

**Vol 4, No 4 (2024)**

**ISSN 2637-3408**

**Symposium of anesthesiologists and  
reanimatologists in FB&H  
with international participation**

***Proceedings***



**04th - 06th October, 2024**

**Hotel "Sunce", Neum, Bosnia and Herzegovina**

**UREDNIK / EDITOR**

Prof. dr.sc. Jasmina Smajić

**IZDAVAČ / PUBLISHER**

Udruženje doktra medicine anesteziologa-reanimatologa u Federaciji Bosne i Hercegovine (UDMAR)

Association of Medical doctors Anesthesiologists-Reanimatologists in FBiH (UDMAR)

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Neum, 2024

## SADRŽAJ / TABLE OF CONTENT

<b>PREDAVANJA PO POZIVU / LECTURES</b> .....	<b>7</b>
ULTRASOUND FOR EPIDURALS AND SPINALS: DO WE NEED IT AND HOW TO PERFORM IT? An educational review of literature and practical implementation <i>Huppertz-Thyssen, M.H.</i> .....	8
INTENZIVNA MEDICINA – PROŠLOST, SADAŠNJOST I BUDUĆNOST <i>Senita Beharić</i> .....	11
CRITICAL CARE MEDICINE – THE PAST, PRESENT AND FUTURE <i>Senita Beharić</i> .....	12
OVERVIEW OF CHRONIC CRITICAL ILLNESS (CCI) <i>Manja Spahalić</i> .....	13
GENERAL ANESTHESIA VS SEDATION FOR NEUROVASCULAR PROCEDURES <i>Dr. Gentian HUTI, MD</i> .....	15
FIBEROPTIC BRONCHOSCOPY FOR PERCUTANEOUS TRACHEOSTOMY: PROS AND CONS <i>Jasmina Smajić</i> .....	17
CLINICAL USES OF ESKETAMINE IN CHILDREN <i>Ivana Budić</i> .....	20
LITTLE HEARTS, BIG WORRIES ANESTHESIA FOR MRI FOR CHILDREN AGED 0-7 – OUR WAY <i>Marko Vukić</i> .....	22
HEART-LUNG INTERACTIONS IN ICU: FROM PATHOPHYSIOLOGY TO PRACTICE LESSONS <i>Rudin Domi</i> .....	24
CARDIOPROTECTION BY MODULATING INTRACELLULAR MECHANISMS <i>Suad Keranović</i> .....	26
FAST EXAMINATION IN OBSTETRIC ANESTHESIA <i>Ivan Velickovic</i> .....	27
FASCIAL PLANE BLOCKS <i>Nada Pejčić</i> .....	28
SAVREMENI KONCEPT LIJEČENJA BOLA U PERIOPERATIVNOM PERIODU <i>Meldijana Omerbegović</i> .....	30
CURRENT CONCEPT OF PAIN CONTROL DURING PERIOPERATIVE PERIOD <i>Meldijana Omerbegović</i> .....	31
REFRIGERATED RADIOFREQUENCY ABLATION IN THE TREATMENT OF KNEE, HIP AND SHOULDER PAIN <i>Dajana Vladić – Spaić</i> .....	32
EPIDURAL STEROID INJECTIONS <i>Anja Petričević</i> .....	33
PERCUTANEOUS LASER DISC DECOMPRESSION <i>Dino Budrovac</i> .....	34
RADIOFREKVENTNA DENERVACIJA FASETNIH ZGLOBOVA <i>Ivan Radoš</i> .....	37
KONGENITALNE KRANIOFACIJALNE ANOMALIJE KAO IZAZOV U ANESTEZIJI <i>Selma Sijerčić</i> .....	39
CONGENITAL CRANIOFACIAL ANOMALIES AS A CHALLENGE IN ANESTHESIA <i>Selma Sijerčić</i> .....	40
RAPID SEQUENCE INTUBATION: UP-TO-DATE <i>Renata Curić Radivojević</i> .....	41
<b>POSTER PREZENTACIJE / POSTER PRESENTATIONS</b> .....	<b>45</b>
ANALGEZIJA I SEDACIJA U JEDINICI INTENZIVNE TERAPIJE (JIT) <i>Senita Beharić</i> .....	46

ANALGESIA AND SEDATION IN THE INTENSIVE CARE UNIT (ICU) <i>Senita Beharić</i> .....	47
PREDNOSTI KAUDALNE ANESTEZIJE U ODNOSU NA OPŠTU ANESTEZIJU KOD PEDIJATRIJSKE POPULACIJE U INFRAUMBILIKALNOJ HIRURGIJI <i>Amira Mešić</i> .....	48
ADVANTAGES OF CAUDAL ANESTHESIA IN RELATION TO GENERAL ANESTHESIA IN THE PEDIATRIC POPULATION IN INFRAUMBILICAL SURGERY <i>Amira Mešić</i> .....	49
DELIRIJUM KAO POSLJEDICA NEUROLEPTIČNOG MALIGNOG SINDROMA <i>Lejla Mujkić</i> .....	50
MOŽDANA HERNIJACIJA U TRAUMATSKOJ OZLJEDI GLAVE – "BRAIN CODE" <i>Ana Milas</i> .....	51
ANATOMSKI PARAMETRI VRATA KAO PREDIKTORI OTEŽANE ENDOTRAHEALNE INTUBACIJE <i>Armin Šarić</i> .....	52
PRIKAZ SLUČAJA: "SEPTIČNA ENCEFALOPATIJA" <i>Jasmina Smajić</i> .....	53
ANESTEZIOLOŠKI IZAZOVI PRI OPERATIVNOM ZAHVATU OBOSTRANOG RASCJEPANJE NEPCE I USNE KOD DJECE SA ZBRINUTOM TETRALOGIJA FALLOT: PRIKAZ SLUČAJA ANAESTHESIA CHALLENGES FOR BILATERAL CLEFT LIP AND CLEFT PALATINUM IN A CHILD WITH REPAIRED TETRALOGY OF FALLOT: A CASE REPORT <i>Belma Kadić</i> .....	54
BENEFITS OF REGIONAL ANESTHESIA FOR CAROTID ARTERY SURGERY <i>Edis Salihović</i> .....	56
PREDNOSTI REGIONALNE ANESTEZIJE ZA HIRURGIJU KAROTIDNE ARTERIJE <i>Edis Salihović</i> .....	57
CASE REPORT: POSTOPERATIVE ILEUS FOLLOWING HEART SURGERY <i>Jasmina Kovčić Suman</i> .....	58
OZLJEDA ŽUČNIH VODOVA- RANA DETEKCIJA I VITALNA RJEŠENJA - PRIKAZ SLUČAJA <i>Jasmina Smajić</i> .....	59
HEPATOBLASTOM KOD MALOG DJETETA <i>Amela Dalibegović</i> .....	60
HEPATOBLASTOMA IN A SMALL CHILD <i>Amela Dalibegović</i> .....	61
LIJEČENJE TRAUMATSKÉ POVREDE BUBREGA U PEDIJATRIJSKOJ POPULACIJI PRIKAZ SLUČAJA <i>Ermina Sitnić-Milanović</i> .....	62
TREATMENT OF TRAUMATIC KIDNEY INJURY IN THE PEDIATRIC POPULATION CASE REPORT <i>Ermina Sitnić-Milanović</i> .....	63
FORMULISANJE SIGURNOG I EFIKASNOG PLANA ANESTEZIJE PRI ADENOTOMIJI DJECE SA CEREBRALNOM PARALIZOM: PRIKAZ SLUČAJA FORMULATION OF A SAFE AND EFFECTIVE ANESTHESIA PLAN FOR ADENOTOMY FOR PATIENTS WITH CEREBRAL PALSY: CASE REPORT <i>Belma Kadić</i> .....	64
ANESTHESIA APPROACH FOR BRONCHOGENIC CYST IN AN INFANT CAUSING PNEUMOTHORAX <i>Lejla Dedic Simendic</i> .....	66
MINIMALLY INVASIVE ANESTHESIA FOR MINIMALLY INVASIVE ENDOSCOPIC CARDIAC SURGERY IN HIGH RISK PATIENTS, EMERGING STRATEGIES FOR THE STATE OF ART ANESTHESIA APPLICATION <i>Edin Kabil</i> .....	67

MINIMALNO INVAZIVNA ANESTEZIJA ZA MINIMALNO INVAZIVNU KADIOHIRURGIJU KOD VISOKORIZIČNIH PACIJENATA, PRIMJENA NOVIH STRATEGIJA SAVREMENE ANESTEZIJE	
<i>Edin Kabil</i> .....	68
NEUROAKSIJALNA ANESTEZIJA U PORODU	
<i>Mirela Džomba-Mandžuka</i> .....	69
TRANSPOZICIJA I PERFORACIJA ŽELUDCA U PRSNOJ ŠUPLJINI NAKON RUPTURE DIJAFRAGME USLIJED POLITRAUME: PRIKAZ SLUČAJA	
<i>Mirko Mihalj</i> .....	70
INTRATHORACIC TRANSLOCATION AND PERFORATION OF STOMACH FOLLOWING POLITRAUMATIC DIAPHRAGM RUPTURE: CASE REPORT	
<i>Mirko Mihalj</i> .....	71
SEPTIČNI ŠOK, ARDS I MULTIORGANSKO ZATAJENJE	
<i>Narhela Mujačić</i> .....	72
SEPTIC SHOCK, ARDS AND MULTIORGAN FAILURE	
<i>Narhela Mujačić</i> .....	73
ANTIMICROBIAL PROPHYLAXIS FOR THE PREVENTION OF INFECTION IN SURGERY	
<i>Sadija Lušija</i> .....	74
ANTIMIKROBNA PROFILAKSA ZA PREVENCIJU INFEKCIJE U HIRURGIJI	
<i>Lušija Sadija</i> .....	75
"FLAIL CHEST" KOD TUPE TRAUME GRUDNOG KOŠA	
<i>Vikalo L</i> .....	76
POSTOPERATIVNI ILEUS NAKON SRČANE OPERACIJE	
<i>Jasmina Kovčić Suman</i> .....	77
UTICAJ ANESTEZIJE NA KARDIOLOŠKE PACIJENTE /PRIKAZ SLUČAJA/ <i>Bavčić Selma</i> .....	78
ANESTEZIOLOŠKI TRETMAN KARCINOMA BUBREGA SA UDRUŽENIM TROMBOM DONJE ŠUPLJE VENE	
<i>Lejla Altumbabić</i> .....	80
ANESTHESIOLOGY TREATMENT OF KIDNEY CARCINOMA WITH ASSOCIATED INFERIOR VENA CAVA THROMBUS	
<i>Lejla Altumbabić</i> .....	81
SPONTANEOUS TWIN ANEMIA POLYCYTHEMIA SEQUENCE- CASE PRESENTATION	
<i>A. Djordjević</i> .....	82
REMIMAZOLAM, IDEALAN SEDATIV?	
<i>Martina Vukoja</i> .....	83
REMIMAZOLAM, AN IDEAL SEDATIVE?	
<i>Vukoja Martina</i> .....	84
STUDIJA SLUČAJA O REFRAKTARNOJ VENTRIKULARNOJ FIBRILACIJI U VANBOLNIČKOM SRČANOM ZASTOJU	
<i>Osmanbegović A</i> .....	85
A CASE REPORT STUDY OF REFRACTORY VENTRICULAR FIBRILLATION IN OUT-OF-HOSPITAL CARDIAC ARREST	
<i>Osmanbegović A</i> .....	86
HIPERTENZIJA KOD AKUTNOG MOŽDANOG UDARA U PREHOSPITALNIM UVJETIMA	
<i>Palikuća Ljuhar Amna</i> .....	87
HYPERTENSION IN ACUTE STROKE IN PREHOSPITAL SETTINGS	
<i>Palikuća Ljuhar Amna</i> .....	88
STUDIJA SLUČAJA O ZNAČAJU PRIMJENE BENZODIAZEPINA KAO SEDACIJSKE MJERE POSTRESUSCITACIJSKOG MEDICINSKOG TRANSPORTA	
<i>Bećirović K.</i> .....	89

CASE REPORT STUDY OF THE IMPORTANCE OF BENZODIAZEPINE ADMINISTRATION AS A SEDATION MEASURE IN POST-RESUSCITATION MEDICAL TRANSPORT	
<i>Bećirović K</i> .....	90
KOMPRESIVNI TUMOR MEDIJASTINUMA PRIKAZ SLUČAJA	
<i>Fata Imamović</i> .....	91
COMPRESSIVE TUMOR OF THE MEDIASTINUM CASE REPORT	
<i>Fata Imamović</i> .....	92
KOMPLEKSNA INTERAKCIJA AKUTNOG POLIRADIKULONEURITISA I PRIMARNOG HIPERPARATIREOIDIZMA: PRIKAZ SLUČAJA	
<i>Lejla Mazić</i> .....	93
EFFICACY OF EPIDURAL STEROID INJECTIONS IN CHRONIC PAIN TREATMENT	
<i>Anida Jamakosmanović</i> .....	94

**PREDAVANJA PO POZIVU / LECTURES**



# ULTRASOUND FOR EPIDURALS AND SPINALS: DO WE NEED IT AND HOW TO PERFORM IT? An educational review of literature and practical implementation

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## Key words

Sonography, anatomy of the spine, epidural anaesthesia, spinal anaesthesia, patientsafety

## Material and methods

Literature research of PubMed/ MEDLINE, Cochrane Database, Google Scholar and NYSORA learning system (nysoralms.com). Educational articles, systematic reviews, randomized trials and case series from 2001 on.

## Introduction

The use of ultrasound for neuroaxial anaesthesia is less common and popular than for peripheral nerve blocks or fascial blocks. Traditionally, epidural and spinal anaesthesia are performed using landmark techniques. The problems are inconsistent, variable landmarks, a growing population of morbidly obese patients, a growing population with prior back surgery, scoliosis, difficulties to position old, multimorbid patients properly, and the fact that even experienced anaesthesiologists may miss the anticipated level of puncture by 2 levels. Technical difficulties, multiple attempts on different levels, traumatic needle insertion and multiple skin punctures increase the risk of infection, hematoma and subsequent nerve injury (1). At the beginning of the 2000s, several researchers like Grau et al. started investigating possible advantages of using sonography to make neuroaxial anaesthesia and analgesia easier and safer (2-7). The presumed or actual difficulty to find adequate acoustic windows through the bony structures of the spine still discourages providers from using ultrasound for central neuroaxial anaesthesia.

Nevertheless, as a review by Chin et al. states: „An interlaminar window that permits the passage of sound waves (..) also will permit the passage of a needle“ (8).

## Incidence of hematoma, infectious complications and subsequent nerve injury in central neuroaxial anaesthesia

There is a very variable range of severe complications reported in literature. Permanent nerve injuries (PNI) are mostly caused by hematoma and infectious complications. Old data states that the incidence of spinal hematoma ranges from 1:200.000 in healthy young women (obstetrics) to 1:3600 in elderly orthopedic patients (9). Infectious complications vary from 0:70.000 to 1:1930 (10,11). Most of the risk factors are patient- related or related to anticoagulant medication.

Identified risk factors for various complications like hematoma, infection and postspinal headache, related to the neuroaxial block technique itself, are (12,13):

- Multiple punctures on several levels
- Multiple skin perforations
- Vascular punctures
- Traumatic punctures

## Advantages of the use of sonography – available evidence

A review by Yoo et al. gives a comprehensive overview over the literature and studies available till 2020 (14). The findings can be summarized as follows:

The use of sonography for central neuroaxial anaesthesia and analgesie helps to:

- Identify the midline
- Identify the intervertebral level
- Locate the interlaminar space
- Measure the distance from skin to lamina, epidural („posterior complex“) and intrathecal space (good correlation between measured distance and actual depth of needle intrusion)
- Identify patients with potential difficulties (clinical decision making)

This has the potential to (8):

- reduce the number of puncture attempts
- reduce the need to puncture multiple levels
- reduce the number of needle manipulations
- reduce the number of traumatic punctures, vascular punctures and postpunctional headache
- increase the first pass success rate
- improve patients comfort and satisfaction
- improve the success rate in difficult anatomy (15)

So we (only) have „indirect evidence“ that the use of sonography for neuroaxial anaesthesia improves patientsafety. The advantages are more pronounced in difficult anatomy like obesity, pregnancy, skoliosis, elderly patients, prior spine surgery For easily palpable spines and for unexperienced trainees performing blocks, reported data on advantages of sonography are not consistent in literature.

### **Ultrasound guided real- time or ultrasound assisted?**

The question, if ultrasound is best to be used to plan the neuroaxial procedure, to measure the distances from skin to epidural and subarachnoidal space and to determine the site of needle insertion, or, if we should practice a real- time ultrasound guided needle advance as in peripheral regional anaesthesia, is open to further research and discussion. There is a rather recent, well designed trial that found several advantages for sonographic planning and assistance over real-time guidance (16). Nevertheless this trial was limited to spinal anaesthesia, geriatric population (hip fracture) and a paramedian approach. Thus, it cannot be generalized for all neuroaxial techniques.

### **How to scan**

The lecture presents the different standard views that can be used for a comprehensive scan. Sonoanatomy and terms like

- „posterior complex“ (dorsal border of the intrathecal space, Flavum- Dura complex, Ligamentum flavum- Dura mater unit) and
- „anterior complex“ (anterior border of the intrathecal space, anterior Dura mater, posterior longitudinal ligament, posterior surface of vertebral bodies, intervertebral disc between vertebral bodies) are defined.

The published standard views are (1,8,14,15,17,18):

- Sagittal transverse process view
  - Sagittal articular process view
  - Sagittal lamina view
  - Sagittal spinosus process view
- Sagittal views are presented from lateral to medial. For didactical and educational reasons, it is possible to visualize also the Erector Spine Plane Block (ESPB) and Paravertebral Block (PVB) positions, while performing this scan.
- Sagittal oblique view, to measure the distance skin- lamina / interlaminar foramen
  - Transverse interspinous / interlaminar view (acoustic window)
  - Transverse spinous process view (acoustic shadow)
  - Diagonal views (especially for real time guidance (14))

### **Necessary training**

Summaries of conclusive scan procedures to train and practice are published in (1) and (8). Literature tells that up to ca. 40 scans with supervision will be necessary to learn the technique (19, 20). 20 supervised trials and training sessions were not enough.

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# INTENZIVNA MEDICINA – PROŠLOST, SADAŠNJOST I BUDUĆNOST

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**Uvod:** Od pojave intenzivne medicine u dvadesetom stoljeću, došlo je do brojnih promjena u zbrinjavanju kritično bolesnih ili povrijeđenih pacijenata i znatnog napretka u dijagnostici, potpori organa i modalitetima liječenja u jedinicama intenzivnog liječenja.

**Cilj:** Da bi zbrinjavanje kritično oboljelih pacijenata bilo još kvalitetnije, od iznimne važnosti su: fizički prostor u kojem je smještena intenzivna, osoblje koje brine o njima, oprema i tehnologija; informacijski sistemi i podaci, i istraživački sistemi koji utiču na ishod liječenja pacijenata, ali i na njihove porodice. U budućnosti su potrebna daljnja poboljšanja kako bi se postiglo personalizirano liječenje vitalno ugroženih bolesnika.

**Materijal i metode:** U intenzivnoj medicini postignut je značajan napredak u toku proteklih godina. Da bi se napredak nastavio, infrastruktura jedinica intenzivnog liječenja treba da se transformiše, a fokus se mora usmjeriti na načine koji unapređuju personalizovanu intenzivnu medicinu. Tehnologija će nastaviti da napreduje što bi nam trebalo pružiti alate za redizajniranje procesa upravljanja i liječenje kritično bolesnih.

**Rezultati i diskusija:** Sa akutno i kritično bolesnim pacijentima i njihovim porodicama kao apsolutnim fokusom, napredak u ovim oblastima će, nadamo se, transformisati intenzivno liječenje i ishode u narednim godinama. Imperativ je da promijenimo paradigmu i razvijemo modele njege koji omogućavaju zbrinjavanje kritično bolesnih.

**Zaključak:** Velika raznolikost u mnogim aspektima intenzivne medicine postoji, ali rad na postizanju buduće vizije organizacije intenzivnog liječenja će dovesti do kvalitetnijeg liječenja, uključujući personaliziranije intenzivno liječenje boljeg kvaliteta, jer će cilj uvijek ostati pružanje najkvalitetnijeg liječenja pacijenata i njihovog ishoda.

**Ključne riječi:** intenzivna medicina, kvalitet

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# CRITICAL CARE MEDICINE – THE PAST, PRESENT AND FUTURE

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**Introduction:** Since the advent of critical care in twentieth century, core elements that are foundation for critical care systems, namely to care for critically ill and injured patients and to save lives, have evolved enormously. Past halfcentury has seen dramatic advancements in diagnostic, organ support, and treatment modalities in critical care, with further improvements now needed to achieve personalized critical care of highest quality.

**Aim:** For critical care to be even higher quality in the future, advancements in the following areas are key: physical ICU space; people that care for critically ill patients; equipment and technologies; information systems and data; and research systems that impact critically ill patients and families.

**Material and methods:** Although critical care has made significant advances over the years, substantial heterogeneity of critical care illnesses has made it challenge to make sufficient progress. In order for progress to continue, infrastructure of critical care needs to be transformed and focus must pivot to ways that enhance personalized medicine. Technology will continue to make strides which should provide us with tools for redesigning processes of critical care management.

**Results and discussion:** With acutely and critically ill patients and their families as absolute focal point, advancements across these areas will hopefully transform care and outcomes over the coming years. It is imperative that we shift paradigm and develop models of care that allow for care of critically ill beyond the walls of ICU.

**Conclusion:** Global variability in many aspects of critical care will forever remain, yet working to achieve this future vision for critical care organization will lead to higher-quality care across systems and continents, including more humanistic and more personalized care with fewer errors and better quality, as the goal will always remain to provide the highest quality patient care and outcomes.

**Keywords:** Critical care medicine, quality

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# OVERVIEW OF CHRONIC CRITICAL ILLNESS (CCI)

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## 1. Overview of Chronic Critical Illness (CCI)

Chronic Critical Illness (CCI) refers to a condition where patients experience prolonged dependence on life-support interventions and persistent organ dysfunction. This subset of ICU patients, approximately 5-20%, endures significant systemic alterations including persistent inflammation, neuroendocrine dysfunction, and muscle wasting (1). Persistent inflammation, marked by elevated cytokines, exacerbates multi-organ failure and infection susceptibility (2). Neuroendocrine changes such as disrupted cortisol secretion and increased sympathetic nervous system activity worsen muscle wasting and metabolic disturbances (5, 6). Muscle atrophy, driven by inflammatory cytokines and glucocorticoids, impairs recovery and long-term functional outcomes significantly (7, 8).

## 2. Patient Trajectories and Clinical Outcomes

The trajectories for CCI patients are often unpredictable, influenced by the length of ICU stay, development of ICU-acquired weakness (ICUAW), and effectiveness of rehabilitation efforts (10, 12, 13). ICUAW affects many patients, leading to extended muscle weakness and impaired recovery (10). Additional complications such as sepsis and delirium prolong ICU stays and elevate mortality rates (12, 13). Mortality is notably high, with 40-67% of patients dying within one year of ICU discharge (14). Functional recovery is generally poor, with only about 10% of survivors achieving full independence, indicating a need for effective long-term rehabilitation (15).

## 3. Challenges Faced by Patients, Families, and Healthcare Providers

CCI patients face numerous challenges, including severe physical impairments such as muscle atrophy and prolonged immobility, along with significant psychological distress, including anxiety and depression (16, 17). Families experience considerable emotional and financial strain due to the complexity of care and the emotional toll of the patient's condition (18, 19). Healthcare providers encounter difficulties in managing care coordination, addressing ethical dilemmas, and ensuring effective communication within interdisciplinary teams (20). Addressing these challenges requires comprehensive collaboration and expertise.

## 4. Management Strategies and Clinical Recommendations

Management of CCI should include early mobilization, physical rehabilitation, and nutritional support. Early physical therapy is essential for reducing ICU-acquired weakness and improving recovery (11). Nutritional support through enteral feeding helps maintain nutritional status and supports recovery, though metabolic derangements present ongoing challenges (21). Pharmacological treatments, such as corticosteroids, have limited efficacy, suggesting a need for further research (22). Palliative care is crucial for symptom management, facilitating shared decision-making, and aligning treatments with patient goals (23).

## 5. Future Directions and Need for Standardized Care Approaches

Future efforts should focus on establishing standardized definitions and diagnostic criteria for CCI to improve research comparability and clinical management (24). Research should evaluate various treatment approaches, including long-term acute care facilities versus home-based interventions, and develop effective rehabilitation programs for long-term impairments (25). A multidisciplinary approach, involving family engagement, is essential for addressing the complex needs of CCI patients and improving overall outcomes.

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## GENERAL ANESTHESIA VS SEDATION FOR NEUROVASCULAR PROCEDURES

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Taking care of patients suffering from cerebrovascular diseases is complex and requires a strong multidisciplinary cooperation. The patients can be directed in OR/Cath lab and/or in intensive care unit first and after stabilization in Cath lab for endovascular procedure. Neuro-endovascular procedures include carotid stents insertion, intracerebral artery aneurism embolization, and thrombectomy. ICU approach of these patients is usually the same as for anesthesia care in operating room. This consists in strict frequently neurological examination, hemodynamic stability maintenance, anticoagulant drugs, and general care of these patients in ICU. Frequently neurological examination, hemodynamic stability maintenance, anticoagulant drugs, and general care o in ICU. Frequently neurological monitoring helps to evidence new neurological signs and the progression of old deficits. The neurological examination is often recommended to be in every 2-4 hours. In case of new neurological signs or decreasing in conscience an imaging control and notifying the neurologist is mandatory. Every patient has his target in blood pressure management depended on current diseases, preoperative blood level, chronic medications, and on the neurovascular procedure. In ischemic events, after endovascular tents or thrombectomy the blood pressure must vary between 140-180 mmHg. After endovascular embolization or in patients in high risk for intracranial bleeding, systolic blood pressure must be maintained 100-110 mmHg. After thrombectomy and/or stents, antiaggregating and/or anticoagulant drugs are used. In such cases the multidisciplinary team must take in consideration the risk of intracranial bleeding and new ischemic events in case of no anticoagulation is used. General care in intensive care of these patients consists in stress ulcer prevention, early mobilizing of the patient, specific nutrition, skin decubitus prevention, and of course prevention of respiratory complications.

Anesthesia techniques depend on the procedure kind, patients' neurological status, and neurovascular team preferences or protocols. Embolization is indicated in case of intracranial aneurism. These aneurisms may be ruptured (subarachnoid bleeding) or non-ruptured so elective embolization is indicated. During embolization thromboembolism, intraprocedural rupture, coil migration, cerebral ischemia, and death can occur. Embolization procedures are performed under general anesthesia. Anesthesia goals include maintaining stable blood pressure avoiding hypertension (especially during induction and intubation), adequate anesthesia deep to avoid unexpectedly patients' movement, and anticoagulation regimen as neuroradiologists advice. Endovascular procedures can be easily performed under general anesthesia and monitored anesthesia care as well. Monitored anesthesia care is generally indicated in cooperative patients, able to protect airways, and in whom side effects of deep sedation (for example respiratory depression in obese patient) are not likely. General anesthesia is reserved in non-cooperative patients, risks for seizures, hemodynamically issues, and for patients with severe compromised mental status. It is recently from the literature reported that general anesthesia use is associated with a high recanalization rate in case of anterior circle thrombectomy. In posterior circle, general anesthesia is almost mandatory to guarantee ventilation and hemodynamics. Anesthesia goals during thrombectomy consist of avoiding hypoxemia and hypotension and maintain blood pressure 140-180 mmHg before recanalization and normal values after thrombectomy.

Carotid stents can be inserted under monitored anesthesia care, sedation, or even general anesthesia. Maintaining mild hypertension is critical in these patients to avoid further cerebral ischemia. During ballooning or opening stent, the anesthesiologist must deal with severe bradycardia (carotid glomus stimulation). An intense intraprocedural communication between physicians is of great importance to guarantee success.

As a conclusion, prognosis can be enhanced by collaboration with other disciplines and offering patient based individually treatment.



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# FIBEROPTIC BRONCHOSCOPY FOR PERCUTANEOUS TRACHEOSTOMY: PROS AND CONS

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## Introduction

Tracheostomy is one of airway management options in patients who need long term ventilation and airway protection. Surgical tracheostomy (ST) was first described by Jackson in 1909. Percutaneous dilatational tracheostomy (PDT) over a guidewire was invented by Ciaglia in 1985. PDT has now become the standard of care in ICU and has replaced ST in this subset of patients to a large extent.<sup>1,2</sup> Percutaneous tracheostomy is an elective method that is increasingly being taken up in the intensive care unit alongside the patient's bed. Percutaneous tracheostomy is a common procedure performed in critically ill patients requiring prolonged mechanical ventilation. The use of fiberoptic bronchoscopy (FOB) during percutaneous tracheostomy remains a topic of debate, with proponents advocating for its utility in enhancing safety and accuracy, while others argue against its routine use due to concerns regarding added complexity and potential complications.

PDT involves blunt dissection of pretracheal tissues followed by dilatation of trachea over the guidewire and insertion of tracheal cannula using Seldinger technique.<sup>3,4</sup>

- *Indications for Percutaneous Dilatational Tracheostomy:*

- (1) to facilitate weaning in difficult to wean patients,
- (2) to aid in tracheobronchial toileting,
- (3) to protect airways in patients at risk of aspiration,
- (4) in anticipated prolonged ventilator stay,
- (5) to minimize sedation requirement.

- *Contraindications for Percutaneous Dilatational Tracheostomy:*

**Absolute:** infants, infection at insertion site, operator inexperience, unstable cervical spine injuries, uncontrollable coagulopathy.

**Relative:** enlarged thyroid glands, presence of pulsatile vessels at the insertion site, difficult anatomy (short neck, morbid obesity, limited neck extension, local malignancy, tracheal deviation), coagulopathy, close proximity to burns or surgical wounds, high PEEP or FiO<sub>2</sub> requirements (FiO<sub>2</sub> >70%, PEEP >10 cm of H<sub>2</sub>O), history of cervical injury or tracheostomy, high riding innominate artery, radiotherapy to cervical region in last 4 weeks, controlled local infection.<sup>5,6</sup>

Best of evidence, in the form of randomized controlled trial (RCT), does not show any benefit of early (<10 days of intubation) when compared to late tracheostomy (>10 days of intubation). No benefit has been observed in terms of mortality, ventilator-associated pneumonia, laryngotracheal complications, and ICU length of stay. Some benefit has been observed in the form of reduced ventilatory stay. Recent guidelines have found insufficient evidence at present for any recommendation to be made regarding this.<sup>7</sup>

## Performing PDT without using fiberoptic bronchoscope

The patient is placed in the supine position, the neck extended with the help of either a rolled towel or a small pillow placed beneath the shoulders. The head is positioned in a 'head-ring' for additional stability. These maneuvers provide for maximal surface exposure and, in most patients, bring the trachea from the intrathoracic to the cervical position. Properly position the patient with maximum neck extension. Keep patient on 100% FiO<sub>2</sub>. Ensure adequate sedation and paralysis of the patient. Deflate the ET cuff and withdraw ET under laryngoscopic vision until cuff is visualized just below cords, then reinflate the cuff. Clean, drape the patient as per protocol. Identify the site of insertion. Infiltrate the skin with local anesthetic containing a vasoconstrictor. After appropriate preparation of the skin and surgical draping, the procedure is accomplished through a short horizontal incision placed at the level of the second tracheal ring. Make a 2–2.5

cm transverse incision at the proposed insertion site. Bluntly dissect subcutaneous fat and pretracheal tissue with mosquito clamp. Advance a 14-gauge sheathed introducer needle into trachea with nondominant hand stabilizing the trachea during the process. Tracheal placement of needle is confirmed by aspirating air bubbles into the saline filled syringe attached to the needle. Withdraw the needle and insert Seldinger guidewire through the plastic sheath. Dilate the insertion site with the help of a small tracheal dilator. Single graduated dilator is moisturized with saline and then loaded over the guiding catheter. The whole assembly is then loaded over the guidewire and advanced as a unit into trachea in a sweeping action. After adequate dilatation, dilator is removed and tracheostomy tube with appropriate adapter is inserted into trachea over the guiding catheter. Placement of tracheostomy tube is confirmed by EtCO<sub>2</sub> graph. Once the tracheostomy tube is positioned and an adequate airway is demonstrated through positive pressure ventilation and visual inspection of chest wall expansion, confirmed by the end-tidal CO<sub>2</sub> tracing the previously placed endotracheal tube is removed from the trachea. The wound is closed appropriately, skin sutures are placed through the flange ends, and a tie is secured around the neck.<sup>8,9</sup>

### **Performing PDT with using fiberoptic bronchoscope**

Performing the procedure can be facilitated by the use of a fiberoptic bronchoscope. Percutaneous tracheotomy technique with the FOB is performed similar to the previous except : the set PEEP on the ventilator is discontinued, ETT and the tracheal suctioning are done thoroughly by the help of the flexible fiberoptic bronchoscope, the choice of site of intended skin incision and then tracheal puncture is helped by the appearance of endoscopic indentation of the anterior tracheal wall on gentle pressure by the finger of the operator and by trans-illumination. ETT withdrawal is done under the visual control of the bronchoscope. All other steps are done by the visual control of the bronchoscope thus avoiding any structural injury.

### **Dilemmas about PDT technique**

FOB can be used to clear airway secretions. Using fiberoptic bronchoscopy with a light source, a surgeon can easily locate the tracheostomy site accurately by transillumination of the fiberoptic bronchoscope light inside the trachea. Because the fiberoptic bronchoscope has a camera, the surgeon can easily monitor the percutaneous dilatational tracheostomy procedure. Data from randomized studies on percutaneous dilatational tracheostomy with or without FOB are limited.<sup>10</sup> Bronchoscopy is not obligatory in performing PDT. Recent studies in trauma patients showed that using bronchoscopy does not change complications of tracheostomy.<sup>11</sup> There is no consensus about using bronchoscope during PDT as routine or in special conditions, and in some centers, bronchoscopy is never used during PDT. Whereas some studies recommend using bronchoscope as a guide during PDT, and mention that its usage, reduces complications like pneumothorax, and tracheal posterior wall damage, and is useful to treat intrabronchial hemorrhage.<sup>12</sup> Using bronchoscope increases the safety of PDT procedure, but can cause hypoventilation, hypercarbia, and respiratory acidosis. Also, it increases the cost of percutaneous tracheostomy and will necessitate the presence of another specialist because of the complexity of the procedure.<sup>13</sup>

Some authors suggest that it is a safety measure that can prevent serious complications and should be considered in all PDT procedures in the absence of contraindications. For others, these studies are limited and unclear whether visualization of the interior of the airway is a necessary component of the procedure. It has been suggested that bronchoscopy should be used by surgeons who are less skilled with PDT, as a method to reduce complications or in case of anatomical challenge. FEPIMCTI (The Pan-American and Iberian Federation of Critical Medicine and Intensive Therapy, A.C.) guidelines do not establish recommendations regarding this technique because there is insufficient evidence to suggest that using a bronchoscope while performing PDT reduces the rate of complications. The French Society of Intensive Care guidelines established a weak recommendation based on a study in 60 patients in which endoscopic guidance was associated with fewer minor complications. The Indian Society of Critical Care Medicine expert panel states that fiberoptic bronchoscope may be used, whenever

available to aid PDT although it does not reduce the rate of complications. Currently, evidence regarding the use of FB in PDT is practically non-existent.<sup>14</sup>

Percutaneous dilatational tracheostomy (PDT) is increasingly used as an alternative to surgical tracheostomy. Bronchoscopy provides direct visualization, enabling education of those gaining experience in the insertion of tracheostomy. However, complication rates with bronchoscopy may also depend on the experience of the physicians

## Conclusion

In the earlier studies, it was found that bronchoscopic guidance reduces the risk of complications and is safe and cost-effective, but the recent comparative studies (although retrospective) have suggested that PDT can be safely performed without bronchoscopic guidance without any increase in complications and it is not mandatory to do bronchoscopy guided PDT. Use of flexible bronchoscopy has succeeded in decreasing the number of trials of needle insertion and decreasing the incidence of overall complications, while blind technique was better in shortening procedural time and avoidance of hypercapnia. International guidelines have not been able to establish a recommendation regarding this measure due to a lack of evidence. Therefore, the controversy surrounding the routine use of FB as part of PDT remains open. Large prospective randomized studies are needed comparing PDT with and without FB, performed by experienced personnel in both the PDT technique and the endoscopic guidance.

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## CLINICAL USES OF ESKETAMINE IN CHILDREN

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Ketamine is a racemic mixture that consists of equal amounts of two enantiomers, (S)-ketamine and (R)-ketamine (or esketamine and arketamine). (S)-ketamine has a three to fourfold greater binding affinity for the NMDA receptor than (R)-ketamine and is more potent than (R)-ketamine both as an anaesthetic and as an analgesic. It was argued that because of its increased potency, lower doses of (S)-ketamine could be used in anaesthesia/analgesia with faster recovery times and therefore potentially some diminution in dissociative and psychotomimetic side effects.

(S)-ketamine and (R)-ketamine both undergo extensive metabolism by cytochrome P450 enzymes (CYP3A4 or CYP2B6) to corresponding forms of norketamine, dehydronorketamine (DHNK), hydroxyketamine (HK) and hydroxynorketamines (HNKs) (1).

Esketamine has a wide range of applications in the fields of pediatric anesthesia, conscious sedation, and emergency analgesia. In addition, it is also used for pain that is difficult to relieve with conventional drugs and to prevent postoperative pain. Various routes of administration are also suitable for patients who need short-term analgesia and sedation (2).

The dose of S-ketamine used to induce anesthesia is half that of ketamine, and the recovery time is one-third that of ketamine. There are several hypotheses regarding the mechanism of action of S-ketamine: inhibits NMDA receptors; blocking the spinal cord reticular pathway; blocking the hyperpolarization-activated cyclic nucleotide gated channel-1 (HCN-1); inhibition of cation channels; inhibiting the large-conductance Ca<sup>2+</sup>-activated potassium channels (BK channels); acts on opioid receptors. Because esketamine acts on a variety of receptors and channels, it is difficult to avoid some side effects in clinical use, and these side effects limit its use to a certain extent. Common side effects of the esketamine are increased heart rate and blood pressure, nausea or vomiting, impaired vision, dizziness, and psychomotor agitation.

Esketamine could be used as a single agent for procedural sedation in the emergency departments after intravenous administration, nebulised inhalation or nasal cavity instillation using nasal atomizer (3). It also could be used for intranasal premedication (4).

Combination with propofol is the most common drug regimen of esketamine for sedation or analgesia (dexmedetomidine and remimazolam could be also combined with esketamine). Low-dose esketamine as an adjuvant has been shown to have several benefits for sedation or anesthesia, including stabilizing hemodynamics and respiratory function, decreasing propofol requirements, or reducing postoperative pain sensitivity. In children, metanalysis of Kan et al. (5) demonstrated that esketamine adjunct to propofol sedation probably caused a lower risk of hypotension but a higher risk of visual disturbance and dizziness. Unlike in adults, the combined use of esketamine and propofol in children provided a limited benefit on the incidence of oxygen desaturation. The possible explanation for these findings is the different respiratory physiology of children such as vulnerable airways, low functional residual capacity of the lungs, poor oxygen reserves, and high oxygen consumption and basal metabolic rate, which makes them more susceptible to respiratory depression from anesthetics.

Xu et al. study suggested that a low-dose esketamine vs dexmedetomidine adjunct to propofol sedation for pediatric MRI decreased propofol consumption and shortened recovery, without incurring bradycardia or other significant adverse events (6). The combination of midazolam and S-ketamine can provide deep sedation for bone marrow aspiration (7).

Esketamine is an effective adjuvant anesthesia for children undergoing gastrointestinal endoscopy. However, the general dose of esketamine may increase the risk of dizziness, which can be avoided by administering a low dose ( $\leq 0.3$  mg/kg) (8). On the other hand, in children who accomplished diagnostic paediatric upper gastrointestinal endoscopy under deep

sedation/anaesthesia, the total dosage of propofol needed was reduced significantly in esketamine 0.5 and 1 mg/kg groups (9).

Subanesthetic dose of esketamine as an adjuvant to propofol/remifentanyl and spontaneous respiration could be an effective regimen for children undergoing flexible fiberoptic bronchoscopy (10)

Esketamine combined with ultrasound-guided nerve block anesthesia was superior to ultrasound-guided nerve block combined with general anesthesia in children with lower extremity fractures, with fewer complications (11). Continuous intravenous infusion of esketamine provide safe and effective postoperative analgesia for pediatric patients undergoing surgery for hypospadias (12). Esketamine may be an ideal substitute for ketamine during cochlear function measurement (13). Studies have also confirmed that esketamine reverses the respiratory depression induced by remifentanyl in a dose-dependent manner. It indicates that esketamine may have an antagonistic effect on respiratory depression caused by opioids (14).

The effect of intraoperative subanaesthetic doses of esketamine on postoperative pain and consumption of analgesic drugs needs to be confirmed by a large number of studies.

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# LITTLE HEARTS, BIG WORRIES

## ANESTHESIA FOR MRI FOR CHILDREN AGED 0-7 – OUR WAY

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### INTRODUCTION:

Pediatric patients represent a particularly sensitive group. Due to advancements in medical technology they are increasingly subjected to advanced diagnostic procedures requiring analgosedation or anesthesia. This presentation show our method for sedating children aged 0-7 years for magnetic resonance imaging (MRI) at the Vitalis Polyclinic in Mostar.

### PURPOSE OF THE WORK:

The objective of this study is to describe our approach to sedation and anesthesia for MRI procedures in children aged 0-7 years at Vitalis Polyclinic in Mostar. In Bosnia and Herzegovina, such procedures are predominantly, if not exclusively, performed using inhalation anesthesia. Given the limitations and contraindications associated with inhalation anesthesia for certain pediatric diagnoses, we have introduced an alternative approach involving oral midazolam syrup followed by intravenous propofol administered via bolus and continuous infusion via perfusor.

### MATERIAL AND METHODS:

In this retrospective observational study, we reviewed medical records of 72 children aged 0-7 who underwent sedation for an MRI at Vitalis Polyclinic from April 13, 2023 to September 01, 2024.

Sedation Protocols:

16 children were sedated using a combination of Sevoflurane and N<sub>2</sub>O.

21 children were sedated with Dormicum (midazolam) intravenously, combined with intermittent boluses of propofol administered every 2-3 minutes throughout the imaging procedure, where the doctor or anesthesiography technician needed to be present directly in MRI cabinet.

**35 children** were sedated using a midazolam syrup, made by mixing intravenous midazolam ampoules with Pikovit multivitamin syrup. Midazolam syrup was administered 20-45 minutes prior to anesthesia induction. Since children come to our institution accompanied by their parents 1 hour before the scheduled imaging, our task is also to place the venous line. Midazolam syrup is the most important factor in the process of placement of venous line, because it significantly sedates the child.

Following venous line placement, deep sedation was achieved with intravenous propofol, initially given as a bolus dose, followed by a continuous infusion through a perfusor. A pulse oximeter and facial oxygen mask with an oxygen flow rate of 3-4 l/min were used. Additional boluses of propofol were administered if necessary, with continuous infusion via perfusor maintained for approximately 45 minutes.

In total, 72 anesthetic procedures were conducted, including both male and female patients:

Average Age: 4.11 years

Average Weight: 18.7 kg

Gender Distribution: 50 boys and 22 girls

After the MRI and waking, children spent an additional 1-2 hours under observation by our medical technicians with their parents before being discharged home.

No adverse effects were noted with this anesthetic approach.

In two cases, the MRI could not be performed due to difficulties with venous line placement, resulting in the children being sent home.

**CONCLUSION:**

Our use of midazolam syrup and propofol administered via perfusor represents an innovative approach to pediatric sedation for MRI. This method, which has thus far not resulted in any complications, offers a viable alternative to traditional inhalation anesthesia. Compared to the average length of stay of 1.5 days in public institutions in Bosnia and Herzegovina, our protocol significantly reduces the duration of the procedure, resulting in a stay of only 3-5 hours. This not only enhances convenience for parents and children but also offers a more cost-effective solution for the healthcare system.



## HEART-LUNG INTERACTIONS IN ICU: FROM PATHOPHYSIOLOGY TO PRACTICE LESSONS

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Heart-Lung relationship is one of the sharper dualities in the problem of intensive therapy wards. There are several "conflicts" which include reno-cardiac, renal, reno-pulmonary syndromes, mechanical ventilation-brain problems, and anticoagulants for cardiac reasons causing in different hemorrhages (gastrointestinal, cerebral). The tendencies of recent literature regarding heart-lung duality seems helpful to understand the main problems and side effects on each system in case of therapeutic actions with the other system. It is well-known, the heart-lung circulation connects these two organs/systems with each other and for a correct practice in one organ, the effects on the other organ must be considered to prevent the decompression of the related chronic diseases. During chronic pulmonary diseases (asthma, emphysema, chronic obstructive broncho pneumopathy) we face an increased pulmonary resistance, i.e. so-called pulmonary hypertension. Pulmonary hypertension increases right ventricle afterload and pressure in the pulmonary artery, directly affecting the tendency to decompensate right ventricle. During asthma, forced inspiratory pressure causes a greater negative intrathoracic pressure increasing so the venous return and overfilling the right ventricle. In case of right failure and increased filling pressures, the interventricular septum goes left and decreases the filling volumes of the left ventricles, causing low cardiac output and pulmonary congestion. During spontaneous tachypneic respiration, we experience increased respiratory work, fatigue and hypoxia. Hypoxia dysregulates the poor balance of myocardium oxygen requirements and negatively affects cardiac output, arterial pressure, and systemic organ perfusion. During mechanical ventilation, the heart is found "imprisoned" between the lungs, and this can be accompanied by increased diastolic filling pressures, decrease of filling volumes at the end of the diastole, significant diastolic dysfunction, and further decrease of the stroke volume and cardiac output. The breakdown of normal physiology during mechanical ventilation affects heart function and hemodynamics. Under normal conditions during inspiration because of the diaphragm movements, negative pressure is realized which increases the pressure difference between the average systemic pressure and pressure in the right atrium. This pressure difference is the determining factor for preload and improved venous return, which in turn is one of the components of the cardiac debit. So negative intrathoracic pressure directs venous blood into the heart and increases the end-diastolic filling. It is well-known during mechanical ventilation that right ventricle may be overloaded, dilatated, and so pressing the left ventricle. In the conditions of mechanical ventilation/PEEP/recruitment maneuvers, we are dealing with abnormal positive pressure inspiration and decreased venous return, decreased cardiac output and hypotension/hypotension/hypoperfusion. In the conditions of the preexisting hypovolemia, these phenomena are more visible and important.

Lung hyperinflation induces increased right ventricle afterload and decreased right ventricle stroke volume predisposing for hypotension by shift of intraventricular septum and reduced left ventricle preload. During mechanical ventilation also we faced pulmonary vasculature stretching and pulmonary hypertension, therefore.

During weaning process, spontaneous breathing induced negative intrathoracic cause increased left ventricle afterload, left overfilling, left ischemia, and pulmonary edema especially in previously impaired left ventricle function.

Therapeutic maneuvers include several strategies. First, strict hemodynamic monitoring especially in ventilated patients suffering septic shock and/or ARDS. TEE, TTE, Doppler examination, PICCO, and pulmonary artery catheter may give useful information about hemodynamic changes during mechanical ventilation. Right ventricle filling monitoring is of great importance. Exaggerating ventilation, stretches pulmonary vessels, causing pulmonary hypertension and further reducing right ventricle afterload and ejection. Right ventricle overfilling contributes to right ventricle ischemia and failure and reduced diastolic filling of left ventricle. Right ventricle can be helped by optimizing volume, inotropism, and reduced afterload. Reducing

afterload drugs include inodilators (dobutamine, milrinone) and pure dilators as NO. ECMO helps to avoid side effects of mechanical ventilation.

As a conclusion intensive therapy physicians should have accurate knowledges of the interrelated adverse effects of heart-lung pathophysiological relationship.

Key words: mechanical ventilation, PEEP, hypotension

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## CARDIOPROTECTION BY MODULATING INTRACELLULAR MECHANISMS

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**Introduction:** Modern cardiothoracic surgery and complex cardiac procedures have advanced alongside cardioprotection. Cardioprotection by modulating intracellular mechanisms is based on the autoregulation and adaptation of the heart. It aims to protect myocytes, endothelium, smooth muscles of coronary arteries, conducting system of the heart, and connective tissues, which are highly sensitive to ischemia. Special attention is paid to microcirculation, which recent research identifies as a critical precondition for the survival of the heart as a whole.

**Patients and Methods:** The study included patients undergoing cardiothoracic procedures, covering induction of anesthesia, maintenance of anesthesia, and the subsequent 12 hours of postoperative recovery. Metabolic modulation using glucose, insulin, and potassium solutions showed significant recovery of cardiac index, reduced requirements for inotropic support, and lower incidence of atrial fibrillation. Experimental studies have confirmed that ischemic-reperfusion preconditioning improves mitochondrial function by opening potassium energy-dependent channels, thereby preventing mitochondrial overload with calcium ions. Other important methods include pharmacological-anesthetic myocardial preconditioning and cardioprotection by remote ischemic conditioning.

**Conclusion:** Cardioprotection of the myocardium is crucial for the successful performance of complex cardiothoracic procedures. By understanding the heart as a complex organ-system with numerous intracellular mechanisms and processes, and modulation of these processes can effectively protect all cellular structures and microcirculation from the harmful effects of ischemia during procedures.

**Keywords:** cardioprotection, modulation of intracellular mechanisms, ischemic-reperfusion preconditioning, pharmacological-anesthetic preconditioning, remote ischemic conditioning.

## **FAST EXAMINATION IN OBSTETRIC ANESTHESIA**

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The POCUS ultrasound examination has been a routine part of the daily work of emergency medicine and intensive care physicians for the past 20 years (at least in the context of medicine in the United States). When it comes to the use of POCUS ultrasound in the perioperative period, things have significantly changed in the last five years. There are increasing recommendations for POCUS to become a standard practice for all anesthesiologists. In 2021, the American Society of Anesthesiologists (ASA) began offering an educational course called the “ASA Diagnostic POCUS Certificate Program.” This course sets the standards for how POCUS should be performed. At the same time, the American Board of Anesthesiology included the POCUS examination as part of the practical component of the specialist exam (OSCE exam). Every future specialist (board-certified anesthesiologist) is now expected to know how to perform PLAX, PSAX, and A4C exams. Additionally, future anesthesiology specialists are expected to be proficient in performing POCUS examinations of the lungs, stomach, as well as the FAST examination. All of this highlights the need for POCUS examination to be extensively discussed during professional meetings, symposiums, congresses, and other educational activities.

The FAST examination (Focused Assessment with Sonography for Trauma) is a very important part of the POCUS examination. It consists of RUQ (right upper quadrant), LUQ (left upper quadrant), and pelvic examinations.

The presentation on FAST in obstetric anesthesia focuses on the use of the FAST examination in the daily work of obstetric anesthesiologists. Participants will receive information on several conditions where the FAST examination can make a significant difference.

## FASCIAL PLANE BLOCKS

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**Introduction.** Fascial plane blocks (FPBs) are a large family of ultrasound-guided regional analgesic (RA) techniques that involve the injection of a local anesthetic (LA) into the fascial plane, a space between two muscles or between a muscle and bone, targeting small nerves or nerve endings [1]. A Delphi consensus study on abdominal wall, paraspinal, and chest wall blocks, conducted in collaboration with the American Society of Regional Anesthesia and Pain Medicine (ASRA) and the European Society of Regional Anaesthesia and Pain Therapy (ESRA), recommended the use of the term "fascial" rather than "interfascial" plane blocks to describe these planes composed of connective tissue, though this does not apply to the names of specific blocks [1]. They also standardized the nomenclature for FPBs to clarify their understanding and encourage their use in multimodal analgesia (MMA), particularly following abdominal and thoracic surgeries to promote pain relief and an opioid-sparing strategy. FPBs performed near the spine, often referred to as paraspinal blocks, allow the LA to spread into the paravertebral and possibly epidural spaces, providing both parietal and visceral analgesia [2]. FPBs are volume-dependent blocks, and although there are no precise recommendations regarding the optimal dose, measures to prevent local anesthetic systemic toxicity (LAST) are necessary. FPBs are technically easier to perform than thoracic epidurals (TED) or paravertebral blocks (PVB), and can be mastered relatively quickly, although the learning curve varies due to individual differences in dexterity and the ease of obtaining ultrasound images. The fact that FPBs are not associated with significant skill challenges or serious side effects makes them a valuable component of postoperative MMA.

**Review of the literature.** A newly expanded list of "must-know" FPBs for every anesthesiologist, as part of the residency curriculum, was recommended by Italian regional anesthesia experts a few months ago [3]. This list includes the erector spinae plane block (ESPB), deep serratus anterior plane (SAP) block, superficial (pecto)intercostal plane block, interpectoral plane block, pectoserratus plane block, rectus sheath (RS) block, ilioinguinal-iliohypogastric nerve (II-IH) block, and subcostal and midaxillary transversus abdominis plane (TAP) block (with strong consensus – more than 75% of experts agreed). A low consensus was achieved for the anterior and lateral quadratus lumborum block (QLB) and the PVB.

The **ESPB** involves the injection of a LA deep to the erector spinae muscle and superficial to the transverse process of the vertebra. The ESPB can be performed at all levels of the spine and provides analgesia to most regions of the trunk, making it the ultimate "Plan A block" for a wide range of thoracic and abdominal surgical interventions, from premature infants to elderly patients with multiple comorbidities [2, 4]. ESPB is also effective for pain relief in rib fractures. Delaying ESPB administration for more than 48 hours after a patient's admission for a rib fracture is associated with an increased incidence of respiratory complications and a longer ICU stay [5]. As a superficial block, ESPB is considered low risk for bleeding complications and may be used in patients on anticoagulants and antithrombotics [6].

The **pectointercostal fascial plane block**, now renamed the **superficial parasternal intercostal plane (PIP) block** [1], has been proposed as a simple, superficial, opioid-sparing block. It is performed near the incision site, away from vascular structures, and is highly reproducible with low risk, making it suitable for perioperative pain management following sternotomy [7]. LA is injected about 2 cm from the sternum between the 3rd and 4th ribs, into the fascial plane below the major pectoral muscle (MPM) and above the ribs and intercostal muscles, where the anterior cutaneous branches of the intercostal nerve emerge from the lateral side of the sternum. Additionally, the PIP block can complement the pectoral nerves block (PECS) for MMA after breast surgery.

The **interpectoral plane block** involves the injection of LA into the plane between the MPM and the minor pectoral muscle (mPM). In this way, the injected LA spreads between the clavipectoral fascia and the deep layer of the pectoral fascia toward the axilla, covering pain caused by axillary dissection [8]. The **pectoserratus plane block** refers to LA injection into the plane between the

mPM and the serratus anterior muscle (SAM). The **deep SAP block** involves LA injection in the plane between the posterior surface of the SAM and the periosteum of the rib, allowing wide dispersion of the LA. This block affects the intercostobrachial nerves and the lateral branches of the third through sixth intercostal nerves, providing relatively long-lasting analgesia suitable for surgical procedures on the chest wall [8, 9].

The **RS block** involves LA injection into the plane between the rectus abdominis muscle and the posterior rectus sheath, commonly used for MMA after open umbilical hernia repair [10]. The **II-IH block** involves LA injection near the ilioinguinal and iliohypogastric nerves, located in the plane between the internal oblique muscle (IOM) and the transversus abdominis muscle (TAM) in the lower quadrants of the anterior abdominal wall, commonly used for MMA after open inguinal hernia repair [10].

The **midaxillary TAP block** involves LA injection into the plane between the IOM and TAM at the midaxillary line. According to Tran's review [11], the TAP block is reserved for Cesarean section, open appendectomy, and colectomy when intrathecal morphine or TED cannot be used. The **subcostal TAP block** targets the same plane along the medial costal margin in the upper quadrants of the anterior abdominal wall and may be considered for laparoscopic cholecystectomy [11].

The **anterior QLB** involves the injection of LA into the plane between the quadratus lumborum muscle (QLM) and the psoas major muscle. The **lateral QLB** involves LA injection into the plane between the fused aponeuroses of the IOM and TAM and the lateral border of the QLM. The QLB has great potential to be part of MMA in abdominal surgeries [12]. Some authors consider the QLB a challenging technique to perform. Senior anesthesiologists often prefer the TAP block, as it is a technique with years of established experience. The author of this review states that QLB, with its needle trajectory far from the peritoneal cavity and viscera and no serious associated complications, is a safer option for beginners in regional anesthesia than the TAP block. The TAP block's needle trajectory is in close proximity to the peritoneal cavity and viscera, which increases the risk of complications [6, 10-12].

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# SAVREMENI KONCEPT LIJEČENJA BOLA U PERIOPERATIVNOM PERIODU

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Neophodnost odgovarajuće terapije bola prepoznata je kao značajan faktor poboljšanja ishoda liječenja i kvaliteta života kod svih populacija i uzrasta pacijenata u svakodnevnoj praksi zdravstvene zaštite. Poseban značaj ima obezbjeđenje odgovarajuće terapije bola u perioperativnom periodu s obzirom na izbjegavanje uobičajenih komplikacija neodgovarajuće liječenog bola i povoljnosti dobre analgezije za uspješan oporavak u ranom i kasnijem postoperativnom periodu.

Postoperativni akutni bol je kompleksan simptom udruženih nociceptivnih signala nakon traume , inflamatorne reakcije kao i signala neuroendokrinog sistema aktiviranog traumom. Smanjivanje postoperativnog bola je značajno za perioperativni morbiditet, tok hospitalizacije i konačni ishod liječenja. Od velike je važnosti i značaja obezbijediti odgovarajuću terapiju za smanjenje akutnog bola na vrijeme, čime se omogućava izbjegavanje razvoja dodatnog oboljenja kod pacijenata.

U svakodnevnoj kliničkoj praksi je evidentno da tradicionalni pristup primjene opioidnih i neopiodnih analgetika u postoperativnom periodu kod velikog broja pacijenata obezbjeđuje odgovarajuću analgeziju ali neželjeni efekti opioda i nesteroidnih antiinflamatornih lijekova mogu dovesti do povećanja morbiditeta i produženja hospitalizacije. Eksperimentalne studije i studije sa pacijentima sa fantomskim bolom su pokazale da preoperativna primjena analgetika može dati povoljnije rezultate, međutim za sada nije pokazana efikasnost preemptivne analgezije u svakodnevnoj kliničkoj praksi.

Multimodalne analgetske tehnike poboljšavaju postoperativnu analgeziju smanjenjem skorova bola, smanjivanjem potrebe za opioidima i njihovim neželjenim efektima i ubrzavanjem rane mobilizacije i rehabilitacije nakon zahvata. Trenutni dokazi upućuju da se poboljšanja ishoda mogu najbolje postići kombinacijom preventivnih analgetskih tehnika koje uključuju i centralno i periferno djelujuće analgetike i nove pristupe u primjeni ovih kombinacija lijekova. Budućnost za multimodalnu analgeziju izgleda povoljna uzimajući u obzir veliki broj lijekova koji su u ispitivanju uključujući formule postojećih lijekova.

U kontekstu multidisciplinarnog pristupa i biopsihosocijalnog modela tretmana akutnog i hroničnog bola različiti modaliteti terapije daju sinergistički efekat smanjenja iskustva bola : farmakološki agensi, restorativne terapije, interventne procedure, bihevioralna terapija i pristup komplementarnog i integrativnog zdravlja.

Cilj ovog rada je razmatranje savremenog koncepta terapije bola u perioperativnom periodu.

**Ključne riječi:** perioperativni period, multimodalna analgezija, opioidi, neopiodi, multidisciplinarni pristup

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## CURRENT CONCEPT OF PAIN CONTROL DURING PERIOPERATIVE PERIOD

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Importance and necessity of efficient pain control has been recognized as a significant factor of improvement of the outcome of treatment and quality of life of patients of all populations and age in everyday practice of health care. Appropriate pain control during perioperative period has particular importance considering the possible complications of inadequate pain control and benefits of efficient analgesia for good recovery in early and later postoperative period.

Postoperative acute pain is a complex symptom of associated nociceptive signals after trauma, inflammatory response and neuroendocrine signals activated by trauma. Relief of postoperative pain is very important for perioperative morbidity, overall course of treatment and outcome. Adequate pain relief on time is of paramount importance for avoiding development of chronic pain and further suffering.

Traditional approach of pain relief that consists of administration of opioid and nonopioid analgesics during postoperative period may provide appropriate analgesia in many patients, but adverse effects of opioids and nonsteroidal anti-inflammatory drugs may limit their effects, contribute to morbidity and prolong hospitalization. Experimental studies and studies about patients with phantom pain have shown that preoperative administration of analgesics may provide better results in terms of pain relief during postoperative period, but for now there is no clear evidence of efficacy of preemptive analgesia in everyday clinical practice.

Multimodal analgesic techniques may improve postoperative analgesia by reducing of pain scores, reducing of the need for opioids and their adverse effects, and by acceleration of early mobilization and rehabilitation after surgery. Current evidence suggest that significant improvement of outcome could be achieved by combination of preventive analgesic techniques that include analgesics acting on central and peripheral components and new approaches in the administration of the combinations of these drugs. The future for multimodal analgesia looks favorable considering the great number of medications under research along with existing formulations.

In the context of the multidisciplinary approach and biopsychosocial model of treatment of acute and chronic pain different modalities of therapies may give synergistic effects of pain relief: pharmacological therapy, restorative therapy, interventional procedures, behavioral therapy and complementary and integrative health approach.

The aim of this paper is reconsidering of the current clinical knowledge and recommendations on the topic of new concept of pain control during perioperative period.

**Key words:** perioperative period , multimodal analgesia, opioids, nonopioid analgesics, multidisciplinary approach

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## **REFRIGERATED RADIOFREQUENCY ABLATION IN THE TREATMENT OF KNEE, HIP AND SHOULDER PAIN**

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Knee osteoarthritis (OA) is a chronic degenerative disease and including hip arthritis is the most common arthritis in adults. It is commonly known as wear-and-tear arthritis and the age is a major risk factor for developing osteoarthritis of the knee. The prevalence of the knee osteoarthritis is increasing in modern countries due to the rise in life expectancy, high body mass index (BMI) and other factors that increase the risk for OA. There is an increased risk of mortality for individuals who have knee pain alone or with OA. Effective interventions to reduce knee pain, particularly those including weight management and prevention of comorbidities, could reduce mortality. Treatment for knee OA usually has a multimodal approach, including nonpharmacological therapies (reduce BMI, education, exercises, physical activity) and pharmacological therapies (topical and systemic NSAIDs, paracetamol, tramadol, duloxetine), intraarticular injections, genicular radiofrequency denervation and total knee endoprosthesis.

Intraarticular injection of local anaesthetic and corticosteroid into knee for OA treatment is one of the most common procedures for reducing the symptoms. Trials of intraarticular glucocorticoid injections have demonstrated short-term efficacy (up to 6 weeks) for pain relief. The efficacy of genicular nerve blocks and genicular radiofrequency ablation for knee pain was proven in numerous studies. Genicular nerve blocks are typically used in patients with knee osteoarthritis unresponsive to other therapies. Genicular nerve block is a procedure where the genicular nerves are blocked with lidocaine or other local anaesthetics under fluoroscopy or ultrasound. If patients get relief from this trial, then many proceed to radiofrequency ablation of the genicular nerves performed under fluoroscopy. Patients typically experience anywhere from three to 12 months of pain relief.

## **EPIDURAL STEROID INJECTIONS**

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Pain is defined as „unpleasant sensory and emotional experience associated with actual or potential tissue damage“ by the International Association for the Study of Pain (IASP). Conservative therapy consists of an appropriate combination of medications in addition to physical therapy, spinal manipulation therapy, cognitive behavioral therapy or other interventions based on the individual's specific presentation, physical findings and imaging results. However, some people have a poor response to drugs or other conservative methods. Therefore, minimally invasive procedures have gradually become an important auxiliary method in pain treatment, which can reduce dependence on opioids as well as adverse drug reactions and improve patients' quality of life. Epidural steroid injections (ESI) have been used for pain relief since 1950s. When indicated, they are an invaluable minimally invasive, nonsurgical treatment for managing low back pain radiating to the lower extremities and, less commonly, for neck pain radiating to the arms (radiculopathy), caused by disc herniation or degenerative changes in the vertebrae. Typically, the pain is due to nerve root irritation from mechanical compression by an intervertebral herniated disc, leading to inflammation. Additional etiologies include spondylosis, spondylolistesis and ligamentum flavum hypertrophy, resulting in neuroforaminal stenosis. Performing an effective epidural steroid injection requires the steroids to reach the epidural space. Successful epidural steroid injections provide inflammation reduction, pain relief, restoring function and return to a physical therapy regimen when indicated. The three primary routes for epidural steroid delivery include transforaminal, interlaminar and caudal approach. The standard of care involves using fluoroscopy guidance to ensure proper needle placement with the aid of contrast flow. Epidural steroid injections are crucial for chronic pain management, requiring a multidisciplinary team for patient-centered care. Nurses handle pre- and post-procedural care, physical therapists support rehabilitation, and primary care clinicians educate on lifestyle changes, ensuring informed consent, ethical practices and effective interprofessional communication.

Keywords: chronic pain management, radiculopathy, minimally invasive procedures, epidural steroid injection

## PERCUTANEOUS LASER DISC DECOMPRESSION

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According to the revised definition of the International Association for the Study of Pain (IASP), pain is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or similar to that associated with actual or potential tissue damage" (1). Sciatica is the leading cause of disability in the world, and the prevalence of sciatica, which limits physical activities, is around 20%, which is contributed by a sedentary lifestyle and being overweight with a lack of physical activity (2–4). It is estimated that around 85% of the world's population experiences pain in the lumbar spine at least once during their lifetime (5,6). Lumbar radicular pain is defined as pain in the lumbar spine with spread to the lower extremities (7). It can be unilateral or bilateral and most often spreads along one or two dermatomes. It represents a major public health and socioeconomic problem and is one of the most common reasons for absenteeism from work and professional disability, and it leaves consequences on the patient's mental health and affects the quality of life (8,9). About 80% of patients experience a spontaneous reduction of pain in a few weeks or months, but still 10-20% of patients develop chronic pain (4). Lumbar radicular pain is usually self-limiting, but in some patients it can turn into a chronic form of pain (10). If left untreated, acute pain turns into chronic pain and is then much more difficult to treat. It is estimated that 15-40% of patients with the first episode of pain will develop a chronic form of pain (11).

The most common cause of lumbar radicular pain is a herniated intervertebral disc with or without pressure on the nerve root, which leads to an inflammatory process and pain (12,13). Pain can be caused by direct pressure of a herniated intervertebral disc on the nerve root, but pain can also be present if there is no contact. In this case, the dominant cause of pain is the local inflammatory process (12,14).

The first line of treatment for lumbar radicular pain is conservative treatment, and the gold standard in the treatment of lumboschialgia caused by disc herniation, when conservative treatment is ineffective, is microdiscectomy (15–18). In order to avoid systemic and unwanted effects of analgesics, undergoing anesthesia and operations, minimally invasive procedures are increasingly used in the treatment of lumbar radicular pain. One of these methods is percutaneous laser disc decompression (19,20).

Percutaneous Laser Disc Decompression (PLDD) is a minimally invasive method of treating lumbar radicular pain developed by Dr. Choy and Dr. Ascher (21). The procedure is performed under local anesthesia under analgosedation under the control of a fluoroscope. A laser probe is placed through the needle, which transmits laser energy into the tissue of the nucleus pulposus, which leads to the evaporation of a small volume of water inside the disc (20,22). A small decrease in the volume of water inside the disc leads to a large decrease in intradiscal pressure, which leads to a decrease in the size of the herniated disc. Laser energy also causes structural changes in the nucleus pulposus, thus preventing further accumulation of water in the disc (22,23). In addition, the immunomodulating effect of laser energy is also known. PLDD is a long-term effective method with a low complication rate (24,25).

Indications for PLDD are symptomatic disc protrusion, radicular pain, discogenic pain, failed non-invasive treatment methods, absence of segmental instability, preservation of at least 75% of disc height.

Contraindications for PLDD are intervertebral disc extrusion, acute pain not treated conservatively, severe spondylolisthesis, severe scoliosis, vertebral compression fracture, nerve root compression by bone structure, disc sequestration and hemorrhagic diathesis.

Complications are rare but possible: septic and aseptic discitis, spondylodiscitis, pain caused by a free fragment, spinal nerve root injury, intestinal perforation, cauda equina syndrome, thermal tissue injury, thermal necrosis of the end plate, spasm of the paraspinal muscles.

Recommendations after the procedure are rest, lying down, avoiding prolonged standing and sitting, wearing a lumbar orthosis for two weeks after the procedure and antibiotic prophylaxis. The most serious complication is aseptic or infectious discitis, and the most common cause of infectious discitis is *Staphylococcus aureus*.

Percutaneous laser disc decompression is a minimally invasive method in the treatment of lumbar radicular pain. A good patient selection results in a high success rate with a low complication rate.

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# RADIOFREKVENTNA DENERVACIJA FASETNIH ZGLOBOVA

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## Indikacije

Dijagnostička a nakon toga radiofrekventna denervacija medijalne grane (rami medialis), dijela stražnje grane moždinskih živaca (rami posteriores nervorum spinalium), indicirana je pri bolima kojima su uzrok fasetni zglobovi. Radiofrekventna lezija medijalne grane indicirana je u bolesnika koji su imali privremeno poboljšanje nakon dijagnostičke blokade ili pozitivnog odgovora na intraartikularnu fasetnu injekciju. Kliničko iskustvo i ograničeni broj publiciranih radova sugerira da intraartikularna injekcija lokalnog anestetika i steroida dovodi do kratkotrajnoga smanjenja fasetne boli, dok je radiofrekventni postupak siguran i mnogo djelotvorniji s dužom remisijom djelotvorne analgezije. Prije radiofrekventne lezije potrebno je učiniti dijagnostički blok da bi se potvrdila uspješnost radiofrekventnog tretmana.

## Postupak blokade medijalne grane lumbalne kralježnice

Postupak se izvodi pod nadzorom fluoroskopa. Koža i potkožno tkivo anestetiziraju se s 1 ml 1%-tnog lidokaina, a zatim se plasira spinalna igla od 22 gauge kroz kožu prema fasetnom zglobu. Pri stražnjem pristupu, igla se plasira između baze transverzalnog nastavka i superiornoga zglobnog nastavka. Položaj se igle potvrdi fluoroskopom u AP i lateralnoj snimci (slika 30). Nakon toga se injicira 0,5 mL 2%-tnog lidokaina ili 0,5%-tnog bupivacaina. Bolesnika se nakon toga zamoli da prati i procjenjuje svoju bol u satima nakon bloka.

## Postupak radiofrekventne denervacije fasetnih zglobova lumbalne kralježnice

Radiofrekventna se igla plasira na istovjetan način kao i kod bloka medijalne grane. Fluoroskop je nakrivljen za 25-30 stupnjeva kaudalno tako da aktivni vrh radiofrekventne igle bude paralelan s medijalnom granom. Prije svake lezije učini se fiziološko testiranje (bolesnik osjeća bol ili svrbež tijekom stimulacije s 50 Hz i manje 0,5 V, i nema motornu stimulaciju u području donjih udova nakon stimulacije s 2 Hz i 3 V). Svaka razina prije same radiofrekventne lezije anestetizira se s 0,5 mL 2%-tnog lidokaina te se učini radiofrekventna lezija s 80 °C tijekom 60 do 90 sekundi. Igla pulsirajuće radiofrekventne lezije plasira se na isti način. Konvencionalna radiofrekventna lezija dovodi do koagulacije malog područja oko aktivnoga vrha radiofrekventne (RF) igle, što uzrokuje denervaciju neuralnih struktura koje se nalaze u neposrednoj blizini. Najčešće rabljene RF igle jesu 22 gauge, a mogu imati različito dugačak pomični vrh (4-10 mm), te biti različite dužine (5-15 cm). Radiofrekventna lezija je invazivna proceura za liječenje osobito refraktarne i perzistirajuće boli. Prolaskom radiofrekventne izmjenične struje kroz tkivo (frekvencija 500 000 Hz) postižu se dva temeljna učinka. Stvaranje topline s posljedičnom termičkom lezijom i neurodestrukcijom, te neuromodulacija prijenosa bolnog impulsa. Temperatura viša od 45 stupnjeva uzrokuje oštećenja živaca. Kod konvencionalne radiofrekventne lezije postiže se temperatura od 80 do 90 °C u trajanju do 60 sekundi (slika 31). Pri pulsirajućoj radiofrekvenciji na vrhu RF igle temperatura ne dovodi do neurodestrukcije. Provodi se 120 sekundi jakošću struje od 45 V i s maksimalnom temperaturom do 43 °C. Pulsirajuća radiofrekvencija, za razliku od konvencionalne radiofrekvencije, ne oštećuje živac, ne uzrokuje deaferentacijsku bol i neuritis. Iz kliničke studije Lorda i suradnika vidljivo je da u 70% bolesnika kod cervikalne blokade medijalne grane radiofrekventnom lezijom imaju kompletno smanjenje boli, a studija Dreyfussa i suradnika dokazala je da je 60% bolesnika imalo najmanje 90%-tno smanjenje boli tijekom 12 mjeseci, a 87% bolesnika održalo je 60%-tno poboljšanje, tj. smanjenje boli u donjem dijelu leđa.

## Komplikacije blokade medijalne grane i radiofrekventne denervacije

Komplikacije bloka medijalne grane su rijetke i iste su kao i kod intraartikularne fasetne blokade. Za razliku od intraartikularne fasetne blokade, blokada medijalne grane ne uzrokuje pogoršanje boli. Bolesnici mogu osjećati blagu bol na mjestu uboda dan do dva nakon postupka. Iako konvencionalna radiofrekventna lezija dovodi do destrukcije neuralnoga tkiva, ozljede spinalnih živaca rijetke su zbog fiziološkog testiranja prije svake lezije. Pogoršanje boli je učestalo nakon

konvencionalne radiofrekventne lezije, te zbog toga bolesnike treba upozoriti na to da očekuju pogoršanje boli tijekom nekoliko dana do tjedana. Manji broj bolesnika imaće neugodnu disesteziju tipa pekuće boli u području kože spinoznih nastavaka na razini na kojoj je zahvat izvođen, a često se pojavljuje i alodinija. Također, neki bolesnici imaju na određenom području gubitak kompletnog osjeta, a također se može pojaviti ozljeda živčanih korjenova s posljedičnom radikularnom boli. Bolna disestezija i druge nervne ozljede ne pojavljuju se pri pulsirajućem radiofrekventnom liječenju (ili su izrazito blagog i kratkog trajanja).

**Ključne riječi:** fasetna bol, radiofrekventna denervacija, lumbalna bol

## KONGENITALNE KRANIOFACIJALNE ANOMALIJE KAO IZAZOV U ANESTEZIJI

*Selma Sijerčić*

Kongenitalne abnormalnosti koje zahvaćaju lice i lobanju često predstavljaju izazovne dijagnostičke i rekonstruktivne probleme koji zahtijevaju koordiniran tretman od strane tima stručnjaka. Primarni članovi kraniofacijalnog hirurškog tima čine predstavnici plastične hirurgije, oftalmologije, oralne hirurgije, ortodoncije, otorinolaringologije, neurohirurgije, psihijatrije i anesteziologije. Djeca s kraniofacijalnim anomalijama, posebno ona s rascjepom na licu i pridruženim sindromima Treacher Collins, Pierre Robin i Klippel-Fiel i kraniosinostozom i povezanim sindromima, predstavljaju neke od najopasnijih i najtežih izazova s kojima se anesteziolozi mogu susresti u praksi pedijatrijske anestezije. Upravljanje dišnim putevima kod pacijenata sa kraniofacijalnim poremećajima predstavlja mnoge izazove. Anesteziolog mora biti upoznat s normalnom anatomijom kostiju i mekih tkiva u disajnim putevima i kako se anatomija mijenja zbog raznih urođenih poremećaja. Epidemiološke studije su potvrdile da su respiratorne komplikacije zajedno vodeći uzrok morbiditeta i mortaliteta kod pedijatrijske anestezije. Perioperativne plućne komplikacije povezane sa sedacijom i/ili općom anestezijom uključuju opstrukciju, atelektazu, aspiraciju, pneumoniju, bronhitis, laringospazam, bronhospazam, hipoksemiju i respiratornu insuficijenciju. Pacijenti s kraniofacijalnom anomalijom su pod većim rizikom od razvoja infektivnih komplikacija, imaju veće bolničke troškove i duže ostaju u bolnici nakon ortognatske operacije u odnosu na one bez kraniofacijalne anomalije.

**Ključne riječi:** kraniofacijalne anomalije, pedijatrijska anestezija, respiratorne komplikacije.



## CONGENITAL CRANIOFACIAL ANOMALIES AS A CHALLENGE IN ANESTHESIA

*Selma Sijerčić*

Congenital abnormalities involving the face and cranium often present challenging diagnostic and reconstructive problems which require coordinated management by a team of specialists. The primary members of a craniofacial surgical team consist of representatives from plastic surgery, ophthalmology, oral surgery, orthodontics, otolaryngology, neurosurgery, psychiatry, and anaesthesiology. Children with craniofacial anomalies, in particular those with facial clefts and the associated syndromes of Treacher Collins, Pierre Robin, and Klippel-Fiel and craniosynostosis and its related syndromes, present some of the most hazardous and difficult challenges that anesthetists may encounter within the entire practice of pediatric anesthesia. Airway management for patients with craniofacial disorders poses many challenges. The anaesthesiologist must be familiar with the normal bony and soft-tissue anatomy in the airway and how anatomy is altered by various congenital disorders. Epidemiological studies have confirmed that respiratory complications are collectively the leading cause of pediatric anesthetic - related morbidity and mortality. Perioperative pulmonary complications associated with sedation and/or general anesthesia include obstruction, atelectosis, aspiration, pneumonia, bronchitis, laryngospasm, bronchospasm, hypoxemia and respiratory failure. Patients with a craniofacial anomaly are at higher risk of development of infectious complications, have higher hospital charges, and stay in the hospital for a longer duration after orthognathic surgery when compared with those without a craniofacial anomaly.

**Key words:** craniofacial anomalies, pediatric anesthesia, respiratory complications.

## RAPID SEQUENCE INTUBATION: UP-TO-DATE

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### Introduction

Rapid sequence intubation (RSI) is a method developed to maximally shorten the time interval between the loss of the airway protective reflexes and the tracheal intubation. RSI consists of virtually simultaneous administration of a rapidly acting induction agent and neuromuscular blocking agent (NMBA) to induce unconsciousness and paralysis to create optimal intubating conditions and enable rapid control of the airway. RSI presupposes the patient is at risk for aspiration of gastric contents and incorporates medications and techniques to minimize this risk. This paper aims to summarize up-to-date knowledge related to RSI.

### Indications for RSI

Importance of RSI lies in providing a safe tracheal intubation in patients at high risk of bronchoaspiration. Incidence of aspiration of gastric content for elective cases is reported between 0.014% and 0.1% for adult patients and between 0.08% and 0.1% for pediatric patients. Mort's review of 2,833 emergency airways found a 1.9% incidence when laryngoscopy was performed 1 to 2 times vs. 22% with 3 or more attempts. Mortality from aspiration in anesthetic practice is considered rare, but reported figures vary considerably and have been reported as high as 4.6%. In Mort's review, when aspiration of gastric contents occurred in emergency airways, hypoxemia followed in 91% of cases, with severe desaturation (70% SpO<sub>2</sub>) in 30%. Aspiration contributing to severe hypoxemia is likely to be a significant factor in cardiac arrest occurring in emergency airways.

Patients that are considered at high risk for aspiration and therefore have indications for RSI include patients with full stomach requiring emergency surgery, trauma patients regardless of the interval since last oral intake and patients with unknown fasting status or the ones who have not fasted according to the preoperative fasting guidelines. Other indications include patients with increased abdominal pressure - pregnant patients (more than 20 weeks of gestation), patients with ascites or abdominal mass and morbidly obese. RSI is also indicated for patients with gastrointestinal pathology which includes conditions such as gastroparesis or delayed gastric emptying, small bowel obstruction, previous esophageal surgery, history of esophageal cancer, history of bariatric surgery or very common gastroesophageal reflux disease (GERD). Patients should be questioned about symptoms during preoperative evaluation and the ones with active reflux, the ones who had significant symptoms of active reflux prior to starting antacid therapy and the ones with hiatal hernia and endoscopic evidence of GERD should be considered for RSI. It is also common to prescribe PPIs before surgery to reduce gastric volume and increase pH, they are more effective if given in two doses – one the night before surgery and another on the morning of surgery. Delayed gastric emptying, usually associated with diabetes mellitus, is also a potential side effect of GLP-1 receptor agonists (e.g., semaglutide, liraglutide), which are used to treat diabetes and are increasingly used for weight loss. Patients who take these medications may have residual gastric contents despite preoperative fasting. In 2023, the American Society of Anesthesiologists issued guidance on preoperative management of patients taking GLP-1 agonists recommending holding it for a week before elective surgery if they are taken on a weekly schedule. If the dose was not held as advised, it is recommended to proceed with 'full stomach' precautions. Gastric ultrasound evaluation before surgery is an option and is becoming a standard in clinical practice.

### Performance of RSI

The updated 'seven Ps of RSI' is a mnemonic that outlines the key steps of RSI planning and performance – preparation, preoxygenation, physiologic optimization, paralysis with induction, positioning, placement with proof and postintubation management.

The goal of **preparation** is to maximize the chances for successful intubation on the first attempt since studies suggest that the risk of an adverse event increases with the number of attempts. Basic preparation steps include assessing the patient for anatomic features and clinical findings that indicate the patient may be difficult to intubate, making an airway management plan, including a backup approach and gathering all necessary personnel, equipment and medications. Prior to proceeding with RSI, at least one, but preferably two, functioning intravenous lines should be in place as should cardiac and blood pressure monitors, pulse oximetry and capnography. If anatomically difficult airway is predicted or rapid desaturation is anticipated, RSI may not be the safest approach and instead awake tracheal intubation should be taken into consideration.

**Preoxygenation** is a critical component of RSI that extends the safe apnea time. Ideally, it is performed with the patient in at least 30 degrees head-up position using a nonrebreather mask with flush-flow rate of oxygen for at least three minutes, or eight full vital capacity breaths if circumstances do not allow 3 minutes of preoxygenation. If the patient is uncooperative a delayed sequence intubation (DSI) may be useful. DSI is a form of procedural sedation where the procedure is preoxygenation. It involves the administration of a dose of ketamine (1 mg/kg IV) intended to cause sufficient dissociation while preserving airway reflexes and respiratory drive. Preoxygenation replaces nitrogen in the gas-exchange portions of the lungs (functional residual capacity) with oxygen, thereby creating a large oxygen reservoir. Expected time to desaturation below 90% in healthy, apneic, properly preoxygenated adult patients is 6 – 8 minutes; 3 minutes in adults with severe illness or obesity, and pregnant patients nearing the end of their third trimester, even if ideal preoxygenation is achieved. Time to desaturation in emergency patients is often more rapid than anticipated. Passive oxygenation during apneic period is recommended for all patients managed with RSI. Reasoning behind this is that during apnea, oxygen consumption continues at the rate of approximately 250 ml/min while only 8-20 ml/min of CO<sub>2</sub> moves into the alveoli, with the rest buffered in the blood. This results in reducing the pressure in the alveoli to sub-atmospheric levels which then, if the airway is patent, generates a mass flow of gas via diffusion from an area of higher pressure to the area of lower pressure, that is from pharynx to alveoli. Passive oxygenation is usually achieved via standard nasal cannula or high flow nasal cannula. The procedure bears no risks and can prolong time to desaturation.

Unless the need for intubation is immediate, patients undergoing emergency intubation should be **physiologically optimized** prior to the procedure. This includes hemodynamic optimization with intravenous (IV) fluids, blood products, vasopressors, and inotropes as necessary, relief of hemothorax and hemostasis for trauma patients, and maximal preoxygenation for all. The strongest predictors of peri-intubation circulatory arrest are hypotension, elevated shock index (heart rate divided by systolic blood pressure) >0.8 and oxygen saturation < 93%. Therefore, these must be recognized and corrected, if possible, before RSI medications are given.

To achieve **paralysis with induction** during RSI performance, neither induction agent nor NMBA dose is titrated but is precalculated and administered by rapid IV push, virtually simultaneously. Perfect induction agent for RSI is fast acting without causing hemodynamic side effects. No available drug meets these criteria. Drugs currently available are propofol, etomidate, midazolam and ketamine. Certain drugs may offer advantages over others in specific clinical scenarios. For example, for patients with potentially elevated intracranial pressure, patients in status epilepticus or patients with concomitant cardiovascular disease, etomidate is recommended, with strong suggestion for opioid pretreatment in patients with coronary artery disease to mitigate catecholamine surge caused by laryngoscopy; for patients with severe bronchospasm requiring intubation, propofol or ketamine are drugs of choice due to their bronchodilatory properties; in shock, etomidate or ketamine are most commonly used. Only two NMBAs have onset times short enough for RSI – succinylcholine and rocuronium. The onset of effect for rocuronium is dose dependent and, at higher doses (1.5 mg/kg), onset and intubation conditions are comparable to those provided by succinylcholine.

Proper **positioning** for direct laryngoscopy is applied when RSI is performed. Additionally, by elevating the head of the bed to 30 degrees we elevate the patient's laryngeal inlet above the stomach level, thereby minimizing the risk of passive regurgitation and aspiration. Once the respiratory activity ceases, bag-mask ventilation is not required, but can be performed when the risk of hypoxia is greater than the risk of aspiration. Cricoid pressure (Sellick maneuver) was once

widely used during RSI. Nowadays, many clinicians argue that there is insufficient evidence to either continue or abandon its use. Several studies suggest that it is often used inconsistently and applied improperly during airway management. In addition to that, other studies suggest it may even contribute to difficult intubation. Since there is limited scientific proof that it reduces the incidence of aspiration, it is no longer routinely recommended for RSI protocol, and whether or not to use it, depends on local policies or practitioner's personal choice. Once intubation is performed, confirmation of proper endotracheal tube (ETT) **placement** is crucial. End-tidal carbon dioxide (EtCO<sub>2</sub>) determination (preferably with waveform capnography) must be performed to determine proper placement, or, in other words, to exclude esophageal intubation.

Immediate **postintubation management** consists of cuff insufflation, securing of ETT and initiating mechanical ventilation. Minor reductions in SpO<sub>2</sub> and blood pressure may be observed and if these do not rebound quickly with appropriate treatment, or if previously stable vitals suddenly deteriorate after tube placement, the clinician should search for signs of peri-intubation adverse event such as tension pneumothorax, ETT cuff rupture, mucus plugging or interruption of oxygen circuit. Additionally, in this phase, clinicians must provide adequate longer-term sedation, analgesia, and sometimes paralysis since the drugs used for RSI are generally short acting.

## Conclusion

RSI is the method of choice for airway management of patients who are at high risk for aspiration of gastric content when the difficult intubation is not expected. It is important to create a plan, gather equipment and the team and prepare the patient before administering any drugs. Passive oxygenation is now recommended during all rapid sequence intubations while once widely recommended Sellick maneuver is no longer mandatory part of a routine protocol.

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***POSTER PREZENTACIJE***

## ANALGEZIJA I SEDACIJA U JEDINICI INTENZIVNE TERAPIJE (JIT)

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**Uvod:** Analgezija i sedacija u jedinici intenzivne terapije (JIT) su važni terapijski modaliteti i sastavni su dio cjelokupnog intenzivnog tretmana. Bol može uticati na imunološku funkciju i koagulaciju, te na simpatikus što rezultira povećanom frekvencom srca i većom potrebom miokarda za kiseonikom.

Kod pacijenata koji su pri svijesti i/ili se odvikavaju od respiratora za prevenciju delirija važne su i nefarmakološke mjere, koji se, prema nekim studijama, razvija kod čak 80% hospitaliziranih pacijenata.

**Cilj:** Iako cijena lijeka može biti važna determinanta ekonomičnog administriranja analgezije i sedacije kod kritično bolesnih pacijenata, razmatranje farmakokinetike i farmakodinamike može biti od veće važnosti u odabiru najpogodnijeg medikamenta.

**Materijal i metoda:** Opioidi su kamen temeljac analgezije kod kritično bolesnih. Druge tehnike kao što su regionalna i inhalaciona anestezija su opcije, ali opioidi su efikasni i nude širok terapijski indeks kod većine pacijenata. Sedaciju treba započeti tek nakon što se isključe fiziološke promjene koje se mogu pokazati kao anksioznost ili uznemirenost. Opioidi imaju neka sedativna svojstva, ali njihova sposobnost da pruže duboku sedaciju i amneziju je minimalna.

**Rezultati i diskusija:** Trajanje sedacije je važno, jer različiti agensi mogu imati različite nuspojave u zavisnosti od trajanja primjene. Svaki kritično bolesni pacijent je jedinstven u smislu svoje osnovne funkcije organa, procesa bolesti, starosti i distribucije.

**Zaključak:** Poznavanje profila lijeka, kliničkog scenarija i kontinuirano kliničko praćenje su od suštinskog značaja za odgovarajuće ordiniranje sedacije i analgezije kod kritično bolesnog pacijenta.

**Ključne riječi:** analgezija, sedacija, JIT

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## ANALGESIA AND SEDATION IN THE INTENSIVE CARE UNIT (ICU)

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**Introduction:** Analgesia and sedation in ICU are important therapeutic modalities that are often handled as afterthoughts rather than integral parts of overall care of patient. Physiologically, modulating pain with use of analgesics such as opioids is important, as recent work suggests that pain may influence immune function and coagulation, and may increase sympathetic outflow resulting in increased heart rate and myocardial oxygen demand.

In patients who are conscious and/or being weaned from the ventilator non-pharmacological measures are important to prevent delirium, which, according to some studies, develops in as much as 80% of hospitalized patients.

**Aim:** There is no evidence that one opioid is better than another for management of pain. While drug cost may be an important determinant of cost-effective management of analgesia and sedation in critically ill, consideration of pharmacokinetics and pharmacodynamics may be of greater importance in selecting the most cost-effective regimen.

**Material and method:** Opioids are the cornerstone of analgesia in the critically ill. Other techniques such as regional and inhalational anesthesia are options, but opioids are effective and offer wide therapeutic index in most patients. Sedation should be initiated only after excluding physiologic alterations that may present as anxiety or agitation. Opioids have some sedative properties, but their ability to provide deep sedation and amnesia are minimal.

**Results and discussion:** Duration of sedation is important as various agents may have different economic and side-effect profiles depending on duration of administration. Scientific study of pharmacologic agents requires precise definition of population of interest. Each critically ill patient is unique in terms of her/his baseline organ function, disease process, age, and volume of distribution.

**Conclusion:** Knowledge of drug profile, clinical scenario, and continuous clinical monitoring are essential to appropriate and cost-effective management of sedation and analgesia in critically ill patient.

**Keywords:** analgesia, sedation, ICU

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# PREDNOSTI KAUDALNE ANESTEZIJE U ODNOSU NA OPŠTU ANESTEZIJU KOD PEDIJATRIJSKE POPULACIJE U INFRAUMBILIKALNOJ HIRURGIJI

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**Uvod:** Pedijatrijska regionalna anestezija je još uvijek u razvoju, kako klinički, tako i znanstveno. Kaudalni blok ostaje jedna od najvažnijih tehnika regionalne anestezije. Prema nedavnim meta analizama trajanje analgezije sa kaudalnim blokom može da se produži četiri sata nakon završenog operativnog zahvata uz dodatak lokalnih anestetika. Nakon kontrole mnogih zbunjujućih faktora, blokada kaudalnog živca nije bila povezana s povećanim rizikom od postoperativnih komplikacija. Korištenjem multimodalnog pristupa koji uključuje regionalnu anesteziju, pedijatrijsko liječenje boli trebalo bi težiti smanjenju boli na prihvatljivu razinu bez ugrožavanja stepena njihove imobilizacije. Buduće velike prospektivne studije bi se trebale provesti kako bi se ocrtila učinkovitost, trajanje i sigurnost kaudalnog bloka. Kaudalni blok u sedaciji predstavlja izbornu tehniku anestezije za brojne operativne zahvate u pedijatrijskoj infraumbilikalnoj hirurgiji. Ovdje spadaju ingvinalne herniektomije, orhidopeksije, rekonstrukcije uretre, anoplastike i druge procedure ispod umbilikalnog nivoa, a to je više od trećine operativnih zahvata kod djece.

**Prikaz slučaja :** u dva prikaza slučaja djece starosti četiri mjeseca i osam godina, rađen je hitni i elektivni operativni zahvat ingvinalne herniektomije, prikazana je prednost izbora kaudalne anestezije u odnosu na opštu anesteziju.

**Zaključak :** jednostavnost, efikasnost i bezbjednost ove tehnike nalažu njenu znatno veću upotrebu u tercijarnom nivou zdravstvene zaštite.

**Ključne riječi:** kaudalna anestezija, djeca, prednost.

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# ADVANTAGES OF CAUDAL ANESTHESIA IN RELATION TO GENERAL ANESTHESIA IN THE PEDIATRIC POPULATION IN INFRAUMBILICAL SURGERY

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**Introduction:** Pediatric regional anesthesia is still in development, both clinically and scientifically. Caudal block still remains one of the most important techniques of regional anesthesia. According to recent meta-analyses, the duration of analgesia with caudal block can be extended by four hours after the completion of the surgical procedure with the addition of some local anesthetics. After controlling for many confounding factors, caudal nerve block was not associated with an increased risk of postoperative complications.

Using a multimodal approach that includes regional anesthesia, pediatric pain management should aim to reduce the patient's pain to an acceptable level without compromising their degree of immobilization. Future large prospective studies would be conducted in order to delineate the effectiveness, duration and safety of the caudal block. The caudal block under sedation is the anesthetic technique of choice for numerous operations in pediatric infraumbilical surgery. These include inguinal herniectomies, orchidopexies, ureter reconstructions, anoplasty and other procedures below the umbilical level, which represent more than a third of surgical procedures in children.

**Case report :** In two case reports in children aged four months and eight years, who underwent an emergency and elective surgical procedure of inguinal herniectomy, the advantage of choosing caudal anesthesia compared to general anesthesia will be shown.

**Conclusion :** The simplicity, efficiency and safety of this technique dictate its significantly greater use in the tertiary level of health care.

**Key words:** caudal anesthesia, children, advantage.

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## DELIRIJUM KAO POSLJEDICA NEUROLEPTIČNOG MALIGNOG SINDROMA

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**Uvod:** Delirijum predstavlja klinički sindrom koji karakteriše promjena pažnje, svijesti, kognicije, psihomotorna izmijenjenost i poremećaji sna, uzrokovan svime što narušava hemostazu. Neuroleptički maligni sindrom (NMS) je po život opasno stanje karakterizirano febrilnošću, promjenom mentalnog statusa, mišićnom rigdnošću i autonomnom nestabilnosti. Etiologija obuhvata antagoniste dopaminskih receptora ili brzo ukidanje dopaminergičkih lijekova.

**Prikaz slučaja:** 57-godišnja pacijentica hospitalizovana na Klinici za ortopediju zbog preloma kuka, svjesna, orijentisana, afebrilna, boluje od ulceroznog kolitisa i epilepsije, u terapiji koristi fenobarbiton, nitrazepam, alprazolam, primazin, maprotilin i escitalopram, bez podataka o redovitosti terapije, ali anamnestički ovisnost o benzodiazepinima. Preoperativno iz urina izolovana E.coli te se uključi antibiotska terapija. Psihijatar ordinira manje doze Haldola zbog uznemirenost pacijentice. Narednog dana pacijentica somnolentna, kontakt se teže uspostavlja, orijentisana samo prema sebi, tahikardična, febrilna 39°C. Urađen RTG pluća, CT abdomena koji su uredni, laboratorijski nalazi sa dvostruko povišenim CK, urinokultura i hemokultura koje su sterilne. Konsultuju se hirurg, infektolog, klinički farmakolog, neurolog i psihijatar koji isključi Haldol iz terapije te ordinira Escitalopram i Diazepam. Pacijentica se premjesti u Odjeljenje intenzivne terapije na daljnje liječenje. U narednom toku bolesti pacijentica afebrilna, odbija verbalni kontakt, naloge ne izvršava. Sa ordiniranjem Escitaloprama i Diazepama pacijentica počinje surađivati, svjesna, orijentisana i premjesti se na Kliniku za ortopediju. Dva dana nakon pacijentica febrilna i dezorijentisana. Održi se konzilijarni kolegij te se pacijentica hospitalizuje u Odjeljenje intenzivne terapije. Narednih dana pacijentica soporozna, reaguje na duboke draži, verbalni kontakt se ne ostvaruje, febricira, ima epileptičke napade. Konsultovani neurolog ordinira Phenobarbiton i Klonazepam. Petog dana pacijentica svjesna, kontaktibilna, hemodinamski i respiratorno stabilna, afebrilna uz normalne laboratorijske nalaze.

**Zaključak:** Zbog autonomnih simptoma i febrilnosti sumnjamo na NMS suspektno uzrokovanim naglim uvodjenjem Haldola. Prema Levenson kriterijuma za NMS pacijentica je pozitivna na sva tri major i četiri minor kriterija. Doze antipsihotika se trebaju postepeno uvoditi i smanjivati u dozi do isključenja s obzirom da nagli prekidi i ordiniranja vode do životno ugrožavajućih stanja.

# MOŽDANA HERNIJACIJA U TRAUMATSKOJ OZLJEDI GLAVE – "BRAIN CODE"

Ana Milas, Mateo Perić

Odsjek za neurokiruršku anesteziju s jedinicom intenzivnog liječenja Odjela za anesteziju, reanimaciju i intenzivno liječenje Sveučilišne kliničke bolnice Mostar

**Uvod:** Akutna moždana hernijacija u traumatskoj ozljedi glave predstavlja katastrofalan niz događaja koji u kratkom vremenskom razdoblju mogu dovesti do teških neuroloških oštećenja i smrti<sup>1</sup>.

Moždani parenhim, krv i cerebrospinalna tekućina predstavljaju fiksni volumen određen nepromjenjivim ograničenjima svoda lubanje. Relativni volumeni ovih sadržaja se mogu mijenjati sporim tijekom rasta određene mase, no ta se kompenzacija gubi nakon što dođe do kritične promjene volumena i akutne intrakranijske hipertenzije i hernijacije<sup>2</sup>.

**Cilj rada:** Predstaviti sindrom moždane hernijacije, s naglaskom na isti posljedično traumatskoj ozljedi glave, uz prikaz tipične kliničke prezentacije u bolesnika liječenog na našem Odsjeku. Koristeći ga kao primjer namjeravamo prezentirati najnovija saznanja i smjernice u inicijalnom zbrinjavanju akutnog porasta intrakranijskog tlaka (ICP) u traumatskoj ozljedi glave.

**Prikaz slučaja:** Bolesnik je muškarac u dobi od 22 godine koji je u sukobu s drugom osobom zadobio traumu glave. Posljedično je razvio akutni subduralni hematoma s kliničkim znakovima moždane hernijacije.

Bolesnik se prezentirao neurološki kao Glasgow Coma Score 3, sa inicijalno reaktivnim zjenicama, no neposredno po učinjenoj dijagnostici dolazi do pogoršanja općeg stanja uz obje dilatirane zjenice, tahikardiju i tahipneju.

Imajući u vidu vrijeme kao najvažniji faktor u sprječavanju trajnog neurološkog oštećenja i smrtnog ishoda bolesniku je žurno plasiran invazivni monitoring arterijskog tlaka u cilju održavanja tlaka moždane perfuzije (CPP) jer je u ovom stanju moždana autoregulacija poremećena. Osiguran je dišni put uz duboku analgesodaciju i relaksaciju imajući u vidu prijeteci skok intrakranijskog tlaka pri laringoskopiji, ali i hipotenziju zbog duboke sedacije. Započeta je neuroprotektivna ventilacija i hiperventilacija, te antiedemska terapija uz restrikciju tekućine i nadzor nad satnom diurezom.

Unutar sat vremena od prijema učinjena je dekompresivna kraniotomija potom evakuiran hematoma i plasirana sonda za mjerenje intrakranijskog tlaka putem koje u realnom vremenu dobijamo podatke ključne za daljnje liječenje bolesnika u jedinici intenzivnog liječenja<sup>3</sup>.

**Zaključak:** Rano specijalističko liječenje i pravovremena intervencija, a potom i ciljano usmjereno liječenje bazirano na uskoj kontroli ICP, pacijalnog tlaka kisika u moždanom parenhimu (PbtO<sub>2</sub>) i CPP sprječavaju sekundarna oštećenja mozga što ima ključnu ulogu u liječenju i prognozi bolesnika s moždanom hernijacijom<sup>4</sup>

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## **ANATOMSKI PARAMETRI VRATA KAO PREDIKTORI OTEŽANE ENDOTRAHEALNE INTUBACIJE**

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Otežano uspostavljanje disajnog puta kritičan je izazov u anesteziji predstavljajući jedno od najhitnijih stanja u medicini koje za posljedicu može imati trajna oštećenja, pa čak i smrt. Preoperativna procjena anatomskih parametara je neophodna u pronalasku pacijenata kod kojih je rizik za otežanom endotrahealnom intubacijom (OEI) povećan. Studije anatomskih varijacija struktura vrata i njihovih implikacija u zbrinjavanju disajnih puteva su pokazale potrebu za dodatnim istraživanjima na ovom polju. Cilj ovog istraživanja bio je ispitati prediktivnu vrijednost, specifičnost i senzitivnost četiri anatomska parametra vrata - tireoentalnu udaljenost (TMD), sternoentalnu udaljenost (STMD), omjer visine i tireoentalne udaljenosti (RHTMD) i opseg vrata (NC), kako bi se procijenio njihov značaj u procjeni težine endotrahealne intubacije. Istraživanje je provedeno na pacijentima podvrgnutim elektivnim operacijama s opšom anestezijom i endotrahealnom intubacijom. Endotrahealna intubacija je ocijenjena teškom u 20 % slučajeva. Ova prospektivna opservacijska studija je identificirala opseg vrata kao najpouzdaniji prediktor. NC je pokazao najveću osjetljivost (72,5%) i specifičnost (74,1%), s pozitivnom prediktivnom vrijednošću od 38,0% i negativnom prediktivnom vrijednošću od 92,5%, što ukazuje na njegovu korisnost kao samostalnog prediktivnog pokazatelja otežane endotrahealne intubacije. Nasuprot tome, TMD i STMD pokazali su ograničenu prediktivnu tačnost, naglašavajući potrebu za kombiniranim pristupom pri procjeni anatomskih prediktora. Ova studija naglašava važnost individualizirane preoperativne procjene anatomskih karakteristika vrata za poboljšanje predviđanja i upravljanja otežanim endotrahealnim intubacijama u kliničkoj praksi.

## **PRIKAZ SLUČAJA: "SEPTIČNA ENCEFALOPATIJA "**

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**Uvod:** Encefalopatija je poremećaj svijesti uzrokovan patološkim procesom koji izravno ne zahvaća sam centralni nervni sistem. U slučajevima sepse definirane prisutnošću sistemnog upalnog odgovora (SIRS - Systemic Inflammatory Response Syndrome) tijekom, najčešće bakterijske ili gljivične infekcije, govorimo o septičnoj encefalopatiji.

**Cilj rada:** Kroz prikaz slučaja prikazati način liječenja i metode primjenjene od momenta prijema do momenta otpusta pacijentice u Odjeljenju intenzivne terapije hiruški blok Klinike za anesteziologiju i reanimatologiju UKC Tuzla.

**Prikaz slučaja:** Radi se o pacijentici K.M. starosti 66 godina koja je boravila u kazneno popravnom zatvoru. Uz pratnju osoblja upućena je na Klinički centar gdje biva hospitalizirana zbog znakova urosepse. Ubrzo nakon prijema zbog lošeg opšteg stanja i poremećaja svijesti premjesti u Odjeljenje intenzivne terapije. U odjeljenju se medikamentozno tretira. Uradi se laboratorijska, radiološka, mikrobiološka dijagnostika, lumbalna punkcija. Pacijentica takođe liječenja mehaničkim tipom ventilacije. Multidisplinarno liječena. Nakon jedanaest dana boravka u odjeljenju, pacijentica se premjesti na matično odjeljenje urologije hemodinamski i respiratorno stabilna, spontanog disanja, urednih laboratorijskih nalaza, bez znakova infekcije.

**Zaključak** SE je ozbiljan sindrom koji direktno utječe na ishod bolesnika sa sepsom. Stoga da bi uspješno liječili septične bolesnike moramo biti upoznati i sa SE te kako je pravodobno prepoznati i pokušati kupirati njezin nepovoljan utjecaj na ishod bolesti.

# ANESTEZIOLOŠKI IZAZOVI PRI OPERATIVNOM ZAHVATU OBOSTRANOG RASCJEP A NEPCA I USNE KOD DJECE SA ZBRINUTOM TETRALOGIJA FALLOT: PRIKAZ SLUČAJA

## ANAESTHESIA CHALLENGES FOR BILATERAL CLEFT LIP AND CLEFT PALATINUM IN A CHILD WITH REPAIRED TETRALOGY OF FALLOT: A CASE REPORT

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**Uvod:** Obostrani rascjep nepca i usne se kod djece javlja u 12% slučajeva. Djeca planirana za operativni zahvat rascjepa nepca i usne imaju pridružene kongenitalne anomalije u 20 do 30% slučajeva, od kojih su najčešće srčane anomalije. Tetralogija Fallot (TOF) je urođena srčana mana koju karakteriziraju četiri srčana defekta: plućna stenoza, defekt komorske pregrade, hipertrofija desne komore i proširenje aorte, za posljedicu ima nisku oksigenaciju krvi te pojavu od blage do duboke cijanoze kod djece. Multidisciplinarni pristup u pripremi za operativni zahvat ovakvih pacijenata je od ključnog značaja kako bi se smanjio morbiditet i mortalitet.

**Cilj:** Cilj je prikazati naše iskustvo i izazovi vođenja anestezije i pri operativnom zahvatu obostranog rascjepa nepca i usne.

**Prikaz slučaja:** Prikazaćemo slučaj jednogodišnje djevojčice primljene na Kliniku za bolesti uha, nosa i grla sa hirurgijom glave i vrata u Klinički centar Univerziteta u Sarajevu sa multiplim anomalijama srca, mozga i tijela, a radi operativnog zahvata obostranog rascjepa nepca i usne.

**Zaključak:** Djeca sa zbrinutim TOF predstavljaju izazov za anestezioški pristup i vođenje anestezije pri izvođenju bilo kakvog operativnog zahvata, a posebno kod djece sa rascjepima nepca i usne. Ozbiljnim i multidisciplinarnim pristupom preoperativnoj pripremi, kao i postoperativnom zbrinjavanju ovakvih pacijenata, smanjena je mogućnost pojave komplikacija, a samim tim obezbjeđeno je promptno djelovanje pri rješavanju istih.

**Ključne riječi:** Anestezija, obostrani rascjep nepca i usne, Tetralogija Fallot, kongenitalne srčane mane

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**Introduction:** Bilateral cleft palate and lip occurs in 12% of the cases. Children scheduled for cleft palate and lip surgery have associated congenital anomalies in 20 to 30% of cases, the most common of which are cardiac anomalies. Tetralogy of Fallot (TOF) is a congenital heart defect characterized by four heart defects: pulmonary stenosis, ventricular septal defect, right ventricular hypertrophy and aortic dilation, resulting in low blood oxygenation and mild to profound cyanosis in children. A multidisciplinary approach in the preparation for surgery of such patients is key of importance in order to reduce morbidity and mortality.

**Aim:** The aim of this case report is to present our experience and challenges of administering anesthesia during surgery for bilateral cleft palate and lip.

**Case report:** We will present the case of a one-year-old girl admitted to the Clinic for ear, nose and throat with head and neck surgery at the Clinical Center of the University of Sarajevo, with multiple anomalies of the heart, brain and body, for the surgery of bilateral cleft palate and lip.

**Conclusion:** Children with repaired TOF are a challenge for the anesthesiology approach and management of anesthesia during any surgical procedure, especially in children with cleft palate and lip. With a serious and multidisciplinary approach to the preoperative preparation, as well as the postoperative care of such patients, the possibility of complications is reduced, and thus prompt action is ensured.

**Key words:** Anesthesia, bilateral cleft palate and cleft lip, Tetralogy of Fallot, congenital heart diseases

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## BENEFITS OF REGIONAL ANESTHESIA FOR CAROTID ARTERY SURGERY

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**Introduction:** Carotid artery surgery, primarily carotid endarterectomy (CEA), is a critical procedure for preventing stroke by addressing carotid artery stenosis. Traditionally performed under general anesthesia, there is growing interest in the use of regional anesthesia due to its potential advantages.

**Objective:** This review aims to evaluate the benefits of regional anesthesia in carotid artery surgery, focusing on patient outcomes, surgical efficacy, and safety profiles compared to general anesthesia.

**Methods:** A systematic review of recent studies and clinical trials was conducted to assess the outcomes of regional anesthesia in carotid artery surgery. Key metrics analyzed include intraoperative hemodynamic stability, postoperative recovery, incidence of complications, and overall patient satisfaction.

**Results:** Regional anesthesia, including cervical plexus block and local infiltration, offers several benefits over general anesthesia. It has been associated with reduced intraoperative blood pressure fluctuations, lower incidence of respiratory complications, and fewer post-operative cognitive dysfunctions. Additionally, patients under regional anesthesia often experience faster recovery times, shorter hospital stays, and decreased need for postoperative analgesics. The technique also allows for real-time neurological monitoring during the procedure, which can enhance surgical outcomes and safety.

**Conclusion:** Regional anesthesia presents several advantages for carotid artery surgery, including improved hemodynamic control, reduced postoperative complications, and enhanced recovery. It provides a viable alternative to general anesthesia, potentially leading to better overall patient outcomes and satisfaction. Further research and clinical trials are warranted to establish definitive guidelines and optimize the use of regional anesthesia in this context.

**Keywords:** Carotid artery surgery, regional anesthesia, carotid endarterectomy, patient outcomes, surgical efficacy

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## PREDNOSTI REGIONALNE ANESTEZIJE ZA HIRURGIJU KAROTIDNE ARTERIJE

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**Uvod:** Hirurgija karotidne arterije, prvenstveno karotidna endarterektomija, je ključna procedura za prevenciju moždanog udara kroz rešavanje stenoze karotidne arterije. Tradicionalno se izvodi pod općom anestezijom, ali postoji sve veće interesovanje za primjenu regionalne anestezije zbog njenih potencijalnih prednosti.

**Cilj:** Ovaj pregled ima za cilj procjenu prednosti regionalne anestezije u hirurgiji karotidne arterije, s fokusom na ishod pacijenata, učinkovitost hirurgije i sigurnost u poređenju s općom anestezijom.

**Metode:** Proveden je sistematski pregled nedavnih studija i kliničkih ispitivanja kako bi se procijenili ishodi regionalne anestezije u hirurgiji karotidne arterije. Ključne analize uključuju intraoperativnu hemodinamsku stabilnost, postoperativni oporavak, učestalost komplikacija i ukupno zadovoljstvo pacijenata.

**Rezultati:** Regionalna anestezija, uključujući blokadu cervikalnog pleksusa i lokalnu infiltraciju, nudi nekoliko prednosti u odnosu na opću anesteziju. Povezana je s smanjenjem intraoperativnih varijacija krvnog pritiska, manjim brojem respiratornih komplikacija i manjim postoperativnim kognitivnim disfunkcijama. Pored toga, pacijenti pod regionalnom anestezijom često imaju brži oporavak, kraće hospitalizacije i smanjenu potrebu za postoperativnim analgeticima. Tehnika takođe omogućava praćenje neurološkog stanja u realnom vremenu tokom procedure, što može poboljšati ishod i sigurnost hirurškog zahvata.

**Zaključak:** Regionalna anestezija pruža nekoliko prednosti za hirurgiju karotidne arterije, uključujući poboljšanu kontrolu hemodinamike, smanjenje postoperativnih komplikacija i unaprijeđeni oporavak. Predstavlja izvodljivu alternativu općoj anesteziji, što može dovesti do boljih ukupnih ishoda i zadovoljstva pacijenata.

Daljnja istraživanja i klinička ispitivanja su potrebna kako bi se utvrdili definitivne smjernice i optimizirala primjena regionalne anestezije u ovom kontekstu.

**Ključne riječi:** Hirurgija karotidne arterije, regionalna anestezija, karotidna endarterektomija, ishodi pacijenata.

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## CASE REPORT: POSTOPERATIVE ILEUS FOLLOWING HEART SURGERY

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**Introduction:** Male patient undergoing heart surgery developed postoperative ileus few hours after admission in ICU. Ileus, a condition characterized by a lack of intestinal peristalsis leading to obstruction, is a recognized complication following abdominal and non-abdominal surgeries, including cardiac procedures. This report discusses a case of postoperative ileus in a patient who underwent heart surgery, highlighting the diagnostic approach, management strategies, and outcomes.

**Objective:** Aim of presenting this case is to highlight rare complication of heart surgery in ICU.  
**Methods:** Patient medical history has been reviewed with following diagnostics features.  
**Results and discussion:** On-time urgent abdominal surgery was performed in order to save critically ill patient. Ileus following heart surgery can be influenced by several factors including the use of narcotics, surgical stress, and postoperative immobilization. Prompt diagnosis and management are crucial to prevent prolonged hospital stays and additional complications. In this case, urgent surgery was performed and electrolyte management was effective in resolving the ileus.

**Conclusion:** This case highlights the importance of monitoring for and managing postoperative ileus in patients undergoing heart surgery. Early recognition and appropriate intervention can lead to a favorable outcome and contribute to overall recovery.

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## OZLJEDA ŽUČNIH VODOVA- RANA DETEKCIJA I VITALNA RJEŠENJA - PRIKAZ SLUČAJA

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**Uvod:** Jatrogene povrede žučnih puteva najčešće nastaju usljed pogrešne identifikacije normalne anatomije žučnih puteva. Faktori rizika uključuju anatomske varijacije, stanje pacijenta i patologiju žučne kese. Kada dođe do povrede žučnog kanala, rano prepoznavanje je ključno za omogućavanje adekvatnog liječenja.

**Prikaz slučaja:** Pacijentica starosti 40 godina, operisana je u privatnoj zdravstvenoj ustanovi, gdje je načinjena laparoscopska holecistektomija.. Postoperativno je verifikovana lezija žučnih vodova i bilijarna fistula, te je pacijentica prebačena na Kliniku za hirurgiju UKC Tuzla radi daljeg tretmana. Nakon sprovedene CT dijagnostike, hirurg je indicirao revizorni operativni zahvat, te se nađe lezija desnog i levog ductus hepaticusa i difuzni peritonitis. Pacijentica je postoperativno prebačena u odjeljenje intenzivne terapije zbog potrebe za daljim intenzivnim liječenjem i monitoringom. Trećeg postoperativnog dana, hemodinamski i respiratorno stabilna, premještena je na Kliniku za hirurgiju. Nakon par dana pacijentica je podvrgnuta rerevizionom operativnom zahvatu, nakon čega je ponovo hospitalizirana u Odjeljenju intenzivne terapije. Pacijentica je postoperativno ekstubirana, spontano disala, hemodinamski stabilna. Redovno su kontrolisani laboratorijski nalazi, koji su pokazali blagi porast parametara upale. Rtg pluća je pokazao kondenzaciju plućnog parenhima, a ultrazvuk srca i pluća je otkrio malu količinu pleuralnog izliva. Trećeg postoperativnog dana, pacijentica je ponovo premeštena na Kliniku za hirurgiju, hemodinamski i respiratorno stabilna, uz preporuke za dalje praćenje i kontrolu.

**Zaključak:** Ključni faktori za uspješno liječenje ovakvih povreda uključuju rano prepoznavanje problema, kontrolu intraabdominalnih kolekcija tečnosti i infekcija te održavanje nutritivne ravnoteže i multidisciplinarni pristup.

## HEPATOBLASTOM KOD MALOG DJETETA

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Hepatoblastom je tumor stanica jetre koji je najučestaliji maligni tumor jetre u ranom djetinjstvu. Većina hepatoblastoma počinje u desnom režnju jetre. Najčešće mjesto metastaze su pluća. Znakovi i simptomi su: velika masa u abdomenu, natečen trbuh, gubitak težine, smanjen apetit, povraćanje, žutica, svrbež, anemija, bol u leđima.

**Prikaz slučaja:** Žensko dijete 2,2 godine, TT:12,3 kg, TV 95 cm, primljeno na Kliniku za dječije bolesti u januaru 2024.godine zbog bolova u trbuhu koji su se intenzivirali noću sa primjetnom oteklinom na desnoj strani trbuha. Sprovede se dijagnostička obrada, nakon čega se postavi dijagnoza Tm lobi hepatitis I dex segmenti V et VI per magnum. Isti nije prirastao uz velike krvne sudove niti portu hepatitis, te dječiji hirug u konsultaciji sa abdominalnim hirugom hepatologom indicira operativni zahvat. Dijete uvedenu u opštu anesteziju intravenskim anestetikom propofolom, relaksirano sukcinil-holinom, intubirano običnim endotrahealnim tubusom 3,5 inča, a zatim dalja relaksacija nedepolizirajućim relaksantom atrakurijom. Nakon uvoda u opštu anesteziju plasiran je CVK. Budući da je operativni zahvat trajao 4h postavljen je grijač za dijete, vršena je promptna nadoknada kristaloidima, koloidima, transfuzije krvnih derivata koncentrata eritrocita, SSP-om i krioprecipitatom. Vaskularna kontrolna se postigne Pringl-ovim manevrom na svakih 15 minuta. Na kraju ekcizije tumora načinjene su i holecistektomia i apendektomia. Dijete je nakon operativnog zahvata intubirano, sedirano i relaksirano premješteno na Odjeljenje intenzivne terapije Klinike za Dječije bolesti radi postepenog buđenja, te intenzivnog praćenja i liječenja.

**Zaključak:** Slučaj je predstavljao jedinstven niz izazova i za hirurge i za anesteziologe sa rizikom od perioperativne plućne embolizacije, koagulopatije, gubitka krvi i hemodinamske nestabilnosti, ishemijske-reperfuzijske ozljede i postoperativnih jetrenih, bubrežnih i plućnih komplikacija svojstvenih hepatektomijama. Potrebno je temeljito poznavanje koraka hirurškog zahvata te njihovih anestezioloških implikacija. Iznad svega od prvenstvene važnosti za uspješno zbrinjavanje ovakvih slučajeva je timski pristup uz adekvatnu komunikaciju između timova koji vode dijete.

## HEPATOBLASTOMA IN A SMALL CHILD

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Hepatoblastoma is a liver cell tumor which is the most common malignant liver tumor in early childhood. Most hepatoblastomas start in the right lobe of the liver. The most common site of metastasis are the lungs. Signs and symptoms are: large mass in the abdomen, abdominal swelling, weight loss, loss of appetite, vomiting, jaundice, itchy skin, anemia and back pain.

**Case report:** Child, female, 2.2 years old, weight: 12.3 kg, height 95 cm, was admitted to the Pediatric clinic in January 2024 because of abdominal pain, which intensifies at night, with noticeable swelling on the right side of the abdomen. After end of diagnostic procedures, the final diagnosis was made: Tm lobi hepatis I dex segments V et VI per magnum, without invasion of the large blood vessels. The pediatric surgeon after consultation with the hepato-biliary surgeon indicated operative treatment. For induction of general anesthesia propofol was used as intravenous anesthetic, for muscle relaxation succinylcholine was used and 3.5 inch plain endotracheal tube was used for intubation. For maintenance of anaesthesia sevofluran was used, and as the muscle relaxant the nondepolarizing atracurium was used. Before the start of operation, CVK was placed. Given that the operation lasted 4 hours, electronic body heaters were used. Fluid compensation was performed with crystalloids, colloids, transfusions of RBC concentrates, FFP and cryoprecipitates. Hepatal perfusion was controled trough the repeated Pringle manuver every 15 minutes. At the end of tumor excision the gallbladder and appendix were removed. After the operation the child was placed in the Intensive Care Department of the Pediatric clinic, intubated, sedated and relaxed because of gradual awakening and intensive monitoring and treatment.

**Conclusion:** The case was a unique set of challenges for surgeons and anesthesiologists with the risk of perioperative pulmonary embolism, coagulopathy, blood loss and hemodynamic instability, ischemia-reperfusion injury, and postoperative hepatic, renal, and pulmonary complications associated with hepatectomy. It is necessary to have a thorough knowledge of steps of the surgical procedure and their anesthesiological implications. A primary importance for the successful handling of cases like this is a team approach with the adequate communication between teams.

# LIJEČENJE TRAUMATSKE POVREDE BUBREGA U PEDIJATRIJSKOJ POPULACIJI

## PRIKAZ SLUČAJA

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**Uvod:** Traume bubrega i urogenitalne traume čine približno 10-20% abdominalnih trauma kod odraslih i kod djece. Tri puta su traume češće kod muškaraca nego kod žena. Djeca imaju veći rizik traume bubrega usljed tupe traume nego odrasli, zbog anatomske faktora. Ozljede bubrega su klasificirane u pet stadija što pomaže u izboru pristupa liječenju. Zbrinjavanje trauma zavisi od načina na koji se desila trauma, hemodinamskog statusa pacijenta i ostalih udruženih trauma, pogotovo kod pedijatrijskih pacijenata kod kojih se neoperativno liječenje odnosno konzervativne metode liječenja urogenitalnih trauma smatraju zlatnim standardom. Sve dok je dijete hemodinamski nestabilno, postoji mogućnost da će biti potrebna eksploracija. Rizik od razvoja komplikacija značajno raste sa stepenom povrede. Kompjuterizirana tomografija (CT) sa intravenskim kontrastom je najbolja metoda za dijagnostikovanje trauma bubrega i urogenitalnih trauma i za stepenovanje bubrežne traume, iako se i ultrazvuk može koristiti kod djece sa blažim simptomima. Kao i kod svih traumatskih stanja, zbrinjavanje urogenitalnih trauma zahtijeva multidisciplinarni pristup, čiji je cilj postići uspješan ishod liječenja.

**Prikaz slučaja:** Prikazani pacijent je dijete muškog pola u dobi od sedam godina, kojeg je porodica dovezla na hitni pregled ljekaru radi povreda zadobivenih padom sa bicikla. Kliničkim pregledom pacijenta su uočeni znakovi hemoragičnog šoka, te je nakon hitne laboratorijske i radiološke dijagnostike, utvrđena ruptura desnog bubrega i retroperitonealni hematoma. Pacijent je ranije bio potpuno zdrav. Odlukom multidisciplinarnog tima uradi se hitni operativni zahvat, nakon kojeg je postoperativni tok i ishod liječenja bio uspješan.

**Zaključak:** Način liječenja traumatske povrede bubrega u pedijatrijskoj populaciji zasniva se na pregledu, hemodinamskoj stabilnosti pacijenta, stepenu bubrežnih povreda, prisustvu ostalih nebubrežnih povreda i prisustvu ili odsustvu hematurije. Zbrinjavanje pedijatrijskih povreda bubrega većinom se tretira konzervativno, osim u slučaju hemodinamske nestabilnosti kada je potrebna eksploracija.

**Glavne riječi:** trauma bubrega, pedijatrijska populacija, tretman urogenitalne traume.

# TREATMENT OF TRAUMATIC KIDNEY INJURY IN THE PEDIATRIC POPULATION CASE REPORT

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**Introduction:** Kidney trauma and urogenital trauma account for approximately 10-20% of abdominal trauma in adults and children. Trauma is three times more common in men than in women. Children have a higher risk of kidney trauma due to blunt trauma than adults, due to anatomical factors. Kidney injuries are classified into five stages that help in choosing a treatment approach. Treatment of trauma depends on the way the trauma occurred, the hemodynamic status of the patient and other associated traumas, especially in pediatric patients where non-operative treatment or conservative methods of treating urogenital trauma are considered the gold standard. As long as the child is hemodynamically unstable, there is a possibility that exploration will be required. The risk of developing complications increases significantly with the degree of injury. Computed tomography (CT) with intravenous contrast is the best method for diagnosing renal trauma and urogenital trauma and for grading renal trauma, although ultrasound can also be used in children with milder symptoms. As with all traumatic conditions, treatment of urogenital trauma requires a multidisciplinary approach, the goal of which is to achieve a successful treatment outcome.

**Case report:** The presented patient is a seven-year-old male child, who was brought by his family to the doctor for an emergency examination due to injuries sustained after falling from a bicycle. Clinical examination of the patient revealed signs of hemorrhagic shock, and after urgent laboratory and radiological diagnostics, rupture of the right kidney and retroperitoneal hematoma were found. The patient was previously completely healthy. With the decision of the multidisciplinary team, an emergency operation was performed, after which the postoperative course and outcome of the treatment was successful.

**Conclusion:** The method of treatment of traumatic kidney injury in the pediatric population is based on the examination, the hemodynamic stability of the patient, the degree of renal injury, the presence of other non-renal injuries and the presence or absence of hematuria. Management of pediatric kidney injuries is mostly treated conservatively, except in the case of hemodynamic instability when exploration is required.

**Key words:** kidney trauma, pediatric population, treatment of urogenital trauma.

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# FORMULISANJE SIGURNOG I EFIKASNOG PLANA ANESTEZIJE PRI ADENOTOMIJI DJECE SA CEREBRALNOM PARALIZOM: PRIKAZ SLUČAJA

## FORMULATION OF A SAFE AND EFFECTIVE ANESTHESIA PLAN FOR ADENOTOMY FOR PATIENTS WITH CEREBRAL PALSY: CASE REPORT

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**Uvod:** Cerebralna paraliza se se manifestuje poteškoćama držanja, ravnoteže i neusklađenim pokretima zbog ukočenosti ili slabosti mišića. Nastaje usljed oštećenja mozga tokom trudnoće, porođaja ili odmah nakon rođenja čime se umanjuje sposobnost mozga da kontroliše mišiće. Za anesteziologa je poseban izazov pružiti sigurnu i efikasnu anesteziju pri izvođenju operativnih zahvata u pedijatrijskoj populaciji posebno zbog slabe kooperativnosti pacijenta. Hronične kontrakture i spazam ekstremiteta može predstavljati problem pri pozicioniranju pacijenta, otežan pristup veskom putu, kao i postavljanje adekvatno monitoringa. Kod pacijenata sa cerebralnom paralizom, izražena je salivacija, oslabljen refleks gutanja i kašljanja, klimavi zubi i disfunkcionalan temporomandibularni zglobovi što vodi otežano disajnom putu.

**Cilj:** Cilj je prikazati naše iskustvo vođenja anestezije pri operativnom zahvatu adenotomije kod djece sa mutiplim neurološkim oboljenjima.

**Prikaz slučaja:** Prikazaćemo slučaj šestogodišnjeg dječaka sa mutiplim neurološkim oboljenjima primljenog na Kliniku za bolesti uha, nosa i grla sa hirurgijom glave i vrata u Klinički centar Univerziteta u Sarajevu radi adenotomije.

**Zaključak:** Zbog prirode samog oboljenja, kod pacijenata sa cerebralnom paralizom najčešće komplikacije su vezane za neurološki status i obezbjeđivanje disajnog puta. Dobra preoperativna priprema pacijenta, ordiniranje adekvatne premedikacije, vođenje sigurne anestezije te postoperativno praćenje je izuzetno značajno.

**Ključne riječi:** Anestezija, cerebralna paraliza, mikrocefalija, adenotomija

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3. B. Øverland *et al.* Surgery for obstructive sleep apnea in young children: outcome evaluated by polysomnography and quality of life. *Int. J. Pediatr. Otorhinolaryngol.* (2021)
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5. N. Dhiman *et al.* Increased complications after appendectomy in patients with cerebral palsy: are special needs patients at risk for disparities in outcomes? *Surgery.* (2013)

**Introduction:** Cerebral palsy is manifested with difficulties in posture, balance and uncoordinated movements due to muscle stiffness or weakness. It occurs as a result of brain damage during pregnancy, childbirth or immediately after birth, which reduces the brain's ability to control muscles. It is a challenging for the anesthesiologist to provide safe and effective anesthesia while performing surgical procedures in pediatric population, especially due to the poor cooperation of the patient. Chronic contractures and extremity spasms can be a problem when positioning the patient, difficult access to the airway, as well as setting up adequate monitoring. In patients with cerebral palsy, there is more salivation, weakened swallowing and coughing reflexes, loose teeth and temporomandibular joint dysfunction, which leads to difficult breathing.

**Aim:** The aim of this case report is to present our experience and challenges of administering anesthesia during surgery for the adenoidectomy in children with multiple neurology disorders.

**Case report:** We will present the case of a six-year-old boy admitted to the Clinic for ear, nose and throat with head and neck surgery at the Clinical Center of the University of Sarajevo, with multiple neurology disorders, for the adenoidectomy.

**Conclusion:** Due to the nature of the disease itself, in patients with cerebral palsy, the most common complications are related to the neurological status and establishing a definitive airway. Good preoperative preparation of the patient, administration of adequate premedication, administration of safe anesthesia and postoperative monitoring are extremely important.

**Key words:** Anesthesia, Cerebral palsy, microcephalia, adenoidectomy

**Literature:**

1. K.H. Hsiao *et al.* The effect of treatment of obstructive sleep apnea on quality of life in children with cerebral palsy. *Res. Dev. Disabil.* (2008)
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# ANESTHESIA APPROACH FOR BRONCHOGENIC CYST IN AN INFANT CAUSING PNEUMOTHORAX

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**Background:** Bronchogenic cyst in infants is congenital, benign lesion of lung or mediastinum. Although congenital bronchogenic cyst can often be asymptomatic rarely in infants and small children it can cause severe and life-threatening symptoms.

**Case Report:** A one month and six days old infant was hospitalized to Pediatric Intensive Care Unit due to respiratory failure. X-ray showed complete right pneumothorax with a diaphragm suppressed caudally and a heart pushed to the left. The right chest was drained and placed on continuous suction. Next five days the baby breathes spontaneously with no signs of respiratory insufficiency. But the chest x-rays showed presence of pneumothorax. Then the CT scan showed a 25x30x40mm bronchogenic cyst in the right lower lobe. The infant was scheduled for thoracotomy and excision of the cyst. Induction was with sevofluran, fentanyl and propofol. During the induction of anesthesia until thoracotomy the right chest was on continuous suction. Atraumatic intubation was performed on spontaneous breathing with a 3,5 diameter cuffed endotracheal tube. Intraoperatively saturation decreased several times, surgeons were requested to stop and saturation improved spontaneously. Postoperative course was unevenful.

**Discussion:** Treatment of bronchogenic cyst with or without symptoms requires surgical treatment. Considering advantages and disadvantages of one lung ventilation in infants we decided to proceed with two lung ventilation. Due to potential risk for development of tension pneumothorax an inhalation induction with sevofluran was performed. Endotracheal intubation, on spontaneous breathing, was facilitated with fentanyl and propofol. To avoid complication multidisciplinary approach is essential in pre and perioperative management.

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**Learning points:** Congenital cystic lesion of lung or mediastinum are often asymptomatic. In case of respiratory failure and pneumothorax in otherwise healthy children, bronchogenic cyst should always be considered.

# MINIMALLY INVASIVE ANESTHESIA FOR MINIMALLY INVASIVE ENDOSCOPIC CARDIAC SURGERY IN HIGH RISK PATIENTS, EMERGING STRATEGIES FOR THE STATE OF ART ANESTHESIA APPLICATION

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## **Introduction**

Minimally invasive (MI) surgical technique today represents the optimal choice for the treatment of a number of cardiac diseases. Anaesthesiologist should use adequate approaches to ensure the effectiveness of subsequent technique used, as well as to obtain plan and measures needed for optimal outcome.

Cardiac diseases along with planned surgery should always be considered as a high-risk task to be completed. Along with all comorbidities and led by imminent heart failure and ultimately operating theatre outcome, this represents special hemodynamic and therapeutic challenge for anaesthesiologist. In a field of emerging MI surgery there has been parallel development of MI anaesthesia technique.

## **Aim**

To review a state of art approach in the field of MI surgery procedures performed with MI anaesthesia and compare outcomes of two different anaesthesiologic techniques.

## **Methods**

This retrospective, observational study, has included elective cardiac patients with developed subsequent heart failure and treated at our Clinic for Cardiovascular surgery Clinical centre University of Sarajevo performing MI, „keyhole“ surgery. Here we have offered special approach to the organization of anaesthesia and developed patient-oriented approach including fast track anaesthesia, single lung ventilation, anaesthetic sparing effect and reduction of medication, early wakeup, early extubation as well optimised painless recovery, fast mobilisation and early intensive care unit discharge, which has led to successful overall outcome.

Patients were divided in two groups according to the technique performed. There has been no major difference between groups due to gender inclusiveness, left ventricle ejection fraction value and median age. The groups were compared by previously defined clinical postoperative outcomes.

## **Results and conclusion**

Our results have confirmed that fast track anaesthesia together with the algorithm of individual prepare of patient, could lead to faster recovery and empowering patient release, mainly based on lower doses of hemodynamically active drugs, and shorted period of application with meticulous individual plan for each patient avoiding cognitive disorders and prolonged sleep time, shorter ventilation time preventing possibility of associated pneumonia, restrictive blood application policy preventing bloodborne diseases transmission as well as complications as TACO and TRALI.

**Keywords:** minimally invasive surgery, keyhole surgery, minimally invasive anesthesia, fast track anesthesia

# MINIMALNO INVAZIVNA ANESTEZIJA ZA MINIMALNO INVAZIVNU KADIOHIRURGIJU KOD VISOKORIZIČNIH PACIJENATA, PRIMJENA NOVIH STRATEGIJA SAVREMENE ANESTEZIJE

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## Uvod

Minimalno invazivna (MI) hirurška tehnika danas predstavlja optimalan izbor za liječenje niza srčanih bolesti. Korištenjem adekvatnih metoda osigurava se efikasnost primjenjene tehnike, i obezbjeđuje preoperativni plan i mjere potrebne za optimalan ishod.

Bolesti srca, zajedno s planiranom operacijom, uvijek treba smatrati zadatkom visokog rizika. Uz sve komorbiditete i uz priustnu srčanu insuficijencu, kao i neizvjesnim krajnjim ishodom u operacijskoj sali, ovo predstavlja poseban hemodinamski i terapijski izazov za anesteziologa. Savremena rastuća MI kardiohirurgija zahtjeva paralelan razvoj metoda i tehnika MI anestezije.

## Cilj

Kroz ovaj rad napravili smo pregled savremenih MI hirurških zahvata koji se izvode uz MI anesteziju, i uporedili rezultate dvije različite anesteziološke tehnike.

## Metode

Ovom retrospektivnom, opservacionom studijom obuhvaćeni su elektivni kardiološki bolesnici sa razvojem srčane insuficijencije koji su operisani metodom MI „keyhole“ hirurgije na Klinici za kardiovaskularnu hirurgiju Kliničkog centra Univerziteta u Sarajevu. Razvili smo naprednu organizaciju anestezije i ponudili pristup orijentiran na pacijenta, uključujući fast-track anesteziju, ventilaciju jednog pluća, učinak poštode anestetika i redukcije lijekova, rano buđenje, ranu ekstubaciju kao i optimiziran bezbolni oporavak, brzu mobilizaciju i rani otpust iz intenzivne njege, što je dovelo do uspješnog ukupnog ishoda.

Bolesnici su podijeljeni u dvije grupe prema urađenoj tehnici. Nije bilo veće razlike između grupa na osnovu spola, vrijednosti ejekcione frakcije i prosječne dobi. Grupe su upoređene prema prethodno definisanim kliničkim postoperativnim ishodima.

### Rezultati i zaključak

Rezultati su potvrdili da brza anestezija, zajedno s algoritmom individualne pripreme pacijenta, može dovesti do bržeg oporavka i ranijeg otpuštanja pacijenata, uglavnom na bazi nižih doza hemodinamski aktivnih lijekova, i skraćenog perioda primjene uz precizan individualni plan za svakog pacijenta, izbjegavajući kognitivne poremećaje i produženo vrijeme spavanja, kraće vrijeme ventilacije sprječavajući mogućnost ventilatorom inducirane upale pluća, restriktivne politike primjene krvi koja sprječava prijenos krvno-prenosivih bolesti, kao i komplikacija kao što su TACO i TRALI.

**Ključne riječi:** minimalno invazivna hirurgija, keyhole hirurgija, minimalno invazivna anestezija, fast-track anestezija

## NEUROAKSIJALNA ANESTEZIJA U PORODU

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Svjetska zdravstvena organizacija (WHO) 2001. godine izdala deklaraciju koja garantuje svakoj ženi pravo na bezbolan porod. Obezboljavanje poroda je fundamentalno ljudsko pravo, koje daje benefit I za majku I za dijete smanjujući maternalni odgovor na stres tj. bol poroda. Upotreba neuroakskijane analgezije u porodu smanjuje rizik I od postpartalne hemoragije, vodećeg uzroka preventabilnog maternalnog morbiditeta . (1)

Neuroaksijalna anestezija je najefektnija I najčešće korištena analgezija za olakšavanje bolova poroda. U te svrhe koristi se epiduralna, kombinirana spinal-epiduralna , te single shot spinalna anestezija kod nas, a u svijetu I tzv. dural puncture epidural tehnika (2). Sve opisane tehnike su sigurne, efikasne, I imaju prednost izbjegavanja sistemske administracije lijekova.

Epiduralna analgezija ostaje zlatni standard dajući odlično olakšanje boli, a istovremeno olakšava konverziju u hiruršku anesteziju ukoliko je potrebna hitno operativno dovršenje poroda, a izbjegava se opšta anestezija I njeni neželjeni rizici po majku I dijete (3).

CSE se osim u porodu, koristi I sve više kod viskoro rizičnih pacijentica ( srčana bolest) intraoperativno, kada je I poželjno segmentalno podizanje bloka, a treba izbjeći opštu anesteziju (4).

Single shot spinal blok se izvodi kada je pacijentica obično u odmakloj fazi poroda, brzo I kratko djeluje (1-2h).

Sve opisane vrste blokova postižu se sa malim koncentracijama lokalnog anestetika I malom dozom opioida.

### Zaključak

Neuraksijalne metode obezboljavanja poroda su sigurne I efikasne I trebaju bi široko I svima dostupne.

Prema više od 40 kontroliranih I revidiranih studija u kojima su poređeni porodi sa epiduralnom analgezijom I bez, nisu nađene razlike u procentu carskih rezova, niti asistiranih vaginalnih poroda. (5)

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# TRANSPOZICIJA I PERFORACIJA ŽELUDCA U PRSNOJ ŠUPLJINI NAKON RUPTURE DIJAFRAGME USLIJED POLITRAUME: PRIKAZ SLUČAJA

*Doc.dr.sc. Mirko Mihalj, dr.med*

**Uvod:** Ozljeda dijafragme je relativno rijetka komplikacija tupe torako-abdominalne traume, a najčešće se javlja u sklopu politraumatske ozljede. Uslijed svoje strukture, kao i fizioloških pokreta disanja tijekom dijagnostičke obrade, manje ozljede dijafragme mogu biti previđene, naročito u hitnim slučajevima kada postoje druge, znatno ozbiljnije ozljede organizma.

**Cilj:** Prikazati neuobičajeni slučaj ruptуре dijafragme praćene translokacijom i perforacijom želuđca u prsnoj šupljini.

**Materijali i metode:** Tema ovog prikaza je slučaj pacijenta lijećenog u jedinici intenzivnog lijećenja Sveučilišne kliničke bolnice Mostar sa inicijalno neprepoznom rupturom lijeve dijafragme kod kojeg je došlo do transpozicije i perforacije želuđca u lijevu torakalnu šupljinu, a 5 dana nakon hitne splenektomije uslijed politraumatskih ozljeda. Ruptura dijafragme dijagnosticirana je četvrtog dana intenzivne njege višeslojnom kompjutorskom tomografijom, dok su se translokacija i perforacija želuđca dogodile petog dana i potvrđene su radiografijom prsnog koša. Hitni kirurški zahvat izveden je abdominalnim pristupom, želuđac je ručno repositioniran, a mjesta perforacije želuđca i dijafragme su zatvorena šavovima.

**Diskusija:** Ruptura dijafragme uslijed tupe traume je relativno rijetka. Prema literaturi, učestalost ovih ozljeda je oko 0,4% - 1,6% i često su praćene značajnim ozljedama susjednih organa. Postoji nekoliko prijavljenih slučajeva transpozicije i perforacije želuđca u prsnu šupljinu, kao posljedica ruptуре dijafragme uslijed traume. U tim slučajevima najčešći uzrok perforacije želuđca je nekroza, zbog kompresije opskrbnih krvnih žila i ishemije želućane stijenke. Međutim, perforacija želuđca također se može razviti kao rijetka komplikacija splenektomije ili kao posljedica stresnih ulkusa.

**Zaključak:** Ozljeda dijafragme nakon tupe ozljede je relativno rijetka pojava, ali se često previđi tijekom početnog lijećenja zbog popratnih ozljeda drugih organa. Kašnjenje u dijagnostici može dovesti do ozbiljnih, potencijalno smrtonosnih komplikacija s često nejasnim, podmuklim simptomima.

# INTRATHORACIC TRANSLOCATION AND PERFORATION OF STOMACH FOLLOWING POLITRAUMATIC DIAPHRAGM RUPTURE: CASE REPORT

*Doc.dr.sc. Mirko Mihalj, dr.med*

**Introduction:** Diaphragmal injuries are relatively rare complications of blunt thoracoabdominal trauma and they are often part of multiorgan injuries. Due to its anatomical structure and physiological movement during diagnostic imaging they can be missed, especially in emergency settings when there could exist other, more dramatic injuries.

**Aim:** To present an unusual case of diaphragmatic rupture accompanied by gastric translocation and perforation in the thoracic cavity

**Materials and methods:** We report a case of initially unrecognized left diaphragmal rupture in our intensive care unit (ICU) with gastric translocation and perforation into the left thoracic cavity 5 days after blunt trauma injuries and emergency splenectomy. Diaphragm rupture was diagnosed on the fourth ICU day with multi-sliced computer tomography while gastric translocation and perforation happened on the fifth day and was confirmed with a chest radiograph. Immediate surgery was performed via an abdominal approach, the stomach was manually repositioned and sites of stomach and diaphragmal ruptures were sutured closed.

**Discussion:** Traumatic diaphragmatic rupture due to blunt trauma is relatively rare. According to the literature, the incidence of these injuries occurs around 0.4% - 1.6% and are often accompanied by significant injuries to adjacent organs. There are several reported cases of stomach translocation and perforation in the thoracic cavity, as a consequence of diaphragmatic rupture due to trauma. In these cases, the most often cause of perforation is necrosis, due to compression of supplying blood vessels and ischemia of the gastric wall. However, gastric perforation can also develop as a rare complication of splenectomy or as a consequence of stress ulcers.

**Conclusion:** Diaphragmatic injury after blunt trauma is a relatively rare occurrence, but is often overlooked during initial treatment due to concomitant injuries to other organs. Diagnostic delay can lead to severe, potentially fatal, complications with often unclear, insidious symptoms.



## SEPTIČNI ŠOK, ARDS I MULTIORGANSKO ZATAJENJE

*Narhela Mujačić*

Septični šok spada u jedno od težih, životno ugrožavajućih stanja, koje nastaje kada sepsa dovede do drastičnog pada krvnog pritiska, abnormalnosti u ćeliskom metabolizmu, što vodi ka zatajenju organa.

U ovoj prezentaciji govorimo o pacijentu, muškarcu, starosti 23 godine kod koga se razvila masivna pneumonija i ARDS kao posljedica infekcije sa *Legionella pneumophilla*. Dolazi do multiorganoskog zatajenja te je pacijent zbog takvog stanja liječen u OIT Klinike za anesteziologiju i reanimatologiju. Zbog respiratorne insuficijencije je bio intubiran i spojen na kontrolisanu mehaničku ventilaciju. U liječenje je uključen tretman hemoperfuzije sa membranom Cytosorb sa hemofiltracijom uz sav ostali terapijski protokol. Dolazi do pada upalnih i renalnih parametara te je u nastavku više puta rađena hemofiltracija.

Stanje pacijenta se klinički i hemodinamski popravlja, 8. dana je ekstubiran a 11. dana premješten u Kliniku za plućne bolesti radi nastavka liječenja.

## SEPTIC SHOCK, ARDS AND MULTIORGAN FAILURE

*Narhela Mujačić*

Septic shock is one of the most serious life-threatening conditions, which occurs when sepsis leads to a drastic drop in blood pressure, abnormalities in cellular metabolism, which leads to organ failure.

In this case, we are talking about a 23-year-old male patient who developed massive pneumonia and ARD as a result of Legionella pneumophilla infection. Multiorgan failure occurs and the patient was treated in the ICU of the Anesthesiology and Reanimation Clinic due to this condition. Due to respiratory insufficiency, he was intubated and connected to controlled mechanical ventilation. The treatment includes hemoperfusion treatment with hemofiltration in addition to all other therapeutic protocols. There is a drop in inflammatory and renal parameters, and subsequently hemofiltration was performed several times.

The patient's conditions is improving clinically and hemodynamically, he was extubated on the 8th day and transferred to the Pulmonary Clinic on the 11th for continued treatment.

## ANTIMICROBIAL PROPHYLAXIS FOR THE PREVENTION OF INFECTION IN SURGERY

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A surgical site infection is a surgery-related infection that occurs at or near the surgical incision within 30 days of the procedure or within 90 days if the prosthetic material was implanted during surgery. Infections at the surgical site are classified into incisional and organic/spatial. At the site of expected microbial contamination during surgery, wounds are classified as clean, clean-contaminated, contaminated or dirty. Antimicrobial prophylaxis is justified for most clean contaminated procedures. The use of antimicrobial agents for dirty procedures or an established infection is not classified as prophylaxis, but is the treatment of a suspected infection

Antimicrobial prophylaxis should prevent surgical wound infections, prevent morbidity and mortality, reduce the duration and costs of health care, cause minimal adverse effects of drugs, and have minimal adverse effects on the patient's microbial flora. To achieve this, the antimicrobial agent should be active against the pathogen most likely to contaminate the surgical site, should be administered at the appropriate dose and time to ensure adequate tissue and serum concentrations during the period of potential contamination, and should be administered for the shortest effective period. In order to reduce adverse effects, emergence of resistance and the choice is based on cost, safety, pharmacological profile and antimicrobial activity. Cefazolin is the drug of choice for many procedures and has been proven to be effective for antimicrobial prophylaxis. Alternative medications include Vancomycin or Clindamycin. Antimicrobial prophylaxis should be administered in doses sufficient to achieve appropriate levels of the drug in the serum and tissue during which the surgical site is open, within 60 minutes before the surgical incision. Repeated intraoperative dosing is justified for procedures that exceed two half-lives of the drug and for procedures in which there is excessive blood loss (>1500 ml of blood). Repeated dosing after wound closure is unnecessary and may cause harm to the patient due to increased risk of developing antimicrobial resistance and *C. difficile* infection. If prophylaxis is continued after surgery, the duration should not exceed 24 hours.

### Reference

<https://www.uptodate.com/contents/antimicrobial-prophylaxis-for-prevention-of-surgical-site-infection-in-adults>

## ANTIMIKROBNA PROFILAKSA ZA PREVENCIJU INFEKCIJE U HIRURGIJI

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Infekcija na mjestu operacije je infekcija povezana sa operativnim zahvatom koja se javlja na ili blizu hirurškog reza unutar 30 dana od zahvata ili unutar 90 dana ako je protetski material ugrađen na operaciji. Infekcije na mjestu operacije se klasificiraju na incizijske i organske/prostorne. Na mjestu očekivane mikrobne kontaminacije tokom operacije rane se klasificiraju kao čiste, čisto-kontaminirane, kontaminirane ili prljave. Antimikrobna profilaksa je opravdana za većinu čistih kontaminiranih postupaka. Korištenje antimikrobnih sredstava za prljave postupke ili utvrđenu infekciju ne klasificira se kao profilaksa nego predstavlja liječenje pretpostavljene infekcije. Antimikrobna profilaksa bi trebala spriječiti infekcije hirurške rane, spriječiti morbiditet i mortalitet, smanjiti trajanje i troškove zdravstvene njege, uzrokovati minimalne štetne učinke lijekova i imati minimalne štetne učinke na mikrobnu floru pacijenta. Kako bi se to postiglo antimikrobni agens bi trebalo biti aktivan protiv patogena koji će najvjerovatnije kontaminirati hirurško mjesto, trebao bi se primjenjivati u odgovarajućoj dozi i u odgovarajuće vrijeme kako bi se osigurala odgovarajuće koncentracije u tkivu i serumu tokom razdoblja potencijalne kontaminacije i primjeniti za najkraće učinkovito razdoblje kako bi se smanjili štetni učinci, pojava rezistence a izbor se temelji na cijeni, sigurnosti, farmakološkom profilu i antimikrobnoj aktivnosti. Cefazolin je lijek izbora za mnoge zahvate i dokazan je kao učinkovit za antimikrobnu profilaksu. Alternativne lijekove uključuju Vankomicin ili Klindamicin. Antimikrobnu profilaksu treba primjenjivati u dozama dovoljnim za postizanje odgovarajućih razina lijeka u serumu i tkivu tokom kojeg je hirurško mjesto otvoreno i to unutar 60 minuta prije hirurškog reza. Ponovno intraoperativno doziranje je opravdano za postupke koji prelaze dva poluživota lijeka i za postupke u kojima postoji prekomjerni gubitak krvi (>1500 ml krvi). Ponovljeno doziranje nakon zatvaranja rane nije potrebno i može uzrokovati štetu pacijentu zbog povećanja rizika od razvoja antimikrobne rezistencije i infekcije *C. difficile*. Ako se profilaksa nastavi nakon operacije, trajanje ne bi trebalo biti duže od 24 sata.

### Reference

<https://www.uptodate.com/contents/antimicrobial-prophylaxis-for-prevention-of-surgical-site-infection-in-adults>

## "FLAIL CHEST" KOD TUPE TRAUME GRUDNOG KOŠA

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**Uvod:** "Flail chest" je najteža komplikacija koja se može javiti nakon tupe ozljede grudnog koša sa mortalitetom od 10% do 33%. Definiše se kao prelom 3 ili više susjednih rebara u najmanje dvije tačke što rezultira paradoksalnim pokretima grudnog koša prilikom disanja. Tretman uključuje kontrolu boli i tretman respiratorne disfunkcije ali i hiruršku fiksaciju i stabilizaciju u pojedinim slučajevima.

**Prikaz slučaja:** Ženska osoba dobi 69 godina je zadobila tešku ozljedu grudnog koša u saobraćajnom udesu kao suvozač. Na prijemu u našu ustanovu pacijentica svjesna, komunikativna, tahidispnoična sa većim hematomom u području lijeve polovine grudnog koša i paradoksalnim pokretima prilikom inspirija uz palpabilan opsežan subkutani emfizem na grudnom košu i vratu. Nakon primarne obrade i CT dijagnostike ustanovljena obostrana fraktura gornjih rebara te srednjih rebara lijevo sa dislokacijom fragmenata, fraktura sternuma te obostrano PNTX izraženiji lijevo. Nakon gasnih analiza arterijske krvi odluči se za sedaciju i intubaciju pacijentice uz torakohiruršku intervenciju u smislu obostrane drenaže prsišta i aktivne sukucije. Uradjen kontrolni CT grudnog koša šestog dana po prijemu koji pokaže hernijaciju lijevog pluća, nakon čega se konzilijarno donese odluka o indiciranoj torakohirurškoj stabilizaciji. Operativni zahvat stabilizacije 2-6 rebra lijevo duplim suturama te plasiranja polipropilenske mrežice 15 x 15 cm preko defekta rebara uradjen devetog dana po prijemu. Pacijentica ekstubirana 14-tog dana na HFOT, a pet dana kasnije premještena na odjel uredne respiratorne funkcije.

**Zaključak:** Dva su načina tretmana "flail chest" ozljede, konzervativni i hirurški. Konzervativni tretman je povezan sa dužom hospitalizacijom, umanjenom respiratornom funkcijom, deformitetima grudnog koša, povećanim rizikom od pneumonija i potrebom za traheotomijom. S druge strane, hirurške komplikacije uključuju infekciju rane, krvarenje i potrebu za transfuzijom krvi. Čini se da je hirurška stabilizacija uznepredovalog " flail chest" sa popratnom frakturom sternuma sigurna procedura koja može reducirati potrebu za mehaničkom ventilacijom, respiratorne komplikacije i dužinu boravka u odjelu intenzivnog liječenja.

## POSTOPERATIVNI ILEUS NAKON SRČANE OPERACIJE

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**Uvod:** Muškarac koji je podvrgnut operaciji srca razvio je postoperativni ileus nekoliko sati nakon prijema na intenzivnu njegu. Ileus, stanje koje karakterizira nedostatak crijevne peristaltike i vodi do opstrukcije, poznata je komplikacija nakon abdominalnih i ne-abdominalnih operacija, uključujući kardiovaskularne procedure. Ovaj prikaz slučaja razmatra komplikaciju postoperativnog ileusa kod pacijenta koji je imao operaciju srca, sa fokusom na dijagnostički pristup, strategije upravljanja i ishod.

**Cilj:** Naglasiti rijetku komplikaciju operacije srca i istaknuti važnost ranog prepoznavanja i upravljanja u postoperativnoj intenzivnoj njezi.

**Metode:** Medicinska istorija pacijenta pregledana je i analizirane su dijagnostičke karakteristike. Ključni faktori uključivali su uticaj narkotika, stres izazvan operacijom i postoperativnu imobilizaciju.

**Rezultati i Diskusija:** Hitna abdominalna operacija izvedena je kako bi se riješio ileus kod kritično oboljelog pacijenta. Postoperativni ileus nakon operacije srca može biti pod uticajem više faktora uključujući upotrebu narkotika, stres izazvan operacijom i postoperativnu imobilizaciju. Brza dijagnoza i upravljanje ključni su za sprečavanje produženih boravaka u bolnici i dodatnih komplikacija. U ovom slučaju, hitna operacija i efikasno upravljanje elektrolitima bili su uspješni u rješavanju ileusa.

**Zaključak:** Ovaj prikaz slučaja naglašava važnost pažljivog praćenja i upravljanja postoperativnim ileusom kod pacijenata koji su prošli operaciju srca. Rano prepoznavanje i odgovarajuća intervencija ključni su za povoljan ishod i cjelokupni oporavak.

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# UTICAJ ANESTEZIJE NA KARDIOLOŠKE PACIJENTE /PRIKAZ SLUČAJA/

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## Uvod

Procjenjuje se da približno milion pacijenata godišnje u SAD-u koji su podvrgnuti operaciji u općoj anesteziji doživi perioperativnog infarkta miokarda (James B Froehlich and Kim A Eagle, Heart. 2002) Kardiovaskularne bolesti, povišeni arterijski tlak, ishemijska bolest srca, te bolesti srčanih zalistaka, često su bolesti koje se susreću u anesteziološkoj praksi i vodeći su uzrok perioperacijskih morbiditeta i mortaliteta.

Odgovor organizma na anesteziološki postupak, endotrahealnu intubaciju, pozitivni pritisak umjetne ventilacije, gubitak krvi, promjene volumena intravaskularne tekućine kao i promjene tjelesne temperature dovode do dodatnog kardiovaskularnog opterećenja. Kako bi omogućili što kvalitetniju anesteziju, posebna pozornost usmjerena je na prijeoperacijsku procjenu bolesnika. Intraoperacijska i poslijeoperacijska skrb kao i liječenje postoperativne boli ključni su u smanjenju kardioloških komplikacija u bolesnika.

## Cilj

Prijeoperacijska procjena srca ima nekoliko ciljeva: procijeniti perioperativni srčani rizik za pacijenta, optimizirati bolesnika za operativni zahvat te izabrati najpovoljniju tehniku anestezije za bolesnika. Prijeoperacijska procjena uključuje povijest bolesti, trenutne bolesti i kroničnu terapiju, prethodno iskustvo s anestezijom, prethodni hirurški zahvat, alergije, procjena dišnog put, laboratorijska analiza krvi te dodatne kliničke pretrage. Prijeoperacijska procjena pacijenata prije elektivne operacije temeljila se gotovo u potpunosti na kliničkoj procjeni i pregledu. Američko društvo za anesteziologiju je 1963. uvelo je u praksu klasifikaciju fizičkog statusa ASA za procjenu perioperativnog rizika. ASA klasifikacija nije usredotočena samo na srčani rizik već na bolesti organskih sistema, pa tako pacijenti u razini ASA IV ili V su pod izuzetno visokim rizikom, ali pacijenti kategorizirani u razini III predstavljali su vrlo širok spektar rizika i komorbiditeta (James B Froehlich and Kim A Eagle, Heart. 2002 Jan; 87).

## Ispitanici i metode

U ovu studiju je bilo uključeno 50 odraslih bolesnika. Bolesnici su podijeljeni u dvije skupine (A i B) od po 25 bolesnika. Skupinu A činili su bolesnici liječeni na Odjelu za intenzivno liječenje kardiokirurških bolesnika (KaJIL), Klinike za anesteziologiju, intenzivno liječenje i terapiju boli, operisani od strane kardiohirurga „operacijom na otvorenom srcu“. Sa uključene dvije kardiološke dijagnoze: IBS i arterijska hipertenzija (AH). Skupinu B čine bolesnici liječeni na Odjelu za intenzivno liječenje I (JIL), nasumično odabrani iz drugih područja kliničke medicine - 16 ispitanika sa „Zavoda za cerebrovaskularne bolesti“, 6 ispitanika „Zavod za traumatologiju“, 3 ispitanika iz OHBP-a kao hitni slučaj. Ispitanici skupine B nisu imali operaciju vezanu uz kardiovaskularni sistem.

## Rezultati

Spol Skupina A - od 25 ispitanika, 10 (40%) je muškog spola, a 15 (60%) ženskog spola. Skupina B – od 25 ispitanika, 20 (80%) ih je muškog spola, te 5 (20%) ženskog spola. Ženski Spol A n (%) 15 (60%) Muški 10 (40%) Spol B Ženski 5 (20%) Muški 20 (80%) Tablica 1. Prikaz : Obilježja ispitanika : Spol Dob Prilikom uzimanja ispitanika za obradu, gledala se dobna granica u kojoj je najmanja vrijednost iznosila 55 godina, a najveća 75 godina. Najveći broj ispitanika, njih 35 (70%) ima 60 godina.

Skupina A: vrsta zahvata „Revaskularizacija miokarda“ – by pass koronarnih arterija autolognim preparatom u 19 bolesnika (76%) te „Implantacija biološke aortalne valvule“ u 6 bolesnika (24%) Skupina B – kriterij je nekardiološki zahvat koji je zahtijevao prijem u JIL Sušak. 4 bolesnika interventna revaskularizacija usljed cerebro vaskularnog infarkta (CVI -a), 6 bolesnika sa dijagnozom subarahnoidalno krvarenje (SAH), 2 sa dijagnozom tm cerebri sa zavoda za

Cerebrovaskularne bolesti. Zavod za traumatologiju – fiksacija zdjelice 1 bolesnik, 5 bolesnika operacija kuka sa komplikacijama. Iz OHBP – a 3 politraume.

### **Zaključak**

Prijeanestezijski pregled je Klinički pregled kojeg obavlja anesteziolog u ambulanti za prijeanestezijsku procjenu sa ciljem smanjenja perioperativnog mortaliteta i postoperativno vraćanje bolesnika što je moguće brže u „normalno” fiziološko, psihološko i socijalno funkcioniranje. Identifikacija bolesnika nad kojim će se provedbom specifičnog tretmana poboljšati ishod operacije, identifikacija bolesnika sa kroničnim bolestima koji ne bi preživjeli zahvat bez optimizacije te identifikacija bolesnika sa specifičnim karakteristikama vezanim za sigurnost anestezije potvrđuje činjenicu da opća anestezija ne utječe značajno na različite skupine pacijenata, u ovom slučaju kod kardioloških pacijenata i nekardioloških pacijenata. Dijelim svoj stav da multidisciplinarni pristup bolesniku u koji su uključene razne medicinske djelatnosti (internist, kirurg, transfuziolog), dijagnostičke djelatnosti (RTG, laboratorij), nutricionisti, ali i nemedicinske struke (centar za socijalni rad, psiholog

**Ključne riječi:** predoperativna priprema, anestezija, hemodinamika, monitoring.



## ANESTEZIOLOŠKI TRETMAN KARCINOMA BUBREGA SA UDRUŽENIM TROMBOM DONJE ŠUPLJE VENE

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**Uvod:** Karcinom bubrežnih ćelija je drugi najčešći tip urološkog karcinoma u svijetu. Ćelije karcinoma mogu se širiti u lumen krvnih sudova u venskom sistemu što rezultira stvaranjem tumorskog tromba. Tumorski tromb može prodrijeti u donju šuplju venu, pa čak i do desne predkomore. CT i MRI su najbolji načini za dijagnosticiranje. MRI slika može koristiti za pouzdanu procjenu invazije zida v. cave inf. Liječenje izbora u takvim slučajevima je radikalna nefrektomija i trombektomija donje šuplje vene. Ova operacija je jedna od najzahtjevnijih zbog brojnih perioperativnih komplikacija kao što su krvarenje, venska embolizacija i ishemija organa. Ključno je osigurati vaskularnu kontrolu donje šuplje vene. Kada se tromb povuče, rizik od smrti je izuzetno visok. Sve to predstavlja velike izazove za anesteziju i perioperativno upravljanje.

**Prikaz slučaja:** Prikazani pacijent je muška osoba, mlađe životne dobi, koji se javio ljekaru zbog anginoznih tegoba kada se dijagnosticira infarkt miokarda, akutna renalna insuficijencija, infiltrativni tumor desnog bubrega i tromb u lumenu v. cave inf. Od ranije kardiološki i onkološki pacijent, sa urađenom nefrektomijom lijevo zbog karcinoma lijevog bubrega i atipičnom resekcijom plućnog krila zbog meta promjena primarnog procesa. Odlukom multidisciplinarnog tima uspješno tretiran operativno.

**Zaključak:** Izbor liječenja je hiruško liječenje koje je visoko rizično. Radikalna nefrektomija i trombektomija donje šuplje vene je izazovna procedura povezana sa značajnim rizikom od perioperativnog morbiditeta i mortaliteta. Tretman mora biti individualan za svakog pacijenta. Zbog svoje složenosti, operaciju bi trebao izvoditi iskusan tim. Anesteziozi moraju posvetiti veliku pažnju hirurškom procesu i precizno zabilježiti vrijeme blokade svakog krvnog suda, pažljivo pratiti vitalne znake, održavati određeni perfuzijski pritisak kroz odgovarajuću primjenu tečnosti, krvi, krvnih derivata i koristiti vazoaktivne lijekove kada je to potrebno. Preoperativno potreban je multidisciplinarni pristup, a intraoperativno bliska saradnja između anesteziologa i hirurga.

**Ključne riječi:** karcinom bubrežnih ćelija, upravljanje anestezijom, tromb donje šuplje vene

# ANESTHESIOLOGY TREATMENT OF KIDNEY CARCINOMA WITH ASSOCIATED INFERIOR VENA CAVA THROMBUS

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**Introduction:** Renal cell carcinoma is the second most common type of urological cancer in the world. Cancer cells can spread into the lumen of blood vessels in the venous system resulting in the formation of a tumor thrombus. Tumor thrombus can penetrate into the inferior vena cava and even into the right atrium. CT and MRI are the best ways to diagnose. MRI image can be used for reliable assessment of v wall invasion. cave inf. The treatment of choice in such cases is radical nephrectomy and inferior vena cava thrombectomy. This operation is one of the most demanding due to numerous perioperative complications such as bleeding, venous embolization and organ ischemia. It is crucial to ensure vascular control of the inferior vena cava. Once the thrombus has retreated, the risk of death is extremely high. All this presents great challenges for anesthesia and perioperative management.

**Case report:** The presented patient is a young man, who came to the doctor because of anginal complaints when he was diagnosed with myocardial infarction, acute renal insufficiency, infiltrative tumor of the right kidney and thrombus in the lumen of v. cave inf. Former cardiology and oncology patient, with left nephrectomy performed due to cancer of the left kidney and atypical resection of a lung wing due to meta changes in the primary process. He was successfully treated operatively by the decision of the multidisciplinary team.

**Conclusion:** The choice of treatment is surgical treatment, which is high risk. Radical nephrectomy and inferior vena cava thrombectomy is a challenging procedure associated with significant risk of perioperative morbidity and mortality. Treatment must be individual for each patient. Due to its complexity, the operation should be performed by an experienced team. Anesthesiologists must pay great attention to the surgical process and accurately record the time of blockage of each blood vessel, carefully monitor vital signs, maintain a certain perfusion pressure through appropriate administration of fluids, blood, blood derivatives and use vasoactive drugs when necessary. Preoperatively, a multidisciplinary approach is required, and intraoperatively, close cooperation between the anesthesiologist and the surgeon is required.

**Key words:** renal cell carcinoma, anesthesia management, inferior vena cava thrombus

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## SPONTANEOUS TWIN ANEMIA POLYCYTHEMIA SEQUENCE- CASE PRESENTATION

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**Introduction:** Monochorionic twins share a single placenta and are connected with each other through vascular anastomoses. Unbalanced inter-twin blood transfusion may lead to complications, including twin-to-twin transfusion syndrome (TTTS) and twin anemia polycythemia sequence (TAPS). TAPS is a chronic form of unbalanced feto-fetal transfusion, leading to anemia in the donor and polycythemia in the recipient, in the absence of twin oligo-polyhydramnios sequence. TAPS may occur spontaneously in 3-5% of monochorionic twins or after laser surgery for TTTS. The prevalence of post-laser TAPS varies from 2% to 16%. Perinatal mortality occurs in 15% of twins and is significantly higher in donors than recipients. Severe neonatal morbidity occurs in 33% of the twins and is strongly predicted by high antenatal TAPS stage and low gestational age at birth.

**Case presentation:** We present a case of monochorionic diamniotic twin pregnancy complicated by TAPS. A spontaneously conceived and regularly monitored twin pregnancy, ended with an operative delivery at 36 weeks of gestation due to fetal distress. The pregnancy concluded with the birth of hypotrophic male twins. The first twin had a birth weight of 1930 grams and Apgar scores of 7/8/8, while the second twin had a birth weight of 1790 grams and Apgar scores of 8/8/9, requiring oxygen support during the adaptation period and for 72 hours after birth. Laboratory tests in the first 24 hours after birth indicated anemia in the first twin (Hg 109, Er 3.05, Hct 0.32), for which decanted red blood cells were administered, and polycythemia in the second twin (Hg 244, Er 6.95, Hct 0.75), along with high indirect bilirubin. By the 9th day after birth, the polycythemia spontaneously normalized, and the second twin underwent phototherapy.

**Conclusion:** Spontaneous TAPS is associated with high rates of adverse perinatal outcome, particularly in donor twins. Because perinatal outcome is greatly dependent on TAPS stage, timely detection is of great importance.

## REMIMAZOLAM, IDEALAN SEDATIV?

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**Uvod:** Remimazolam (CNS7056) je novi, ultra-kratkodjelujući intravenski benzodiazepin, tzv. *soft drug*, koji obećava široku kliničku primjenu u anesteziji i sedaciji zahvaljujući svojoj molekularnoj strukturi i jedinstvenim farmakološkim karakteristikama.

**Cilj:** Cilj rada je pružiti ažurirane informacije o kliničkim primjenama remimazolama kao novog sedativa i istaknuti prednosti u usporedbi s midazolamom i propofolom, trenutnim zlatnim standardima u području anestezije.

**Materijali i metode:** Provedena je analiza podataka dobivenih pretraživanjem baze podataka *PubMed* u razdoblju, od siječnja 2020., kada je lijek odobren za proceduralnu sedaciju, do kolovoza 2024. Rezultati su prikazani korištenjem metode deskriptivne statistike.

**Rezultati i diskusija:** Kliničke studije su dokazale da se remimazolam uspješno primjenjuje u ambulantnim proceduralnim sedacijama za kratke zahvate, za indukciju i održavanje opće anestezije kao i u sedaciji u jedinicama intenzivnog liječenja. Također ima potencijal za primjenu u sedaciji pedijatrijskih bolesnika. Prednosti remimazolama u usporedbi s lijekovima iste indikacije su: brz početak djelovanja (1-3 min), brza hidroliza tkivnim esterazama u neaktivni metabolit (CNS7054), kratko poluvrijeme eliminacije (0,75 h) i visok klirens (54 - 75 L/h). Navedeno rezultira brzim i predvidljivim oporavkom bolesnika, s minimalnom rezidualnom sedacijom. Kod sedacija za duže zahvate bitno je što remimazolam ima mali volumen distribucije nakon dugotrajne infuzije (0,76 - 0,98 L/kg), te minimalan učinak na jetrenu i bubrežnu funkciju. Manja je incidencija kardiorespiratorne depresije i hemodinamske nestabilnosti što je od osobite važnosti kod visoko rizičnih i bolesnika starije životne dobi. Budući da remimazolam nastavlja utvrđivati svoju ulogu u anesteziji, očekuju se stalna istraživanja i napredak u njegovoj primjeni.

**Zaključak:** Remimazolam zbog farmakoloških karakteristika i dosadašnjih rezultata ima svoje mjesto u budućnosti kao alternativa propofolu i midazolamu, a zbog svog profila moguće je da će se nametnuti kao *idealna sedativ*.

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## REMIMAZOLAM, AN IDEAL SEDATIVE?

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**Introduction:** Remimazolam (CNS7056) is a new, ultra-short-acting intravenous benzodiazepine, a *soft drug*, that promises wide clinical use in anaesthesia and sedation due to its molecular structure and unique pharmacological characteristics.

**Aim:** The aim is to provide updated information on the clinical applications of remimazolam as a new sedative and highlight its advantages compared to midazolam and propofol, the current gold standards in anaesthesia.

**Materials and methods:** Data obtained by searching the *PubMed* database was performed from January 2020, when the drug was approved for procedural sedation, until August 2024. The findings are presented with descriptive statistics.

**Results and discussion:** Clinical studies have shown that remimazolam is successfully used in ambulatory procedural sedation for short procedures, for the induction and maintenance of general anaesthesia, and in sedation in intensive care units. It also has potential for use in the sedation of paediatric patients. The advantages of remimazolam compared to drugs of the same indication are fast onset (1-3 min), rapid hydrolysis by tissue esterases into an inactive metabolite (CNS7054), short elimination half-life (0.75 h), and high clearance (54 - 75 L/h). The above results in a fast and predictable recovery of the patient, with minimal residual sedation. With sedation for longer procedures, it is important that remimazolam has a small volume of distribution after a long-term infusion (0.76 – 0.98 L/kg), and minor effects on liver and kidney function. There is a lower incidence of cardiorespiratory depression and hemodynamic instability, which is of particular importance in high-risk and elderly patients. As remimazolam continues to establish its role in anaesthesia, continued research and progress in its use is expected.

**Conclusion:** Remimazolam has a place in the future as an alternative to propofol and midazolam due to its pharmacological characteristics and results of previous studies, and due to its profile, it may impose itself as an *ideal sedative*.

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# STUDIJA SLUČAJA O REFRAKTARNOJ VENTRIKULARNOJ FIBRILACIJI U VANBOLNIČKOM SRČANOM ZASTOJU

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## **Uvod:**

Vanbolnički srčani zastoj predstavlja vodeći javnozdravstveni problem, pri čemu je stopa preživljavanja značajno povećana zahvaljujući promociji upotrebe automatskog vanjskog defibrilatora i kontinuiranim edukacijama primjene mjera kardiopulmonalne resuscitacije (KPR) od strane prolaznika. Iznenadni vanbolnički srčani zastoj je treći vodeći uzrok smrti u razvijenim zemljama. Aktuelne smjernice napredne životne podrške preporučuju defibrilaciju u menadžmentu ventrikularne fibrilacije i ventrikularne tahikardije bez pulsa. Refraktarna ventrikularna fibrilacija se definiše kao perzistentna kroz tri neuspješna pokušaja defibrilacije što rezultuje prognostički niskom stopom preživljavanja i neizvjesnim neurološkim ishodom. Različite farmakološke i nefarmakološke mjere nisu pokazale poboljšanja stope preživljavanja i neurološkog ishoda kod navedene subpopulacije pacijenata. Endotrahealna intubacija je povezana sa poboljšanjem u oksigenaciji i ventilaciji kod produžene KPR i predstavlja važnu komponentu protokola vanbolničkog srčanog zastoja.

## **Prezentacija slučaja:**

Naša studija slučaja se zasniva na pacijentu starosti 72 godine sa iznenadnim vanbolničkim srčanim zastojem tokom vožnje koji je rezultirao saobraćajnom nezgodom. Hitna medicinska pomoć je pozvana, a KPR započeta od strane slučajne prolaznice. Hitna medicinska pomoć je stigla na lice mjesta nakon dvije minute od srčanog zastoja i nastavila KPR. Inicijalnom provjerom ritma na monitoru se registruje ventrikularna fibrilacija koja se konvertuje u ritam spojiv sa životom nakon desetog isporučenog DC-šoka. Tokom KPR-a praćene su smjernice napredne životne podrške koje uključuju primjenu bifaznog defibrilatora u prikladnim intervalima, visokokvalitetnu KPR, napredno osiguravanje disajnog puta, oksigenoterapiju visokog protoka, intravensku aplikaciju epinefrina 1 mg (1:10000), intravensku aplikaciju amiodarona u prikladnim dozama i intervalima (300 mg i 150 mg). Nakon trideset i pet minuta od početka KPR-a ostvaruje se povratak spontane cirkulacije uz trenutnu primjenu mjera postresuscitacijske njege i transport prema centru tercijerne zdravstvene zaštite.

## **Zaključak:**

Da bi se poboljšao ishod kod pacijenata sa vanbolničkim srčanim zastojem, neophodno je razvijati kontinuirane edukacijske programe KPR-a za laike. Navedene edukacije mogu značajno doprinijeti poboljšanju ishoda navedenih pacijenata, naročito u slučajevima refraktarne ventrikularne fibrilacije, gdje je trenutna i efikasna intervencija ključna.

**Ključne riječi:** vanbolnički srčani zastoj, automatski vanjski defibrilator, kardiopulmonalna resuscitacija, napredne mjere životne podrške, ventrikularna fibrilacija, hitna medicinska pomoć, povratak spontane cirkulacije, endotrahealna intubacija, defibrilacija, disajni put, epinefrin, amiodaron, oksigenoterapija

# A CASE REPORT STUDY OF REFRACTORY VENTRICULAR FIBRILLATION IN OUT-OF-HOSPITAL CARDIAC ARREST

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## **Background:**

Out-of-hospital cardiac arrest (OHCA) remains a significant public health challenge, although survival rates have improved due to the widespread use of automated external defibrillators (AEDs) and public education campaigns promoting bystander cardiopulmonary resuscitation (CPR). Sudden OHCA is the third leading cause of death in industrialized countries. Current advanced life support (ALS) guidelines advocate for defibrillation in the management of ventricular fibrillation (VF) and pulseless ventricular tachycardia (pVT). Refractory VF, defined as VF persisting after three defibrillation attempts, is associated with poor survival rates and neurological outcomes. Despite various pharmacologic and non-pharmacologic interventions, none have consistently demonstrated improved survival or neurological recovery in these patients. Endotracheal intubation, however, has been associated with enhanced oxygenation and ventilation after prolonged CPR and represent an important component of OHCA management protocols.

## **Case Presentation:**

We present the case of a 72-year-old male who suffered a sudden OHCA while driving, resulting in a motor vehicle collision. Emergency medical services (EMS) were promptly activated, while bystander CPR performed on-site. EMS arrived on the scene within 2 minutes and resumed the CPR. The initial rhythm assessment revealed VF, which was eventually converted to sinus rhythm after the tenth defibrillation attempt. The ALS algorithm was strictly followed, including biphasic defibrillation when indicated, high-quality CPR, advanced airway placement, high flow oxygen, administration of serial intravenous boluses of 1 mg epinephrine (1:10,000), and intravenous amiodarone (300 mg IV push followed by 150 mg IV push). After 35 minutes of CPR, return of spontaneous circulation (ROSC) was achieved, and post-resuscitation care was initiated promptly. The patient was subsequently transported to a specialized cardiac care centre.

## **Conclusion:**

To improve survival rates in OHCA, it is crucial to develop and sustain continuous CPR educational programs for laypersons. These programs can significantly contribute to improving outcomes for patients experiencing OHCA, particularly in cases of refractory VF, where immediate and effective intervention is paramount.

**Keywords:** OHCA, AED, CPR, ALS, VF, EMS, ROSC, endotracheal intubation, defibrillation, airway, epinephrine, amiodaron, oxygen

# HIPERTENZIJA KOD AKUTNOG MOŽDANOG UDARA U PREHOSPITALNIM UVJETIMA

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## Uvod

Moždani udar je drugi vodeći uzrok smrti u svijetu i jedan od najčešćih uzročnika neurološkog invaliditeta, a hipertenzija vodeći rizikofaktor. Više od 75% pacijenata sa akutnim moždanim udarom će imati sistolni krvni pritisak iznad 140mmHg u momentu prijema u bolnicu, a kod većine pacijenata vrijednosti krvnog pritiska će se vratiti vrijednostima koje su bile prisutne prije moždanog udara unutar jedne sedmice. U prvih 24 do 72 sata od nastanka moždanog udara veoma je čest prolazni porast arterijskog pritiska, ali je najbolji tretman u ovoj fazi akutnog moždanog udara i dalje je nepoznat.

## Metode rada

Studija je retrospektivna, epidemiološka, deskriptivno-analička, provedena u periodu 2018. godine. Istraživanjem su analizirani podaci iz medicinske dokumentacije protokola JU ZHMP Kantona Sarajevo, pacijenata koji su upućeni na definitivno zbrinjavanje pod dijagnozom moždanog udara, a kod kojih je u hospitalnim uslovima CT verificiran udar, kao ishemijski ili hemoragični. Proučavali su se parametri koji se odnose na dob i spol pacijenata, starosnu strukturu, da li je kod bolesnika sa moždanim udarom prisutna hipertenzija, da li je udar ishemični ili hemoragični, da li su pacijenti ranije imali hipertenziju, te vrijednosti tenzije kod hemoragijskog i kod ishemičnog udara.

## Rezultati

U studiju je uključeno 250 pacijenata u periodu 2018. godine, koji su upućeni pod dijagnozom moždanog udara. Rezultati istraživanja pokazuju da je u ispitivanom uzorku veći broj žena, njih 132 (52.8%), u odnosu na muškarce 118 (47.2%), većinom iznad 65 godina starosi kod oba spola. Ishemični udari su najzastupljeniji, a kod 154 (61.6%) pacijenta bila je prisutna hipertenzija u trenutku pregleda. Rezultati pokazuju da je većina pacijenata imala arterijsku hipertenziju, kao komorbiditet, prije udara. Kod 22 (8.8%) pacijenta ordinirana je antihipertenzivna terapija u prehospitalnim uvjetima.

## Diskusija

Ishod akutnog moždanog udara uslovljen je tipom moždanog udara i inicijalnim vrijednostima tenzije. Faktori koji dodatno utiču na ishod akutnog moždanog udara jesu dob, spol i primjena antihipertenzivne terapije prije nastupanja simptoma akutnog moždanog udara. Dosta je dokaza da visoke vrijednosti tenzije donose i goru prognozu za pacijenta s akutnim ishemičnim moždanim udarom – bilo to definirano težinom neurološkog invaliditeta kao posljedicom, recidivima ili letalnim ishodom. Također, visoke vrijednosti tenzije su povezane sa širenjem zone hemoragije. Epidemiološki, dolazi se do zaključka da je potrebno snižavati vrijednosti tenzije kod akutnog moždanog udara. Ali, patofiziološki, obzirom na gubitak normalne cerebralne autoregulacije, javljaju se dvije brige: visok pritisak može odvesti u cerebralni edem, širenje hematoma ili hemoragijsku transformaciju, prenizak pritisak može dovesti do cerebralne infarkcije i perihematomske ishemije. Iako su American Stroke Association i European Stroke Initiative dali smjernice za tretman hipertenzije poslije akutnog moždanog udara, potrebno je još istraživanja kada je u pitanju razvoj smjernica za tretman hipertenzije u toku akutne faze moždanog udara.

**Ključne riječi:** Akutni moždani udar, hipertenzija, ishemijski udar, hemoragični udar, prehospitalni tretman.



# HYPERTENSION IN ACUTE STROKE IN PREHOSPITAL SETTINGS

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## Background

Stroke is the second leading cause of death, and one of the most common causes of neurological disability, whilst hypertension is the main risk factor for stroke. More than 75% of patients presenting with acute stroke will have systolic blood pressure higher than 140mmHg at the time of admission to the hospital, and most patients will have blood pressure values return to those present before stroke onset within one week. In the first 24 to 72 hours from stroke onset, a transient rise in arterial blood pressure is common, but the best management in this phase of acute stroke is still unknown.

## Methods

The study is retrospective, epidemiological, descriptive and analytical, and was conducted for the time period of the year 2018. Research contained the analysis of data collected from the medical records of the Emergency Medical Assistance Centre Canton Sarajevo protocol of patients referred to definitive hospital treatment under the diagnosis of suspected stroke, and which were later verified by CT in the hospital, as either ischemic or hemorrhagic. Parameters that were taken into account were patient age, sex, age structure, whether blood pressure was elevated in these patients with stroke symptoms, was the stroke later verified as ischemic or hemorrhagic, whether these patients had antihypertensive treatment beforehand, as well as the values of blood pressure in ischemic as opposed to hemorrhagic stroke.

## Results

The study included 250 patients in the time period of the year 2018, which were referred to hospital treatment under the diagnosis of suspected stroke. The results of the study show that in the examined sample there was a majority of female patients, 132 of them (52.8%), in comparison to male patients of which there were 118 (47.2%), mostly above the age of 65 in both sexes. Ischemic stroke is the most common, and hypertension was present in 154 patients (61.6%) at the moment of examination. The results show that most patients also had arterial hypertension as a co morbidity, before stroke onset. Antihypertensive treatment was given in 22 patients (8,8%) in prehospital conditions.

## Discussion

The outcome of stroke is determined by the type of stroke and the initial values of blood pressure. Factors that further influence the outcome of stroke are age, sex, and antihypertensive treatment before stroke onset. There is significant evidence that high blood pressure values bring a worse prognosis for patients with acute ischemic stroke – defined either by neurological disability as a consequence, reoccurring stroke or lethal outcome. Also, elevated values of blood pressure are associated with the expansion of the hemorrhagic zone. Epidemiologically, a conclusion can be drawn that it is necessary to lower elevated blood pressure levels in patients with acute stroke. However, pathophysiologically, given the loss of normal cerebral autoregulation, two concerns rise: high blood pressure can lead to cerebral edema, hematoma expansion or hemorrhagic transformation, whereas low blood pressure can lead to cerebral infarction and perihematomal ischemia. Even though the American Stroke Association and the European Stroke Initiative have provided guidelines for the treatment of hypertension after acute stroke, more research is needed when it comes to developing guidelines for the treatment of hypertension in the acute phase of stroke.

**Keywords:** acute stroke, hypertension, ischemic stroke, hemorrhagic stroke, pre-hospital treatment

# STUDIJA SLUČAJA O ZNAČAJU PRIMJENE BENZODIAZEPINA KAO SEDACIJSKE MJERE POSTRESUSCITACIJSKOG MEDICINSKOG TRANSPORTA

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## **Uvod:**

Vanbolnički srčani zastoj je treći vodeći uzrok smrti u razvijenim zemljama, a zbog svojih specifičnosti predstavlja izazov za društvo u cjelini. Stopa preživljavanja i konačni ishod zavise od mnogobrojnih faktora koji se međusobno isprepliću, a jedan od njih jeste agitacija koja se javlja kod značajnog broja pacijenata nakon ROSC-a i ukoliko se ne tretira ima višestruko nepovoljan uticaj na konačan ishod. Zbog specifičnih uslova koji vladaju na prehospitalnom nivou, agitirano stanje pacijenta značajno utiče na kvalitetet i efikasnost pružene hitne medicinske pomoći. Pravilno upravljanje agitacijom smanjuje njene negativne efekte, te donosi benefite i za pacijenta i za medicinsko osoblje. Radi dostupnosti, indeksa sigurnosti i brzine djelovanja benzodiazepini imaju značajnu ulogu u prehospitalnom tretiranju agitacije.

## **Prezentacija slučaja:**

Naša studija slučaja se zasniva na pacijentici starosti 60 godina sa iznenadnim vanbolničkim srčanim zastojem. Nakon jedanaest minuta od početka KPR-a ostvaruje se povratak spontane cirkulacije, pacijentica bez svijesti, palpabilnog pulsa na periferiji, spontanih, ali površnih i insuficijentnih respiracija. U toku transporta pacijentica stavljena na transportni respirator sa postavkama: asistirani ventilacijski mod, MVV 7 L/min, FD 12/min, 100%O<sub>2</sub>. Unatoč odsustvu svijesti, pojavljuju se spontani pokreti i znaci koji ukazuju na intoleranciju endotrahealnog tubusa, te se ordinira midazolam 1 mg intravenski u dva navrata. U nastavku transporta pacijentica hemodinamski stabilna, spontanih i suficijentnih respiracija, bez asistiranih ventilacija transportnog respiratora. Pacijentica nakon kardiohirurškog zahvata (CABG), otpuštena sa bolničkog liječenja očuvanog kvaliteta života, samostalno funkcionalna, bez neuroloških ispada.

## **Zaključak:**

Prehospitalna sedacija ima značajnu ulogu u smanjenju rizika od nepovoljnog neurološkog ishoda nakon ROSC-a u slučaju agitacije kod intubiranog pacijenta. Kako bi prehospitalna sedacija postigla svoj značaj potrebna je edukacija medicinskog osoblja u službama hitne medicinske pomoći te usvajanje jasnih protokola i smjernica o izvođenju iste. Time bi se postiglo češće izvođenje prehospitalne sedacije, a samim tim poboljšao i konačni ishod pacijenata sa vanbolničkim srčanim zastojem.

**Ključne riječi:** vanbolnički srčani zastoj, kardiopulmonalna resuscitacija, napredne mjere životne podrške, sedacija, benzodiazepini, hitna medicinska pomoć, povratak spontane cirkulacije, endotrahealna intubacija, agitacija, oksigenoterapija

# CASE REPORT STUDY OF THE IMPORTANCE OF BENZODIAZEPINE ADMINISTRATION AS A SEDATION MEASURE IN POST-RESUSCITATION MEDICAL TRANSPORT

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## **Background:**

Out-of-hospital cardiac arrest (OHCA) is the third leading cause of death in developed countries and poses a challenge to society as a whole due to its specificities. Survival rates and final outcomes depend on numerous interrelated factors, one of which is agitation, which occurs in a significant number of patients after ROSC (Return of Spontaneous Circulation). If not treated, agitation has multiple adverse effects on the final outcome. Due to the specific conditions prevailing at the prehospital level, a patient's agitated state significantly affects the quality and efficiency of the emergency medical care provided. Proper management of agitation reduces its negative effects, bringing benefits for both the patient and medical staff. Given their availability, safety index, and speed of action, benzodiazepines play a significant role in the prehospital management of agitation.

## **Case Presentation:**

Our case study is based on a 60-year-old female patient who experienced sudden OHCA. After eleven minutes of CPR (Cardiopulmonary Resuscitation), spontaneous circulation was restored; the patient was unconscious, with a palpable peripheral pulse and spontaneous but shallow and insufficient respirations. During transport, the patient was placed on a transport ventilator with the settings: assisted ventilation mode, MVV 7 L/min, RR 12/min, 100% O<sub>2</sub>. Despite the absence of consciousness, spontaneous movements and signs indicating intolerance to the endotracheal tube appeared, prompting the administration of midazolam 1 mg intravenously on two occasions. During the continuation of transport, the patient remained hemodynamically stable with spontaneous and sufficient respirations, without assisted ventilation from the transport ventilator. Following a cardiac surgical procedure (CABG – Coronary Artery Bypass Grafting), the patient was discharged from the hospital with preserved quality of life, functional independence, and no neurological deficits.

## **Conclusion:**

Prehospital sedation plays a significant role in reducing the risk of adverse neurological outcomes after ROSC in cases of agitation in intubated patients. To achieve the significance of prehospital sedation, training of medical personnel in emergency medical services is needed, along with the adoption of clear protocols and guidelines for its execution. This would lead to more frequent implementation of prehospital sedation and consequently improve the final outcomes for patients with OHCA.

**Keywords:** OHCA, CPR, ALS, sedation, benzodiazepines, EMS, ROSC, endotracheal intubation, agitation, oxygen therapy.

## KOMPRESIVNI TUMOR MEDIJASTINUMA PRIKAZ SLUČAJA

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**Uvod:** Medijastinum je kompleksni anatomski prostor koji sadrži važne vaskularne strukture uključujući srce, velike krvne žile, limfne čvorove, djelove jednjaka i dušnika. Medijastinalni tumori su rijetki i čine 3 % svih torakalnih neoplazmi. Pojavljuju se u manje od 1% populacije, obično između 30-50 godine starosti. Najčešći tip su timomi, benigne medijastinalne ciste i limfomi. Mogu biti benignog ili malignog porijekla, smješteni u prednjem, srednjem i stražnjem medijastinumu. Uglavnom su asimptomatski i slučajno se dijagnosticiraju. Zbog invazije ili kompresije tumorske mase na okolne strukture mogu se javiti: otežano disanje, promuklost, kratak dah, krvav iskašljaj, otežano gutanje, povišena tjelesna temperatura, nagli gubitak tjelesne težine, bol u prsima, uvećani limfni čvorovi, ptoza kapka. U dijagnostici se koristi: RTG, CT sa kontrastom, MRI, PET CT, CT-om vođena biopsija i medijastinoskopija.

**Cilj:** ukazati na važnost pravovremenog postavljanja dijagnoze i primjene odgovarajućeg tretmana kod pacijentice sa rijetkim malignim tumorom.

**Prikaz slučaja:** pacijentica dobi 64.godine, javlja se zbog tegoba sa disanjem i zamaranja pri fizičkoj aktivnosti. Od ranije boluje od hronične opstruktivne bolesti i visokog krvnog pritiska. Radiološkom dijagnostikom se verificira opsežna tumorska masa medijastinuma koja se ponaša kompresivno prema svim strukturama medijastinuma. Biopsijom potvrđen maligni tumor mezenhimalnog porijekla. Odlukom multidisciplinarnog konzilija pacijentica uspješno tretirana operativno. Učinjena obostrana torakotomija. Tumor je u cjelosti uspješno uklonjen.

**Zaključak:** Medijastinalni tumori mogu biti životno ugrožavajući obzirom na lokaciju koju zauzimaju i odnos koji imaju prema okolnim strukturama kao što su disajni putevi, srce i veliki krvni sudovi. Važno je pravovremeno postavljanje dijagnoze i multidisciplinarni pristup liječenju koje ovisi o tipu tumora, lokaciji i fazi rasta.

**Ključne riječi:** medijastinalni tumor, torakalna hirurgija, anestezija

## COMPRESSIVE TUMOR OF THE MEDIASTINUM CASE REPORT

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**Introduction:** The mediastinum is a complex anatomical space that contains important vascular structures including the heart, large blood vessels, lymph nodes, parts of the esophagus and trachea. Mediastinal tumors are rare and account for 3% of all thoracic neoplasms. They appear in less than 1% of the population, usually between the ages of 30-50. The most common types are thymomas, benign mediastinal cysts and lymphomas. They can be of benign or malignant origin, located in the anterior, middle and posterior mediastinum. They are mostly asymptomatic and are diagnosed accidentally. Due to the invasion or compression of the tumor mass on the surrounding structures, symptoms may include: difficulty breathing, hoarseness, shortness of breath, bloody cough, difficulty swallowing, elevated body temperature, sudden weight loss, chest pain, enlarged lymph nodes, ptosis of the eyelid. X-ray, CT with contrast, MRI, PET CT, CT-guided biopsy and mediastinoscopy are used in diagnostics.

**Objective:** to point out the importance of timely diagnosis and application of appropriate treatment in a patient with a rare malignant tumor.

**Case report:** a 64-year-old female patient presented with breathing difficulties and fatigue during physical activity. He has been suffering from chronic obstructive disease and high blood pressure for a long time. Radiological diagnostics verifies an extensive tumor mass of the mediastinum, which behaves compressively towards all structures of the mediastinum. Biopsy confirmed malignant tumor of mesenchymal origin. By the decision of the multidisciplinary council, the patient was successfully treated operatively. Bilateral thoracotomy was performed. The tumor was successfully removed in its entirety.

**Conclusion:** Mediastinal tumors can be life-threatening due to the location they occupy and the relationship they have with surrounding structures such as the airways, heart and great blood vessels. Timely diagnosis and a multidisciplinary approach to treatment, which depends on the tumor type, location and growth stage, are important.

**Key words:** mediastinal tumor, thoracic surgery, anesthesia

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## KOMPLEKSNA INTERAKCIJA AKUTNOG POLIRADIKULONEURITISA I PRIMARNOG HIPERPARATIREOIDIZMA: PRIKAZ SLUČAJA

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**Cilj:** Cilj rada je opisati slučaj akutnog poliradikuloneuritisa kod pacijentice sa novootkrivenim hiperparatireoidizmom te uspješnu terapijsku strategiju intravenske upotrebe imunoglobulina.

**Prikaz slučaja:** 73 godišnja pacijentica je primljena u Jedinicu intenzivnog liječenja zbog poremećaja stanja svijesti po tipu kome i akutne respiratorne insuficijencije. Na prijemu izrazito lošeg općeg stanja. Daljnjom dijagnostičkom obradom potvrđi se dijagnoza akutnog poliradikuloneuritisa i primarnog hiperparatireoidizma. Odmah po postavljanju dijagnoze provedena je terapija intravenskom primjenom imunoglobulina u trajanju od 5 dana te terapija bifosfonatom. Nakon završenog terapijskog ciklusa prati se daljnji pozitivni razvoj kliničke slike gdje postepeno dolazi do oporavka mišićne snage, senzibiliteta i bulbarne muskulature.

**Zaključak:** Akutni poliradikuloneuritis je inflamatorno stanje u sklopu kojeg se može razviti ozbiljna komplikacija kada je zahvaćena respiratorna muskulatura kada takvi pacijenti zahtijevaju i mehaničku ventilaciju. U našem slučaju pravilnim planom dijagnostičkih procedura te multikonzilijarnim djelovanjem brzo se došlo do ispravne dijagnoze a samim time i ciljnog terapijskog protokola i brzog odgovora uz pozitivan ishod.

**Ključne riječi:** akutni poliradikuloneuritis, intravenski imunoglobulini, primarni hiperparatireoidizam, bulbarna muskulatura.

# EFFICACY OF EPIDURAL STEROID INJECTIONS IN CHRONIC PAIN TREATMENT

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**Introduction:** Radicular pain is typically caused by nerve root irritation due to mechanical compression by a herniated intervertebral disc and subsequent inflammation, or other conditions that result in neuroforaminal stenosis. Epidural steroid injections (ESI) have successfully been used for the treatment of radicular pain. Pain specialists in our hospital have been performing ESI for radicular pain treatment since the beginning of 2023.

**Aim:** To assess efficacy of ESI performed in our hospital during a 6-month period.

**Materials and Methods:** We gathered data of all patients treated in our hospital with either interlaminar or transforaminal ESI in lumbosacral spine, or caudal ESI. We compared numeric rating scale (NRS) scores before and at least two weeks after the procedure using paired T-test.

**Results:** From September 10 2023 to March 10 2024, we performed 63 ESI procedures (26 transforaminal LS, 29 interlaminar LS, and 8 caudal). Fifteen patients were lost to the follow-up. In transforaminal LS ESI group ( $N_{if}=20$ ), average of differences of NRS scores was 3.8,  $t=6.418$  and  $p<0.0001$ . In interlaminar ESI group ( $N_{if}=21$ ), average of differences was 3.095,  $t=5.18$  and  $p<0.0001$ . In caudal ESI group ( $N_c=7$ ), average of differences of NRS scores was 3.143,  $t=4.26$  and  $p=0.005$ .

**Conclusion:** ESI procedures statistically significantly decreased radicular pain.

## INTRODUCTION

Epidural steroid injections (ESIs) have been a cornerstone in managing radicular pain from lumbar disc injuries since the 1950s. Radicular pain, which radiates along the distribution of a spinal nerve root, is commonly caused by conditions like herniated discs, where the disc material compresses the nerve root. This compression leads to inflammation and neuropathic pain.<sup>1,2</sup>

The primary aim of ESIs is to reduce inflammation around the affected nerve roots, thereby alleviating pain and improving function. They are particularly beneficial for patients whose pain significantly disrupts daily activities and who find limited relief from oral medications. ESIs are also used to address other causes of nerve root compression, such as spondylosis (degenerative changes in the spine), spondylolisthesis (slippage of one vertebra over another), and ligamentum flavum hypertrophy (thickening of the *ligamentum flavum* leading to neuroforaminal stenosis).<sup>1,3</sup>

While ESIs can offer significant relief, especially in acute cases, their efficacy can vary. Some patients experience substantial pain reduction and improved function, while others may have only temporary relief. The decision to use ESIs often depends on the severity of symptoms, the response to other treatments, and the specific diagnosis. For ongoing or severe symptoms that do not improve with conservative treatments, ESIs remain a valuable option in the pain management toolkit.<sup>2,4</sup>

In our hospital, pain specialists (all of them anesthesiologists) have been performing lumbosacral (LS) and caudal ESI procedures since the beginning of 2023, and cervical ESI since July 2024.

## AIM

In this study, we aimed to assess efficacy of transforaminal lumbosacral (LS) ESI, interlaminar LS ESI, and caudal ESI procedures performed in our hospital during a 6-month period.

## MATERIALS AND METHODS

We gathered data of all patients treated in our hospital during a 6-month period with either interlaminar or transforaminal ESI in lumbosacral spine, or caudal ESI. We compared numeric rating scale (NRS) scores before and at least two weeks after the procedure using paired T-test.

## RESULTS

From September 10 2023 to March 10 2024, we performed 63 ESI procedures (26 transforaminal LS, 29 interlaminar LS, and 8 caudal). Fifteen patients were lost to the follow-up, as they did not show up for a scheduled control.

Average age of patients in transforaminal ESI group was 55.8 years, 65 years in interlaminar ESI group, and 64.9 years in caudal ESI group. Twenty-seven of our subjects were male and 36 were female. Age and gender did not significantly differ among the groups.

In transforaminal ESI group ( $N_{TF}=20$ ), average of differences of NRS scores was 3.8, with  $t_{TF}=6.418$  (critical value 2.093) and  $p_{TF}<0.0001$ . In interlaminar ESI group ( $N_{IL}=21$ ), average of differences was 3.095,  $t_{IL}=5.18$  (critical value 2.086) and  $p_{IL}<0.0001$ . In caudal ESI group ( $N_C=7$ ), average of differences of NRS scores was 3.143,  $t_C=4.26$  (critical value 2.447) and  $p_C=0.005$ .

## DISCUSSION AND CONCLUSION

In all three groups of subjects, performed ESI procedures significantly reduced pain. Average of differences of NRS scores in the three groups did not significantly vary. Considering smaller sample size in the caudal ESI group, it was hard to expect to reach statistical significance similar to the other two groups; however, the results indicate that this procedure also led to significantly decreased NRS scores.

It is important to note that ESI procedures are not risk-free. In a study which analyzed data of 4265 injections performed, the most common complications were increased pain (1.1%), pain at injection site (0.33%), and persistent numbness (0.14%).<sup>5</sup>

Although fluoroscopy improves safety and efficacy of these procedures, complications can still occur. Possible complications include: bleeding, infection, allergic reaction, nerve injury, transient lower or upper extremity numbness and tingling, dural puncture (causing positional headache), epidural abscess, epidural hematoma, transient back or lower extremity pain, adrenal suppression, and side effects of steroids, such as transient flushing or hot flashes, fluid retention, weight gain, elevated blood sugars, and mood swings.<sup>1,6</sup> It is important to always keep in mind possible complications and a plan for their management.

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