hemolytic anemia and vomiting, but may also present with abdominal pain due to mesenteric microthrombosis, and rare complication of bilateral renal vein thrombosis [23]. Familial Mediterranean fever (FMF) is caused by missense and nonsense mutations in the MEFV gene, which codes for a protein called pyrin, involved in the function of inflammasome multiprotein complexes. FMF can manifest with acute abdominal pain during acute attacks, and signs of peritonitis. Patients may often undergo unnecessary procedures and even repeated surgical interventions such as laparotomy. FMF can also present with scrotal attacks and erysipelas-like erythema. Additionally, joint attacks may occur. All of this can resemble atypical IgA vasculitis (IgAV). Yalcinkaya–Ozen criteria are used in children with suspected FMF [24].

Table 1. Some of the causes of acute abdominal pain and related diagnostic with clinical cues.

Disease	Clinical features	Ultrasound	Management	Ref.
Appendicitis	Right lower quadrant pain, guarding, migration of periumbilical pain to the right lower quadrant	>0.6 cm, fat standing (increased echogenicity of periappendiceal fat), hyperemia, appendicolith (sometimes normal), echogenic free fluid suspicious for rupture	Surgical or conservative	2, 7
Duodenal hematoma	Epigastric pain, vomiting	Uniform echogenic mass along the duodenal convexity, intestinal wall thickening, obstruction of the duodenal lumen	Primarly non-surgical	13
Gastric ulcer	Burning epigastric pain triggered by meal	Gastric antrum or duodenal bulb show marked, diffuse, and circumferential wall thickening, “HH sign“	Primarily non-surgical	14
Gastroenteritis	Abdominal cramping	Not significant	Primary non-surgical, symptomatic, IV fluids	6
IgA vasculitis	Diffuse (colicky) abdominal pain	Echogenic kidneys, target or doughnut sign (intussusception), ddx scrotal edema	Primarily non-surgical	4
Intussusception	Vomiting, hematochezia, abdominal pain	Concentric ring sign	Surgical	19
Ovarian/ Testicular torsion	Abdominal pain, nausea, vomiting	Twisting of spermatic chord/alterated blood flow, increase in size/ovarian edema/variable echogenicity	Primarily surgical	10
Pancreatitis	Severe, dull pain in the upper left abdominal quadrant or central epigastric pain	Increased pancreatic volume with a marked decrease in echogenicity displacement of the transverse colon and/or stomach	Conservative	21
Renal colic	Sudden flank pain that extends anteriorly and inferiorly towards the groin	Echogenic foci, acoustic shadowing, twinkle artifact on Doppler, color comet-tail artifact	Primarily non-surgical. Analgesia, fluids	12, 1
Volvulus	Bilious vomiting in neonate, abdominal distension and pain	Clockwise whirlpool sign, abnormal superior mesenteric vessels, abnormal bowel, free intra-abdominal fluid	Surgical	16

Table 1. Some of the causes of acute abdominal pain and related diagnostic with clinical cues.

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Acute hepatic porphyrias (AHP) are rare, life-threatening genetic disorders that are caused by enzyme deficiencies in the heme biosynthetic pathway. AHP may present in a child with fever, crampy abdominal pain, darkening of the urine, mental confusion, and cutaneous manifestations on sun-exposed skin. In cases of recurrent and unexplained episodes of abdominal pain in a child, a urinary analysis for δ-aminolaevulinic acid (ALA), porphobilinogen (PBG), and porphyrins may prove diagnostic [25]. Mutations of the SERPING1 gene are thought to give rise to hereditary angioedema (HA), which can lead to recurrent abdominal pain in a high number of cases. Symptoms may overlap with other rare diseases, but cutaneous swelling failing to respond to usual treatment may provoke consideration of HA [26]. Paroxysmal attacks of dull, colicky and/or diffuse abdominal pain that last 17 hours on average can be due to a rare clinical entity of abdominal migraine which can be diagnosed using Rome IV criteria. Various pathophysiology models are proposed to explain this disorder in children. They include theories about visceral hypersensitivity, gut-brain axis, and psychological stressors [27]. Abdominal pain can pose a significant diagnostic challenge, particularly in pediatric patients with atypical forms of IgA vasculitis. Physicians should be mindful of rare causes of abdominal pain and include them in differential diagnosis.

CONCLUSION.

Abdominal pain in children, although mostly caused by common pathology and conditions, can present a significant diagnostic problem, especially in pediatric patients presenting with atypical forms of IgA vasculitis. Physicians must be aware of rare causes of abdominal pain and include them in differential diagnosis.

Conflict of interest:
The author declares no conflict of interest

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IgA VASKULITIS I ABDOMINALNI BOL – PRIKAZ SLUČAJA I PREGLED LITERATURE

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Sažetak: UVOD.Akutni abdominalni bol je jedan od najčešćih razloga posete pedijatrijskoj ambulanti. Etiologija abdominalnog bola je široka. IgA vaskultis karakterišu purpura, abdominalni bol, artritis, artralgija, kao i bubrežna patologija. Atipični slučajevi, naročito gde gastrointestinalni problemi prethode pojavi ospe po koži, mogu predstavljati dijagnostički i terapijski problem. Prikazujemo atipični slučaj „IgA" vaskulitisa kod pedijatrijskog pacijenta gde je bolest počela sa hematohezijom.
PRIKAZ BOLESNIKA.Šestogodišnji dečak primljen je zbog abdominalnog bola, povraćanja, prolivastih stolica, hematohezije, blede i suve kože i suvih sluznica, sa znacima dehidracije. Bio je adinamičan, ali vitalni znaci su bili uredni. Inicijalno je tretiran u matičnoj ustanovi zbog dehidracije pod sumnjom na virusni gastroenteritis. Zbog održavanja simptoma i pogoršanja abdominalnog bola preveden je na Kliniku za dečiju hirurgiju. Po pojavi kožnih promena i nakon konsultacije pedijatra preveden je na Kliniku za pedijatriju gde je postavljena dijagnoza „IgA" vaskulitisa. ZAKLJUČAK.Možemo zaključiti da abdominalni bol kod dece može predstavljati dijagnostičku dilemu, naročito kod pacijenata sa atipičnim „IgA" vaskulitisom. Lekari moraju biti svesni i povremeno uzeti u obzir i retka stanja i oboljenja u diferencijalnoj dijagnozi abdominalnog bola.
Ključne reči ultrazvuk; purpura; gastrointestinalni simptomi; dijagnostička dilema

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Yu WM, Hawley TS, Hawley RG, Qu CK. Immortalization of yolk sac-derived precursor cells.
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Članak u casopisu na internetu:

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Abood S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role.
Am J Nurs [serial on the Internet]. 2002 Jun [cited 2002 Aug 12];102(6):[about 3 p.]. Available
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Electronic references

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