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Adresa uredništva / Editorial Office
Acta Chirurgica Croatica
Klinika za kirurgiju, KBC Zagreb
Kišpatićeva 12
10 000 Zagreb
E-mail: petra.matjasec@kbc-zagreb.hr

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WAR SURGICAL REPAIR OF ARTERIAL INJURIES BY USING ANTERIOR RECTUS SHEATH GRAFT

Izvješće o zbrinjavanju ratnih ozljeda arterija zakrpom od prednjeg lista ovojnice ravnog trbušnog mišića

Josip Husar

Dear Editor,

the intention of this letter is to report how we performed surgery on the spot, under war and battle conditions. The aim is not to teach, propose, make surgical strategy or even doctrine. Just to report how it was done, ON THE SPOT, during the last war in Croatia.

This is a war surgeon's report of experimental and clinical experiences using the anterior rectus sheath graft (the strongest membrane in the human body) as a patch for repair of great arteries injured under war conditions. Such injuries are primarily contaminated and the use of xenografts can be dangerous due to infection. The rectus sheath patch as a potentially growing material was used for repair of congenital heart lesions as atrial septal defect (ASD) primum type. Experimentally, in sheep, the rectus sheath graft was used for repair of femoral arterial artificial lesions. After six months the affected vessels were histologically examined. In both models, animal and human, so far hasn't been observed: early bleeding from rectus sheath patches, infection, aneurysmal dilatation or scar contraction. No manifestation of peripheral emboli was seen as well as no aneurysmal formations, rupture, calcifications or deformations. On the contrary, so far the covering of the lumen by vascular endothelium, laminations of media, formation of serosa layer elements and vascularization of the graft and adventitia like tissue have been observed and reported. During the Croatian War of Independence this kind of surgical repair has been applied on 184 patients with excellent results.

Conclusion

The material is suitable for surgical repair of great vessel injuries, because it is as an autograft usable in infected wounds and available on the spot in satisfactory size in the body of the patient, which is crucial for on the spot application in the field, and it has a growing potential and does not require anticoagulant therapy.

Introduction

The great Croatian war surgeon Prim. Dr. Vatroslav Florschütz wrote a serial of reporting letters from the battle fields in the World War I to illustrate to the following generations of surgeons [1] the implementation of great surgery on battle spot.

This letter is following his work with the same aim: to inform new coming generations of surgeons about surgery under war conditions and on the spot in the last war in Croatia.

Open war surgical wounds are mostly contaminated. Great arteries are very often damaged in open wounds caused by high velocity missiles or sharp weapons [2, 3] widely used in war conflicts, especially in low intensity wars as the one in Croatia 1990–1996 [4, 5]. Elective surgical repairs like lateral vessel suture and prosthetic xenograft are not appropriate due to extended arterial damage caused by molecular stress and infection of war wounds. Very often xenografts are not available on the spot in field surgery [2, 3]. The use of the patient's vein graft is very often limited by the caliber and area of damaged artery. Delay in operation or transportation very often leads to amputation of the limb, because the golden period for repair of the great arteries is only few hours or even less. At the beginning of the Croatian War of Independence a team of war surgeons from the Mobile Surgical Teams (MST) of the Croatian Special Police Forces (SJP-MUP-RH) [4, 5] began a research concentrating on material which is as a homograft suitable for use for repair in the host's infected wound and as human tissue available on the spot as a part of the victim's body.

Following surgical experiments and results of Anagnostopulos, Coursair and Lam [6–8], the research started with experimental surgery on arteries of sheep. Early and late results encouraged us to continue. After histologic confirmations that the anterior rectus sheath graft is suitable for repair of the great arteries, we started to use such patches as autografts for surgical repair of human arteries under war conditions, on the spot.

Material and methods

The anterior rectus sheath used as a patch for surgical repair of arteries was first tested on animals. After reconfirmation that the anterior rectus sheath patch is a suitable material for surgical repair of arteries, the patch was used as a material for surgical repair of arteries under war conditions.

Animal experiment

Fifty sheep aged four weeks (breed Croatian Pramenka) were operated upon.

Surgical technique: sedation by Sedalin (acepromazin) 0.1 mg/kg and I.V. anesthesia by ketamine 10 mg/kg.

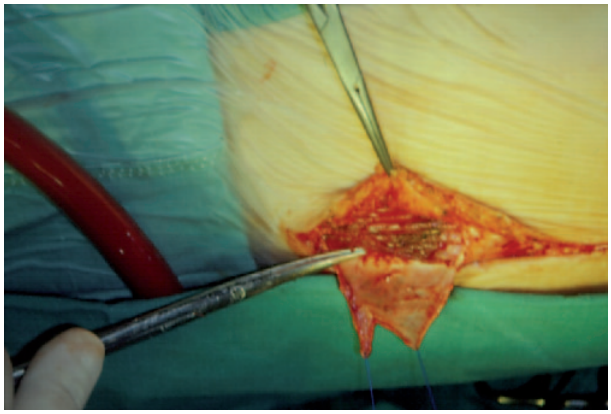
The anterior rectus sheet patch was placed on the longitudinal incision of both femoral arteries. The external surface of the anterior rectus sheath always has to be placed towards the lumen of the vessel. During the first five postoperative days the blood flow was controlled with a Doppler device. After six months the arteries were examined histologically.

War surgical experience

During the Croatian War of Independence in every unit of the Special Police Forces a Mobile Surgical Team was incorporated [4, 5], sometimes more than one depending on strategic situation on the spot, following the Croatian War Surgical Tradition and the strategy of the father of Croatian field surgery Prim. Dr. Vatroslav Florschütz from the World War I [1].

The anterior rectus sheath as a patch for surgical repair of arteries was widely used as a standard procedure by Mobile Surgical Teams. Surgical procedures on various arteries and the number of complications are shown in Table 2. Surgical technique was very simple; after stabilization of the patient and indication for surgical repair of arteries, a patch of the anterior rectus sheath was removed through perirectal incision. The damaged artery was repaired using such a patch or tubular graft. The tubular graft was formatted according to size and length of the damaged artery. First approximation of proximal and distal anastomosis diameter was performed, using single and running stitches. Then the lumen was closed with a longitudinal running stitch. No wrapping of the graft was performed. Surgical techniques by Volmar, Carrel and Zollinger were commonly used. The grafting should always position the external surface of the anterior rectus sheath towards the lumen of the vessel. The patient was monitored in a standard way.

Figure 1. Preparation of the anterior rectus sheath graft.



The patients were not placed on anticoagulant therapy due to lack of proper monitoring, possible reoperations and concomitant lesions of other organs and systems. Monitoring was performed with a portable Doppler machine and clinical observation of the limb and/or wound. After the casualties stabilized, they were transported to hospitals in non-combat areas of the country, mostly by helicopter. No later complications were recorded or reported.

Results

Experimental surgery – animal model

Table 1 shows that there were no surgically related complications among sheep operated upon using the anterior rectus sheath graft as a patch to close the incision of both femoral arteries. After six months the sheep continued their growth together with their arteries, without any signs of circulation related problems.

Histologic examination of the operated part of each artery was performed.

Table 1. Experimental surgery – animal model.

Arteries	Rectus patch	Bleeding	Thrombosis	Infection	Other surgical complications
Common femoral right	50	0	0	0	0
Common femoral left	50	0	0	0	0
Total	100	0	0	0	0

Macroscopic and microscopic histologic findings

Macroscopic

Repaired parts were intact without any signs of thrombosis, calcification or formations of aneurysm. Consequently, there were no signs of degeneration of the operated part of the vessel after the application of the anterior rectus sheath patch.

Microscopic

They showed normal vessel thickness of the vessel wall, without any calcifications.

Three layers of transmural zones:

1. intimal layer shows cellular proliferation with endothelium,
2. media shows fibrous lamellas,
3. external layer shows adventitia like tissue vascularized like normal adventitia of the great vessels.

War surgical results are listed in Table 2.

The patients were operated by surgeons of the Mobile Surgical Teams on the spot or in the nearest hospital by surgeons from the MST.

The mean age of the included patients was 23.58 +/-7. Gender 100% males.

It is visible that the anterior rectus sheath graft was used in 114 (57%) cases of the entire war surgical repair of great arteries, mostly on aorta and iliac arteries, and femoral arteries to the level of about 100%.

Lower arteries were repaired by other surgical techniques, so the use of rectus patch or tubular graft was mostly on the great arteries.

Number of early reoperations: on 29 patients (14%) due to thrombosis and on 17 patients (9%) due to early postoperative bleeding.

No later complications were recorded or reported.

Table 2. Early postoperative complications. War surgical repair.

Artery	Number	Patch	Tubular graft	Intervention / thrombosis	Intervention / bleeding
Aorta abdominal	12	12	0	0	3
Iliac common	14	14	0	0	2
Iliac external	8	8	0	0	1
Femoral common	46	46	0	5	5
Femoral superficial	28	12	16	7	2
Popliteal	52	12	27	4	1
Axillar	21	7	14	5	2
Brachial	16	3	13	8	1
Total	197	114	70	29	17

Discussion

Material of choice for surgical arterial repair under war conditions

War injuries of the great arteries and veins are a common cause of war mortality and morbidity [3, 4]. During war surgical history various techniques have been applied: compression, cauterization and mostly ligation and amputation [2, 3, 8]. Ischemia leads to amputation and massive bleeding, and to shock and sepsis. Late in war surgical history appeared surgical reconstruction of blood vessels on the spot – battlefield hospitals [2, 3, 8]. Venous allografts and homografts are suitable in low percent of casualties. In elective non-war vascular surgery prosthetic grafts are commonly used and followed by low complication rate. Indication for the use of synthetic grafts in war vascular surgery is very narrow, only for blunt injuries. In the Vietnam War, the surgical team of colonel Rich mostly used the vein [3]. In case of that vein being unsuitable, amputation was performed [3].

Frequent problems associated with the use of synthetic grafts are: infection, thrombosis, sepsis and amputation.

Venous homograft

This is a common method with some limitations: not enough material for the repair of big vessels, especially aortic, iliac and femoral arteries. The veins of upper extremities have a small caliber. Neck veins are not suitable for surgical repair of blood vessels. Serious circulatory problems and even thrombosis were reported after extirpation of lower extremity veins. This can compromise recovery of polytrauma patients. Surgical cleaning of the other extremity and preparation of the vein is very often a waste of time [3].

Results of animal experiments about the use of synthetic grafts for blood vessel repair in infected war surgical wounds showed a high infection rate and failure of repair, and were followed by local or disseminated sepsis.

Many of war surgical doctrines, International Committee of the Red Cross (ICRC) and other, have forbidden the use of synthetic grafts for vascular repair under war conditions.

Complications related to the use of synthetic grafts and veins are the same as in the large trials. Saphenous vein grafts often show fusiform aneurysm formation and intimal hyperplasia. Small arteries were opened shortly after reconstruction. Long term studies pointed out that venous and synthetic grafts often lead to complications related to formation of aneurysms, especially after the use of venous grafts, in some follow up studies up to 100%.

What makes war vascular surgery different? [4, 5]

The problem of war surgeons is to find material for reconstruction of the vascular injury in war conditions [2, 4, 8] on the spot. When we can perform repair using lateral arterial suture or end-to-end anastomosis there are no problems, but problems occur when we are faced with the need to repair large caliber vascular injury [2, 3, 8].

Very often war surgeons are under pressure related to strategic battlefield situation, time management, tired and overloaded personnel, and availability of transfusion service [3, 4].

Two choices: new material or amputation?

Use of synthetic materials and venous grafts is of limited availability [2, 3].

New material

According to surgical standards, till the Croatian War of Independence only polytetrafluoroethylene (PTFE) was available for surgery of infected wounds and burns.

History

Anterior rectus sheath graft

Coursair and Lam in 1952 performed plastic repair of coarctation of a dog's aorta using the anterior rectus sheath patch. Stanley in 1982 used a tubular graft made from anterior rectus sheath for replacement of part of thoracic aorta in dogs [8]. After angiographic follow up, growing of tubular graft was reported. Aorta showed growth of about 22.25% in six months and tubular grafts of 22.85%. Histology did not show any calcification or rupture. Authors found laminations of graft and cellular proliferation. The inner layer was covered by vascular endothelium, while adventitia like tissue was found on the surface. The same team repeated the experiment and confirmed earlier results. The growth of graft together with host aorta was noted. Again histology showed vascularization of the graft and formation of elements like media and serosa in the growing graft.

Growing possibility was observed in the use of fresh rectus sheath as a patch. Growing possibility in rectus sheath grafts treated with acetone was not observed.

The mechanical, physical and biodynamical characters of the anterior rectus sheath grafts were tested. The results showed that the anterior rectus sheath as a patch is reliable and trustworthy for use as a patch in vascular surgery [6–8]. Later on they stopped with the use of rectus patch on arteries and shifted towards creation of artificial heart valves.

In the Croatian War of Independence the Mobile Surgical Teams were incorporated into the Special Police Forces Units. Very often they operated on the spot close to the line of fire [4, 5], following the Croatian War Surgical Tradition [1]. The war was of low intensity characterized by wide use of high velocity missiles [4, 5]. As War Commander of the Mobile Surgical Teams of the Police Special Forces (SJP-MUP-RH), due to increased number of vascular injuries and surgical repairs, I started with routine use of anterior rectus sheaths as grafts for surgical repair of arteries under war conditions. Before the beginning, the animal experiment has been performed. The Ethics Committee allowed the use of anterior rectus sheath in vascular and congenital cardiovascular surgery. Early and late experimental results confirmed the results pointed out by other investigators in this field.

Table 1 shows the results are totally consistent with the results of Coursair and Lam [8], Stanley and Anagnostopulos [6, 7]. They do not coincide with the results of Riddez and Vaughan, they used venous and synthetic grafts for surgical repair of war vascular injuries.

A silent period in the available literature of auto grafts in vascular surgery followed. After the last work of Athanasuleas and Sawatari, all the interest was moved to xenografts and polyurethane based prosthesis. Nowadays the focus is on tissue engineered grafts, which means that no new data about rectus sheet grafts are available.

There were no aneurysmal formations, no rupture, no calcifications and no deformations. On the contrary, the covering of the lumen by vascular endothelium, laminations of media, formation of elements of serosa layer and vascularization of the graft and adventitia like tissue has been observed and reported. After the war, the anterior rectus sheath graft was used as a graft in congenital heart surgery with the permit of the Ethics Committee of the University of Zagreb School of Medicine.

Wide use of rectus sheath graft in the field of vascular surgery confirmed the results of the experiments. As can be seen in Table 2, the anterior rectus sheath patch was used 114 times and 70 times as a tubular graft. By repair of arteries widely resected due to molecular stress damage. Reoperation rate due to thrombosis and bleeding should be considered not only as a surgical complication. All the patients were war casualties affected by high velocity missiles and very often in hydrodynamic shock. Molecular distress of the surrounding tissue is also an important factor in analysis of the development of complications. The early surgical reoperation rate should not be compared with rate in non-trauma patients. The patients were not placed on anticoagulant therapy. It is an additional argument for anterior rectus patch grafting as a suitable surgical procedure. No later complications were recorded or reported. It means that after the use of anterior rectus sheath as a patch or tubular graft, anticoagulant therapy is not necessary, which is very important for polytrauma patients under surgical care in the field.

Conclusion

After taking into consideration experimental tests dealing with the use of the anterior rectus sheath as a patch, and after wide war surgical use for repair of vascular injuries, mostly contaminated, and after clinical and histologic follow up, we can conclude that patch or tubular grafts created by using anterior rectus sheath could be a reasonable surgical technique for repair of infected injuries of the great vessels under war conditions.

Positive aspects of using the anterior rectus sheath as patch or tubular graft

- graft biodynamic stability
- autograft
- available in every patient as a part of the body
- applicable on the spot
- does not require anticoagulant therapy
- develops histologic transformation to blood vessel

The graft has been used in cardiac surgery [9].

Josip Husar, MD
Retired Brigadier of the Croatian Army, War Comander of the Mobile Surgical Teams of the Croatian Ministry of Internal Affairs-Special Police-SJP-MUP-RH

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JEDNODNEVNA KIRURGIJA KAO SASTAVNI DIO MODERNE BOLNICE 21. STOLJEĆA

One day surgery as an integral part of the 21st century modern hospital

Anko Antabak, Ivan Šeparović

Poštovani gospodine uredniče,

ovo pismo sastavljeno je s ciljem prezentacije načina rada u jednodnevnoj kirurgiji onima koji se nisu imali prilike susresti s izazovom rada u takvoj jedinici. Jednodnevna kirurgija najmlađa je organizacijska jedinica Klinike za kirurgiju Kliničkoga bolničkog centra Zagreb koja omogućuje brzo, efektivno i financijski učinkovito zbrinjavanje pacijenata pridonoseći na taj način boljem funkcioniranju cijele bolnice, a samim time i cjelokupnog zdravstvenog sustava.

Uprava KBC-a Zagreb krajem 1998. godine krenula je u projekt Dnevne bolnice kirurških struka. Osnovani smo 14. ožujka 2008. godine te smo po uzoru na Britansko društvo dnevne kirurgije definirali pojam jednodnevne kirurgije kao prijem odabranih bolesnika s planiranim kirurškim zahvatima koji se isti dan vraćaju kući, uz minimalnu bolničku opservaciju u trajanju od četiri sata. Ti bolesnici zahtijevaju pun sadržaj operacijske sale ili opću anesteziju. Uz bolesnike ovog tipa, isti tim u istom prostoru paralelno je operirao i ambulantnu kirurgiju. Način financiranja ovih usluga u početku je bio po principu usluga plus materijal, plus dnevni boravak. Naknadno je uvedena kombinacija navedenog i plaćanja po terapijskom postupku (PPTP), a 2009. godine uvodi se financiranje po dijagnostičko terapijskom sustavu (DTS koeficijent – koeficijent dijagnostičko terapijske skupine). Vrijednost DTS koeficijenta u razdoblju od 1. siječnja 2009. do 1. svibnja 2013. mijenjana je osam puta, a od 1. travnja 2012. uvedena je podjela na kirurški i nekirurški DTS. Sve ove promjene administrativno su smanjile vrijednost usluga koje pružamo.

Nacionalni plan razvoja kliničkih bolničkih centara, kliničkih bolnica, klinika i općih bolnica u Republici Hrvatskoj od 2014. do 2016. dnevnu bolnicu definira kao modalitet bolničkog liječenja koje ne traje dulje od 16 sati u tijeku jednog dana [1]. Temeljni preduvjeti su da operacija traje kraće od dva sata i može se izvesti bez gubitka krvi, a postoperativnu bol moguće je kontrolirati peroralnim analgetikom. Pri uspostavljanju jedinice za jednodnevnu kirurgiju treba imati na umu da kirurške djelatnosti ne mogu samo na temelju administrativnih uputa prijeći na rad u dnevnim bolnicama. Također, tek je nešto više od 20 kirurških postupaka pogodnih za rad u jednodnevnoj kirurgiji, kod prethodno probranih bolesnika.

Prostor Specijalističkog zavoda za jednodnevnu kirurgiju Klinike za kirurgiju KBC-a Zagreb dio je zgrade poliklinike, površine oko 200 m^2. Uključuje četiri operacijske sale te prateće prostore za prijeoperativnu i poslijeoperativnu njegu pacijenata. Prvotno je Zavod bio sistematiziran kao Odjel jednodnevne kirurgije (OJK). Unutar odjela formirane su i tri obračunske šifre za razvrstavanje faktura, ovisno o tome koje su usluge bile pružene i kako su se mogle fakturirati. S vremenom je rastao broj odjela i usluga, a samim time i broj osoblja.

Specijalistički zavod za jednodnevnu kirurgiju je samodostatna jedinica koja ima vlastitu opremu, instrumentarij i medicinsku tehniku za izvođenje zahvata. Od bolničkih resursa koristi se isključivo sterilizacija. Ne dolazi do miješanja bolesnika koji borave u bolnici i koriste akutne bolničke resurse te onih koji se liječe u sklopu Specijalističkog zavoda za jednodnevnu kirurgiju. Osoblje trenutno čine dva kirurga, glavna sestra, četiri medicinske sestre, pomoćni djelatnik i spremačica. Na ispomoći su jedan specijalizant i dva mlada kirurga. Anesteziološki tim koristimo samo dva puta tjedno po pola radnog vremena. Fakturiranje usluga i drugu administraciju provodimo unutar dnevne bolnice pa je do kraja dana pripremljena sva administracija, medicinska dokumentacija, sve fakture te sav promet materijala i medikamenata.

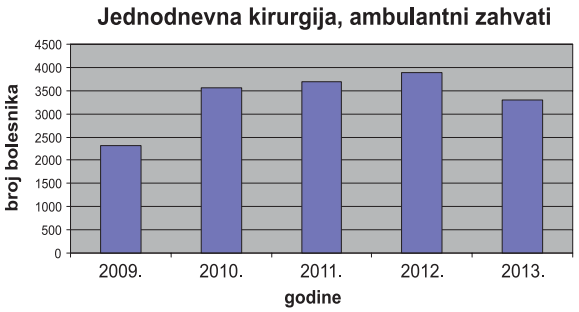
Specijalistički zavod za jednodnevnu kirurgiju informatiziran je te sa četiri računala povezan s bolničkim informacijskim sustavom (BIS). Tako se iz poliklinickih ambulanti (abdominalne, dječje, plastične, opće kirurške, proktološke i vaskularne kirurgije) i s bilo kojeg drugog mrežnog računala preko interneta rezerviraju slobodni termini za operacijsko liječenje. Istovremeno u bolnički informacijski sustav nakon operacijskog zahvata kirurg unosi cjelokupnu medicinsku dokumentaciju, a potom i fakturira izvršene usluge Hrvatskom zavodu za zdravstveno osiguranje (HZZO). Naš administrator sve fakture pohranjuje u mapu dnevne bolnice koja se na kraju radnog dana zatvara. Operacijski program počinje u 8 sati, a svi bolesnici napuštaju jedinicu prije 16 sati. Do podne radimo zahvate jednodnevne kirurgije, a nakon 12 sati

ambulantne zahvate i ambulantne preglede. Od početka rada 2008. godine do kraja 2009. napravili smo 2326 ambulantnih zahvata i 100 operacija koje smo fakturirali DTS gruperom (grafikon 1). Broj ambulantnih zahvata kreće se na godišnjoj razini do 3868, što znači prosječno oko 20 bolesnika dnevno tijekom otprilike 200 radnih dana godišnje. Puno je teže bilo uvođenje jednodnevnih kirurških zahvata, koji su uz to morali biti posve sigurni za bolesnika. Tijekom svih ovih godina samo je četvero bolesnika nakon dnevnog kirurškog zahvata poslano na nastavak opservacije na bolnički odjel. U dva slučaja radilo se o nekirurškom razlogu, a u dva slučaja o suspektnom krvarenju. Broj operacija u jednodnevnoj kirurgiji koji se mogao obračunati po DTS-u varira do maksimalno 303 bolesnika (grafikon 2). U prvih devet mjeseci 2014. godine najčešće su izvođene operacije preponskih hernija (166 bolesnika), pinoidalnih sinusa (35 bolesnika), umbilikalnih hernija (25 bolesnika) i varikoznih vena (25 bolesnika). Točno polovica bolesnika operiranih radi hernija operirana je u lokalnoj anesteziji. Ukupno, u devet mjeseci 2014. godine, u jednodnevnoj kirurgiji izvedeno je (obračunatih po DTS-u) 299 operacija u jednodnevnoj kirurgiji i 2780 ambulantnih zahvata. Istim tempom do kraja ove godine opravdano je očekivati oko 500 zahvata jednodnevne kirurgije i 4000 ambulantnih zahvata.

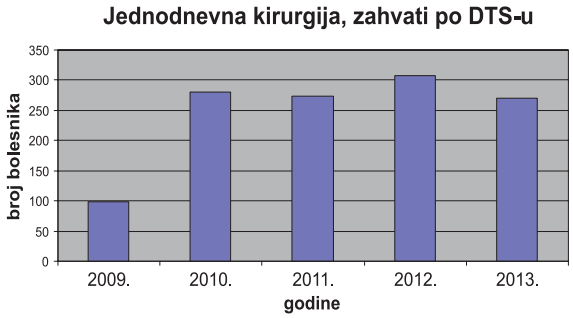
Od početka 2014. godine u jednodnevnoj kirurgiji kod nas se izvode i tretiraju cirkumcizija djece, ubilikalne i ventralne hernije, ingvinalna hernija kod djece u općoj anesteziji, a kod odraslih u lokalnoj ili općoj anesteziji, kriptorhizam, analne i perinealne fistule, pinoidalni sinus u lokalnoj anesteziji, hemoroidi, striping i ligacija varikoznih vena, operacija otapostaze, karpalnog tunela, odstranjenje osteosintetskog materijala, odstranjenje centralnih venskih katetera, ekstirpacije gangliona i Dupuytrenovih kontraktura šake i prstiju, biopsije limfnih čvorova, mišića i živaca kod djece. Izrazito najčešći zahvati jednodnevne kirurgije su postupci zbog ingvinalne kile, a to su ujedno i najčešće izvođeni kirurški zahvati [2]. U Hrvatskoj je tijekom 2013. godine na teret HZZO-a izvedeno 5987 ovih zahvata, s prosječnim trajanjem hospitalizacije 4,15 dana, što znači da su gotovo 24 896 dana bolničkog liječenja zauzimali bolesnici s kilama. Hipotetski, kada bi svi bili liječeni unutar jednodnevne kirurgije, 18 859 dana bolničkog liječenja bilo bi slobodno, što je jedan kirurški odjel od 51 postelje kroz godinu dana. Dakle, zamjena akutnih postelja posteljama dnevne bolnice ima smisla i u kirurgiji, jer dnevna kirurgija daje bolesniku fokusiranu skrb. Ona isključuje prezauzetog kirurga, sam kirurg unaprijed određuje dan i sat operacije. Jednodnevnu kirurgiju radi isključivo iskusan kirurg supspecijalist čime određena operacija zapravo postaje visoko kvalitetna usluga. Pri tome je rizik od hospitalne infekcije zanemariv. Ovakvim se radom akutne postelje oslobađaju za teže bolesnike.

Protočnost bolesnika je višestruka, a iskorištenost opreme optimalna. Uspostavljanje jednodnevne kirurgije pridonosi boljoj njezi bolesnika jer se radi o učinkovitoj usluzi koja za pojedine operacijske zahvate potpuno eradicira liste čekanja. Tako pridonosi bržem liječenju svih bolesnika, kako bolničkih, tako i pacijenata jednodnevne kirurgije.

Tablica 1. Pregled ambulantnih zahvata po godinama.



Tablica 2. Pregled zahvata jednodnevne kirurgije po godinama.



Prof. dr. sc. Anko Antabak, dr. med., pročelnik Specijalističkog zavoda za jednodnevnu kirurgiju, Klinika za kirurgiju, KBC Zagreb

Ivan Šeparović, dr. med., kirurg Specijalističkog zavoda za jednodnevnu kirurgiju, Klinika za kirurgiju, KBC Zagreb

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MULTIDRUG-RESISTANT MICROORGANISMS AND SURGICAL ANTIBIOTIC PROPHYLAXIS – PREVALENCE AT THE UNIVERSITY HOSPITAL CENTRE SESTRE MILOSRDNICE

Višestruko otporni mikroorganizmi i kirurška antibiotska profilaksa – prevalencija u kliničkom bolničkom centru sestre milosrdnice

Ana Gverić Grginić[1], Ružica Grozdek[2], Zrinka Bošnjak[3,4], Tamara Bošnjak[5], Ana Budimir[3,4]

Abstract

Aim

Emergence and spread of multidrug-resistant (MDR) microorganisms in healthcare settings, especially in Intensive Care Units (ICUs), cause concern worldwide. A particular problem is a lack of therapeutic options. One of the inducement factors for MDR microorganisms spread is antibiotic over- and wrong-prescribing. Surgical antibiotic prophylaxis is one of the misused antibiotic prescribing indications. The aims of our study were to determine the prevalence of five key MDR bacteria from blood and urine in order to establish surgical antibiotic prophylaxis compliance with the Croatian National Guidelines.

Methods

A point prevalence study was conducted. We present a laboratory-based WHO designed survey on MRSA, VRE, ESBL and CRE-producing *Enterobacteriaceae*, multi-resistant *Acinetobacter spp.*, isolated from blood and urine of hospitalised patients. Surgical prophylaxis data were gathered from patients who had undergone operative procedures in the General Surgery Ward and Gynecology Ward.

Results

The prevalence of MRSA bloodstream infections was 1.64%, other MDR microorganisms were not isolated.

The prevalence of urine MDR isolates was MRSA 0.07%, *E. coli* ESBL 1.43% (5.79% of overall *E. coli* isolates were ESBL producers), *K. pneumonie* 1.79% (26.3% of *K. pneumoniae* were ESBL producers) and *Acinetobacter spp.* 0.38%. The proportion of patients who continued surgical prophylaxis was 6.4%.

Conclusion

MDR microorganisms' prevalence in our institution is low, but the proportion of resistant strains within isolated species corresponds to European reports. Surgical antibiotic prophylaxis compliance with the Croatian National Guidelines is high.

Constant and recent surveillance data are a significant guide for empiric antimicrobial therapy, an indicator for activities concerning the prevention of MDR microorganisms spread and proper antibiotic stewardship.

Keywords

drug resistance, multiple, bacterial, Gram-positive bacteria, Gram-negative bacteria, prevalence, antibiotic prophylaxis

Sažetak

Cilj

Pojava i širenje višestruko otpornih mikroorganizama (MDR) u okruženju zdravstvene njege, posebice u jedinicama za intenzivno liječenje, uzrokuju zabrinutost diljem svijeta. Poseban problem je nedostatak terapeutskih mogućnosti. Jedan od uzročnih faktora širenja MDR mikroorganizama je pretjerano ili pogrešno

[1] *Department of Microbiology, Parasitology and Hospital Infections, University Hospital Centre Sestre Milosrdnice, Zagreb, Croatia*

[2] *Infection Control Team, Clinic for Tumors, University Hospital Centre Sestre Milosrdnice, Zagreb, Croatia*

[3] *Clinical Department of Clinical and Molecular Microbiology, University Hospital Centre Zagreb, Zagreb, Croatia*

[4] *School of Medicine, University of Zagreb, Zagreb, Croatia*

[5] *Department of Gynecology and Obstetrics, University Hospital Centre Split, Split, Croatia*

Corresponding author: Ana Gverić Grginić, MD, Department of Microbiology, Parasitology and Hospital Infections, University Hospital Centre Sestre Milosrdnice, Vinogradska cesta 29, Zagreb, Croatia, tel.: +385 91 5384 352, e-mail: ana.gveric.grginic@kbcsm.hr

propisivanje antibiotika. Ciljevi ove studije bili su utvrditi prevalenciju pet najvažnijih MDR bakterija iz krvi i urina da bi se kirurška antibiotička profilaksa uskladila s Hrvatskim nacionalnim smjernicama.

Metode

Provedena je studija prevalencije infekcija u određenom vremenu. Prikazani su laboratorijski podaci o sljedećim bakterijskim uzročnicima infekcija: MRSA, VRE, ESBL i enterobakterije koje produciraju karbapenemaze, te višestruko otporna *Acinetobacter spp.*, izolirane iz krvi i urina hospitaliziranih pacijenata. Podaci o kirurškoj profilaksi prikupljeni su od pacijenata koji su bili podvrgnuti operativnim zahvatima na Odjelu opće kirurgije i Odjelu ginekologije.

Rezultati

Prevalencija MRSA infekcija krvi bila je 1,64%, drugi MDR mikroorganizmi nisu bili izolirani. Prevalencija urinarnih MDR izolata bila je sljedeća: MRSA 0,07%, E. coli ESBL 1,43% (5,79% ukupnih *E. coli* izolata bilo je onih koji proizvode ESBL), *K. pneumonie* 1,79% (26,3% *K. pneumoniae* bilo je proizvođač ESBL-a) i *Acinetobacter spp.* 0,38%. Udio pacijenata koji su nastavili s kirurškom profilaksom bio je 6,4%.

Zaključak

Prevalencija MDR mikroorganizama u našoj instituciji je niska, no udio otpornih izolata među izoliranim vrstama odgovara europskim izvješćima. Usklađenost kirurške antibiotičke profilakse sa Smjernicama je visoka.

Kontinuirani i aktualni podaci važna su uputa za provođenje empirijske antimikrobne terapije, pokazatelj za načine sprečavanja širenja MDR mikroorganizama i ispravno korištenje antibiotika.

Ključne riječi

otpornost na lijekove, višestruki, bakterijski, Gram-pozitivne bakterije, Gram-negativne bakterije, prevalencija, antibiotska profilaksa

Introduction

Global emergence and spread of multidrug-resistant (MDR) microorganisms in healthcare settings, especially in Intensive Care Units, cause concern worldwide. Healthcare-associated infections in already critically ill patients are associated with prolonged length of hospitalisation and increased morbidity and mortality [1, 2]. National or multicentre point prevalence surveys of healthcare-associated infections performed in developed countries have shown that the percentage of patients with a nosocomial infection on any given day in acute care hospitals is on average 7.1%, ranging from 3.5% to 10.5%, with main infections of urinary tract (27%), lower respiratory tract infections including pneumonia (24%), surgical site infections (17%) and bloodstream infections (10.5%) [3]. The most frequent cause of these infections are Gram-negative bacteria *Escherichia coli, Klebsiella pneumonie*, other *Enterobacteriaceae* species, *Acinetobacter spp*. and Gram-positive bacteria *Staphylococcus aureus* and *Enterococcus spp*. All these pathogens have the ability of developing effective resistance mechanisms to antimicrobial agents used and becoming multidrug-resistant (MDR) strains presenting a significant problem in therapy optimization because the initial empirical antibiotic choice can be inadequate and there will be a lack of antimicrobial therapeutic options in the future, since no new class of antimicrobials has been developed recently [4]. Surveillance of MDR microorganisms is a fundamental part of an effective response to this threat and surveillance results constitute the essential source of information on magnitude and trends in resistance [5]. It has been identified that one of the inducement factors for selection of bacterial strains with diverse resistance mechanisms and their consequent spread is hospital environment with antibiotic selective pressure [6]. An additional problem is over- and wrong- prescribing of antibiotics within healthcare facilities, despite guidance being available. Surgical antibiotic prophylaxis is one of the misused antibiotic prescribing indications.

World Health Organisation (WHO) recognized the potentially devastating consequences of these issues and has put the spread of antibimicrobial resistance into focus of 2014 WHO – SAVE LIVES: Clean Your Hands global campaign. Since 2009, on May 5th (Hand Hygiene Day), the campaign has launched a call to action to implement and sustain hand hygiene improvement worldwide, to reduce transmission of MDR pathogens causing healthcare-associated infections. WHO proposed a global survey on MDR microorganisms burden and surgical antibiotic prophylaxis use, to raise awareness and promote activities in restraining the beginning of postantibiotic era, such as hand hygiene and antibiotic stewardship [7]. Since our institution is taking part in WHO – SAVE LIVES: Clean Your Hands campaign, the aims of our study were to determine the prevalence of five key Gram-positive and Gram-negative multidrug-resistant microorganisms from blood and urinary specimens and to establish the prevalence of compliance with surgical antibiotic prophylaxis guidelines determining the proportion of patients who continue surgical antibiotic prophylaxis after operative procedures in absence of any infections, either surgical or non-surgical, in order to describe the types of antibiotic prophylaxis prescribed and to ascertain the reasons for prophylaxis prolongation.

Materials and methods

A point prevalence study on multidrug-resistant bacteria and surgical antibiotic prophylaxis was conducted. A laboratory-based study, using WHO

designed survey, was conducted during one week (from March 21st to 28th, 2014) at the University Hospital Centre Sestre Milosrdnice Department of Microbiology, Parasitology and Hospital Infection. Gram-positive multidrug-resistant bacteria (methicillin-resistant *Staphylococcus aureus* – MRSA and vancomycin-resistant enterococci – VRE) and Gram-negative multidrug-resistant bacteria (extended-spectrum β-lactamase ESBL producing *Enterobacteriaceae* – ESBL, carbapenem-resistant *Enterobacteriaceae* – CRE and multi-resistant *Acinetobacter spp.* – MRAB) isolated from blood culture (aerobic and anaerobic blood culture sets) and urine (mid-stream or catheter specimen) of hospitalised patients routinely submitted to our microbiology laboratory, excluding copy strains, were registered in electronic form. Susceptibility patterns of phenotipically identified microorganisms were determined using disk diffusion method. Minimum inhibitory concentration (MIC) of vancomycin was determined by E-test (bioMerieux, France). European Committee on Antimicrobial Susceptibility Testing (EUCAST) antibiotic susceptibility interpretative criteria were used [8]. ESBL is a beta-lactamase that mediates resistance to all cephalosporins and monobactams (aztreonam), but does not effect carbapenems and cephamycin. CRE *Enterobacteriaceae* produce any beta-lactamase that hydrolises carbapenems (any or all of ertapenem, doripenem, imipenem and meropenem). MRAB *Acinetobacter spp.* isolate is resistant to at least three classes of antimicrobials (penicillins, cephalosporins, flouroquinolones and aminoglycosides).

Surgical prophylaxis data were gathered using WHO designed survey with a "closed-question" questionnaire by a hospital infection control professional in one day (March 27th, 2014), from patients hospitalised in the General Surgery Ward and Gynecology Ward at the University Hospital Centre Sestre Milosrdnice Clinic for Tumors. Data were collected from patient records (and by asking clinical ward staff if necessary) on all patients who had operative procedure in the previous three consecutive working days excluding the day of the survey (March 24th, 25th and 26th, 2014). Surgical antibiotic prophylaxis was defined as administration of systemic antibiotics before surgical procedure optimally within 60 minutes (exceptions are vancomycin and flouroquinolones), with possible repetition during the operation depending on its duration. Surgical procedures were classified according to the National Healthcare Safety Networklist of Operative Procedures Categories (CDC). Surgical wounds were classified using Wound Classification. Type 1 are clean, non-traumatic, uninfected operative wounds in which no inflammation is encountered. There is no break in (sterile) technique and the respiratory, alimentary, or genitourinary tracts or the oropharyngeal cavities are not entered. Clean wounds are primarily closed and, if necessary, drained with closed drainage. Type 2 is an operative wound that enters the respiratory, GI, genital or urinary tract under controlled conditions without unusual contamination when no infection or major break in technique has occurred. Type 3 are contaminated wounds which occur when the operation is associated with open, fresh and accidental wounds. In addition, this is a surgical procedure in which a major break in sterile technique occurs or gross spillage from the gastrointestinal tract and incisions in which acute, non-purulent inflammation is encountered. Type 4 are dirty or infected wounds involving old traumatic wounds with retained or devitalised tissue and those that involve an existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the surgical procedure [9]. Each operative procedure was compared with the Interdisciplinary Section for Antibiotic Resistance Control (ISKRA) of the Croatian National Guidelines for Antimicrobial Prophylaxis in Surgery [10].

Results

During the study period 61 blood culture sets were processed. In 6.56% blood cultures of different microorganisms were isolated. The prevalence of MRSA bloodstream infections was 1.64%, while other MDR microorganisms were not isolated. Other isolated microorganisms were *E. coli* and *K. pneumoniae*, both with a wild type susceptibility pattern (susceptible to all antibiotics tested) and *Candida glabrata* (Figure 1). The total number of inpatient urine specimens processed during the study week was 279. The proportion of urine specimens with isolated pathogens was 39.78%. The prevalence of MRSA was 0.35%, ESBL *E. coli* 1.43%, ESBL *K. pneumonie* 1.79% and multidrug-resistant *Acinetobacter spp.* 0.38%. The frequency of multidrug-resistant strains within isolated Gram-positive and Gram-negative species was diverse. One third (33.3%) of overall isolated *Staphylococcus aureus* were methicilin-resistant (MRSA), 5.79% of *E. coli* isolates and 26.3% *K. pneumoniae* were ESBL producers. No vancomycin-resistant *Enterococcus spp.* and carbapenem-resistant *Enterobacteriaceae spp.* were isolated (Figure 1). On the day of the surgical antibiotic prophylaxis survey 31 patients were registered. Seventeen patients (54.83%) had breast surgery, four (12.9%) had thyroid surgery, four (12.9%) had vaginal hysterectomy, two (6.45%) had neck surgery and one (3.22%) had colon surgery, bile duct surgery, abdominal hysterectomy and ovarian surgery. Type 1 were 67.74% operative procedures, Type 2 were 32.25% operative procedures. The patients who had Type 1 procedure and administred prophylaxis had breast surgery. The proportion of patients who had Type 2 procedure and received prophylaxis according to the Croatian National

Guidelines (single pre-operative dose of 1 g cefazoline, 600 mg clindamycin and 1 g cefazoline plus 500 mg metronidazole depending of the operative procedure) was 80%. Other patients received prolonged antibiotic therapy during the day of the operative procedure following departmental guidelines for patients with specific risk factors (Table 1). Overall proportion of patients who continued surgical prophylaxis, overstepping guidelines, was 6.4%.

Discussion

Our study shows that multidrug-resistant micro-organisms' prevalence in our institution is comparable to other prevalence studies on MDR microrganisms. In 2012 a large nationwide study in German hospitals showed MRSA was the most frequently reported causative pathogen in all healthcare-associated infections with prevalence 1.53%, ESBL *E. coli* 0.97%, ESBL *K. pneumoniae* 0.27%, VRE 0.27% and *Acinetobacter spp.* 0.1% [11].

As opposed to reports, significant and encouraging is the fact that no carbapenem-resistant *Enterobacteriaceae* and vancomycin-resistant *Enterococcus spp.* were isolated (Figure 1). So far carbapenem-resistant *Enterobacteriaceae* species have presented a new global threat to carbapenems, our last-line broad spectrum antimicrobial agents and are in the spotlight of all hospital infection preventionists in Croatia, since there have been reports of their epidemic spread in the region [12]. The proportion of resistant strains within isolated species in our institution corresponds to antibiotic resistance in Croatia and to European Centre for Disease Prevention and Control (ECDC) Earss-Net latest reports, with the exception of high MRSA proportion in overall *S. aureus* isolates (33.3%), since the Croatian average is 13%. The proportion of ESBL producing *K. pneumoniae* strains is lower than the Croatian average (36%) [13]. Although point prevalence studies have limitations, they are a valuable tool for assessment of routine data, they can help raise and maintain awareness of MDR microorganisms and can therefore contribute to planning prevention strategies.

The other part of our study concerning surgical antibiotic prophylaxis showed high compliance with the Croatian National Guidelines. Published data on this subject are in range from appropriate prophylaxis in 18.1% cases as in the Italian study, 28% in the Dutch study to 93% in the Canadian research [14–16]. The interpretation of different compliance rates requires caution. It depends on patient cohorts, studies design and evaluation methods. The prevalence of surgical antibiotic prophylaxis prolongation in our institution is low and with short duration (no longer than 24 hours). The Croatian National Guidelines recommend prophylaxis administration for Type 2 operative procedures. Type 1 are considered clean procedures with low prevalence of surgical site infections and antibiotic prophylaxis is recommended only in cardiovascular surgery and prosthetic implants insertion. No recommendations are given on breast surgery prophylaxis. It is considered clean surgery and the effectiveness of prophylaxis is not clear. In our institution, the decision on prophylaxis is based on the patient's general state and local risk factors for surgical site infection development. Further research of this issue is needed, since recommendations and guidelines are not consistent.

Our study shows that point prevalence studies are an inexpensive and fast way to provide significant data and to unfold new research ground for clinicians and hospital infection practitioners in their efforts for better patient care and prevention of healthcare-associated infections management, using costless tools such as hand hygiene and rational antibiotic prescribing.

Figure 1. Gram-positive and Gram-negative bacteria isolated in blood and urine specimens and the prevalence of antimicrobial drugs' sensitive and multidrug-resistant strains.

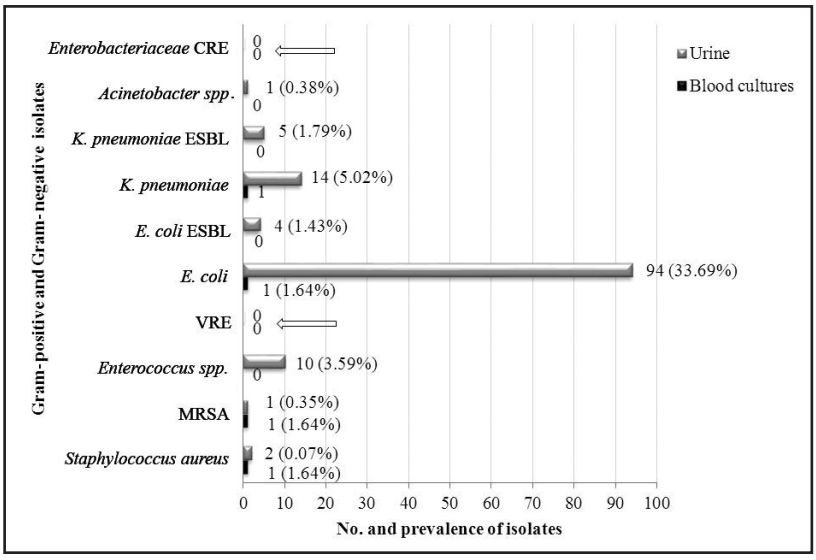

Table 1. Surgical antibiotic prophylaxis according to operative wound classification type.

Wound classification type	No. of operations	Antibiotic Prophylaxis Administered	Antimicrobial Agent Used			Prolongation of Prophylaxis	Reason for prolongation
			cefazoline 1 g	clindamycin 600 mg	cefazoline + metronidazole 1 g + 500 mg		
Wound Type 1.	21 (67.74%)	4 (19.04%)	3	1	0	0 (0%)	
Wound Type 2.	10 (32.26%)	8 (80%)	4	1	3	2 (20%)	Departmental guidelines

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META-ANALYSIS OF THE EFFICACY OF A SINGLE-STAGE LAPAROSCOPIC MANAGEMENT VERSUS TWO-STAGE ENDOSCOPIC MANAGEMENT OF SYMPTOMATIC GALLSTONES WITH COMMON BILE DUCT STONES

Meta-analiza učinkovitosti laparaskopskog liječenja u jednom aktu u usporedbi s endoskopskim liječenjem simptomatskih žučnih kamenaca i žučnih kamenaca u glavnom žučovodu u više akata

Olushola Ajayi[1], Borislav D. Dimitrov[2], Mitchel Barry[3], Malcolm R. Kell[3]

Abstract

Background. The optimal treatment of gallstones with associated common bile duct stones in the laparoscopic era is controversial. Various reviews and decision based algorithms have been published, but the superior treatment modality is unclear. Therefore, a meta-analysis was conducted to compare the two most commonly used treatment strategies.

Methods. A systematic review was conducted to compare single stage laparoscopic cholecystectomy with common bile duct exploration versus a combined endoscopic and laparoscopic treatment. Eligible studies were identified using a search of Medline, Embase, Cochrane and Science Citation Index Expanded databases. Appropriately selected articles were independently reviewed and data was extracted and cross referenced. A meta-analysis was conducted of the pooled trial data to determine difference in outcomes.

Results. A total of seven randomized trials were identified with 746 patients with 366 in the laparoscopic only treatment group and 380 in the combined endoscopic and laparoscopic treatment arms. There was no significant difference in successful bile duct clearance between the two groups (OR 1.23; 95% CI 0.55 to 2.75, P = 0.61). There was no statistical difference in morbidity (RR 1.23; 95% CI 0.92 to 1.66; P = 0.17), mortality (RD -0.00; 95% CI -0.02 to 0.01, P = 0.59) or length of hospital stay (MD -0.31; 95% CI -1.68 to 1.06, P = 0.66). However, there was a statistically significant difference in the duration of procedure in favour of the single stage laparoscopic treatment (MD -6.83; 95% CI -9.59 to -4.07, P < 0.00001).

Conclusion. Both the laparoscopic alone or the combined endoscopic and laparoscopic treatment approaches show comparative efficacy in management of symptomatic gallstones with associated choledocholithiasis.

Keywords

gallstones, choledocholithiasis, cholecystectomy, laparoscopic, endoscopic retrograde cholangiopancreatography

Sažetak

Pozadina. Optimalno liječenje žučnih kamenaca uz prateće žučne kamence u glavnom žučovodu u eri laparoskopske kirurgije je kontroverzno. Objavljeni su razni pregledni radovi i algoritmi odlučivanja, no pitanje odluke o odabiru preporučenog načina liječenja ostaje neriješeno. S ciljem usporedbe dva najčešće korištena načina liječenja provedena je meta-analiza.

Metode. Sistematsko istraživanje provedeno je kako bi se usporedila kolecistektomija s eksploracijom glavnog žučovoda u jednom aktu u odnosu na kombinirano endoskopsko i laparoskopsko liječenje. Dostupne studije nađene su pomoću sljedećih baza podataka: Medline, Embase, Cochrane i Science Citation Index Expanded. Probrani relevantni radovi zasebno su pregledani, a podaci izdvojeni i međusobno uspoređeni. Provedena je meta-analiza svih prikupljenih podataka da bi se odredila razlika u ishodima.

[1] *General Surgery Department, Letterkenny General Hospital, Letterkenny, Co. Donegal, Ireland*

[2] *Academic Unit of Primary Care and Population Sciences, University of Southampton, Southampton, United Kingdom*

[3] *Department of General Surgery, Mater Misericordiae Hospital, Dublin, Ireland*

Correspondence: Olushola Ajayi, IMRCSI MCh, General Surgery Department, Letterkenny General Hospital, Letterkenny, Co. Donegal, Ireland, tel: +353861516028, e-mail: ajayishola90@yahoo.com

Rezultati. Pronađeno je sveukupno sedam randomiziranih studija sa 746 pacijenata od kojih je 366 u skupini liječenoj isključivo laparoskopski te 380 liječenih kombinirano endoskopski i laparoskopski. Nije utvrđena značajna razlika u uspješnom čišćenju žučnih vodova između dvije skupine (OR 1,23; 95% CI 0,55 do 2,75, P = 0,61). Nije nađena značajna razlika u morbiditetu (RR 1,23; 95% CI 0,92 do 1,66; P = 0,17), smrtnosti (RD -0,00; 95% CI -0.02 do 0,01, P = 0,59) ili trajanju hospitalizacije (MD -0,31; 95% CI -1,68 to 1,06, P = 0,66). Međutim, postojala je statistički značajna razlika u trajanju zahvata (MD -6,83; 95% CI -9,59 do -4,07, P < 0,00001).

Zaključak. Laparoskopski ili kombinirani endoskopski i laparoskopski pristup liječenju pokazuje značajnu učinkovitost u liječenju simptomatskih žučnih kamenaca s pratećom koledoholitijazom.

Ključne riječi

žučni kamenci, koledoholitijaza, kolecistektomija, laparoskopski, endoskopska retrogradna kolangiopankreatografija

1. Introduction

Cholelithiasis and complications thereof are a common clinical entity as 5 to 25% of adults in western countries have gallstones [1]. Symptoms and complications related to gallstones are one of the most costly digestive disorders [2]. In addition, 10–15% of patients with gallstones have associated or suspected common bile duct (CBD) stones (choledocholithiasis) [3, 4] and several risk factors, including clinical, biochemical and imaging variables, can help predict the presence of CBD stones [4].

Endoscopic retrograde cholangiopancreatography (ERCP) combined with endoscopic sphincterotomy (ES) has a key role in the management of CBD stones. Successful clearance of CBD stones ranges between 87 to 97% depending on the experience of the endoscopist [5, 6]. ERCP has evolved from a diagnostic to a therapeutic procedure due to high rate of negative examinations, risk of complications and increasing availability of laparoscopic common bile duct exploration (LCDBE) [7, 8]. Other non-invasive or minimally invasive diagnostic techniques to detect CBD stones have also evolved [9–11], and it is therefore imperative to identify the most efficient and effective treatment strategy for CBD stones. Laparoscopic cholecystectomy (LC) has replaced open cholecystectomy as the standard treatment for gallbladder stones [12, 13], with successful common bile duct clearance rates in experienced hands exceeding 90% [3, 14, 15]. Therefore, with improved skill and advances in laparoscopic techniques and given the time frame of previous reviews, a comparison of the two approaches is essential to identify the most optimum method of treatment of symptomatic gallstones with associated CBD stones.

2. Materials and Methods

2.1. Study design

This review was conducted according to the PRISMA guidelines for systematic review reporting [16]. A quality assessment of each trial using the Cochrane collaboration tool for assessing the risk of bias was applied [17]. The design is a systematic review with meta-analysis of randomized controlled trials with no restriction on the year of publication, or language.

2.2. Inclusion and exclusion criteria

We included in this review randomized controlled trials comparing single stage laparoscopic exploration of CBD with LC to a two stage endoscopic with LC treatment irrespective of language, year of publication or patient populations in the primary studies. We excluded observational studies, review articles and other non-randomized trials comparing both interventions. Outcomes measured include; primary outcome – successful bile duct clearance of stones, secondary outcomes include – morbidity, mortality, length of hospital stay, duration of procedure and total hospital cost.

2.3. Search methods for identification of studies

The electronic data base searched till March 2012 includes The Cochrane Hepato-Biliary Group Controlled trials Register, Cochrane Central Register of Controlled Trials in the Cochrane Library, Medline (1950 to March 2012), Embase (1980 to March 2012), and Science citation index expanded database (1970 to March 2012). The following keywords: gallstones OR choledocholithiasis OR ("bile duct stones" AND cholecystectomy); laparoscopic OR choledochotomy; laparoscopic OR (laparoscopic AND "bile duct") AND (cholangiopancreatography endoscopic retrograde OR endoscopic sphincterotomy). These keywords were mapped to Medline medical subject heading (MeSH) terms as well as searched for as text items. A filter for identification of randomized controlled trials recommended by the Cochrane Collaboration was used to filter out non-randomized trials in Medline and Embase database. Hand searches of references of cited journals were conducted to also identify potential eligible articles to include in the review. Search of reputable international conference journals was also conducted to identify potential eligible papers.

2.4. Study selection and data extraction

A flow sheet was used to tract abstracts of identified, screened and eligible articles (Figure 1). Full text of eligible articles was independently reviewed by two investigators and required data of the outcomes needed to collate results was collected by two

independent investigators on a data extraction sheet. This is further synthesized into a comprehensive summary of randomized trials table comparing both treatment outcomes as shown in Table 1. For missing outcome data, a contact was made with the corresponding author by e-mail to obtain such additional information.

2.5. Quality assessment of included studies

There is a risk of over or under estimation of beneficial treatment effects in trials with high risks of bias [17]. Selected trials were graded for risk of bias at study level using the guidelines of the Cochrane collaboration tool for assessing risk of bias table and quality assessment [18]. The assessment was done on trials using the six main components of the tool such as; sequence generation, allocation concealment, blinding of participant, personnel and outcome assessors, incomplete outcome data, selective outcome reporting and other sources of bias such as funding bias or early stopping bias. A score was given to each component of either "low risk", "unclear" or "high risk", and reasons for the score are included (Table 2). Three of the trials show low risk of bias in the parameters while the remaining studies are low risk in two parameters. The performance and detection bias were of high risk as there was no attempt of blinding in any trials though the outcomes are objectively measured but the impact on the results and trials quality may be difficult to predict.

2.6. Statistical methods

The software package Review Manager 5 [19] provided by the Cochrane Collaboration Version 5.1 (Copenhagen) was used for data analysis. For dichotomous outcomes, odds ratio or relative risk with 95% confidence interval was calculated using the Mantel-Haenszel statistical method for the meta-analysis. For data with zero events, risk difference was calculated; this was used for the mortality results. While for continuous outcomes, the mean difference with 95% confidence interval was used. In continuous outcomes, if mean and standard deviation were not given, the median and range can be used to estimate the mean and variance using the formula proposed by Hozo et al. [20], and the estimated result will be used for the meta-analysis.

For odds ratio and mean difference outcomes, we used the random-effects and fixed-effect models (e.g. see Figure 2). If there are no differences between the results of the two models, the fixed effect model will be reported. If differences exist in the intervention effects, both the random and fixed effect model will be reported, otherwise the random effect model will be reported if statistical heterogeneity exists.

Heterogeneity was explored using the chi-squared test, to provide an indication for between-study heterogeneity with a significance set at $P < 0.050$. The degree of heterogeneity observed in the results was quantified using the I-squared (I^2) statistics, which is presented as a percentage, with heterogeneity considered not to be present within a range of 0–50%. On finding significant heterogeneity in the result, a careful review of the studies will be conducted to identify the reason for this.

A funnel plot of the primary outcome was determined to look for potential publication bias in the trials (Figure 3). Data analysis was based on the results obtained according to the "intention-to-treat" principle in each original study, using the fixed or random effects model for meta-analysis.

3. Results

3.1. Results of the literature search

A total of 884 articles were identified through searches of electronic journal databases, with no additional article identified through hand searches of references of published articles. Following exclusions of duplicates, 843 articles were screened by the investigative team. Abstracts of screened papers were retrieved and a total of 11 full text articles were obtained. The texts were further screened and only seven [21–27] articles meet the inclusion criteria of the present review comparing laparoscopic single stage treatment to endoscopic two-stage treatment of common bile duct and gall bladder stones. A total of 746 patients randomised between LC and LCBDE versus ERCP/ES and LC. Figure 1 shows the flow chart for selection of articles according to the Preferred Reporting Items for Systematic reviews and Meta-Analysis. A summary of RCT of included studies with summary results of the outcomes are shown in Table 1.

3.2. Description of included trials

Distribution of patients between either treatment arms is fairly even with 366 patients in the laparoscopic and 380 in the endoscopic treatment arms. Five trials [22–25, 27] compared LCBDE versus pre-operative ERCP + LC, while two trials [21, 26] compared LCBDE versus LC with post-operative ERCP. Most of the endoscopic two-stage treatment performed the LC during same admission, except one trial [27] that performed LC 4–6 weeks post ERCP. Follow up duration was mentioned in two trials [22, 24] while a trial [26] gives some long term complications without specifying follow-up duration. Sample size calculation was explained in three trials [23, 25, 26], while it was not clear how it was done in another trial [21].

All trials were performed on fit adult population from age 18 and above with ASA grade I and II with fitness for general anaesthesia except one trial [23] that recruits elderly patients with average age of 74 years with co-morbidities and ASA grade I to III. Sex distribution is equivalent across most trials. Only two

trials [25, 26] are multi-institutional, while the remaining a single institution. Three trials had confirmed CBD stones before randomization, one trial [27] was by MRCP/EUS, while the remaining two trials [21, 24] were by intraoperative cholangiography and had intra-operative randomization. Exclusion criteria were uniform in most studies, although some trials stated the reason for exclusion. Interventions performed were explained in all the trials except some few differences, one trial [24] performed only trancystic approach, while another trial [27] performed only the choledochotomy approach. The primary outcome is given in all trials, including data for morbidity, mortality and length of hospital stay. Duration of procedure is only reported in four trials, while total cost of hospitalisation was reported by one trial [24].

3.3. Quality assessment of included studies

The quality assessment of included studies is summarized in Table 2. Three of the trials show low risk of bias in the parameters while the remaining has low risk in two parameters. The performance and detection bias were of high risk as there was no attempt of blinding in any trials though the outcomes are objectively measured but the impact on the results and trials quality may be difficult to predict.

3.4. Effects of interventions

Primary outcome: successful ductal clearance

A total of 746 patients were randomized, 366 in the laparoscopic treatment and 380 in the endoscopic treatment arm. A total of 259 patients had successful ductal stones clearance against 254 patients in the endoscopic arm, giving a rate of 70.8% and 66.8% respectively, on an intention-to-treat basis. Our meta-analysis found no statistical difference between the treatment arms as shown in the forest plot with OR of 1.23 95% CI 0.55 to 2.75, p=0.61 and I^2 =71% using the random effects model due to statistical heterogeneity (Figure 2). The funnel plot for the studies in relation to the primary outcome on Figure 3 shows that only two out of the seven trials are outside the triangle thus indicating a lack of or at least a very low degree of publications bias.

Morbidity

The total morbidity rate was 20.2% in the laparoscopic arm and 16.6% in the endoscopic treatment, relative risk 1.23, 95% CI 0.92 to 1.66, P=0.17 and I^2=0%, using the fixed effect model. The forest plot on Figure 4 shows no statistical difference between the treatment arms.

Mortality

There were two deaths in the laparoscopic treatment and four in the endoscopic treatment arms, with no statistically significant difference between them. Risk difference of -0.0 and 95% CI -0.02, 0.01 and the forest plot using fixed effect model due to lack of heterogeneity are shown on Figure 5.

Length of hospital stay

All the trials reported the total length of hospital stay in median and range and the meta-analysis was performed by converting these data to mean and SD values. The results show no statistical difference between treatment arms with mean difference of -0.29, CI of -1.68–1.10 and P = 0.68 with a random effects model (Figure 6). One of the trials has provided inadequate data but the contact with the author for missing data by e-mail has not returned any additional information.

It is important to note that five of the studies show a shorter length of hospital stay in the single-stage laparoscopic treatment arm and the difference ranges between one and three days with statistical significance in two of the trials [21, 25], with a significant difference also between the trancystic approach to the endoscopic treatment in one study [22]. Though, one of the trials [26] is not included in the meta-analysis due to incomplete reporting, there is a low probability of tipping the overall result in favour of the single-stage treatment if this study had been included. Only one trial shows a shorter stay with endoscopic treatment [23] while one trial shows no differences in length of stay [27].

Duration of procedure

Only four trials reported on duration of procedure, data were presented in median and range, except in the study by Rogers et al. [24] that reported mean and SD. The meta-analysis was done with only three trials due to inadequate data in the fourth trial, though an e-mail request was sent to the author for the missing outcome data.

The results from the meta-analysis (Figure 7) show a statistical significance in favour of the single stage laparoscopic treatment as shorter in duration of procedure compared to the two-stage endoscopic treatment with P < 0.00001, CI -9.59 to -4.07. It is also important to note that, overall, only three of the trials reported a shorter duration of procedure in the single-stage treatment (median values) and the differences range from 15 to 18 min, with no statistical significance. Only one trial [26] reported a longer duration in the two-stage treatment arm but it was not included in the meta-analysis due to inadequate data.

Health economics

Only the study by Rogers et al. [24] reported the total hospital charges with a median of $24,399 (range 11,190–60,138) in the single stage treatment to $26,656 (range 4,496–85,085) in the two stages endoscopic treatment. The study found, however, a statistically significant difference in the professional fees between

the single stage treatment with mean (SD) of $5054 (1637) against two stage treatment with a mean of $6191(1583) (P = 0.001).

4. Discussion

This systematic review and meta-analysis of randomized controlled trials include seven studies containing 746 patients into either laparoscopic single stage treatment or to endoscopic two-stage treatment arm. The results demonstrate equivalent success in common bile duct stone clearance rate, morbidity, mortality and length of hospital stay, but a statistically significant difference in favour of the single stage technique in terms of duration of procedure. The first review on this subject by Tranter et al. [28] in 2002 involved two randomized controlled trials (RCTs) and reported similar clearance rates and length of stay between laparoscopic surgery and endoscopic treatment, but higher morbidity and mortality in the endoscopic treatment. In addition, Martin et al. [29] in a Cochrane review with 591 patients in five RCTs found no significant difference in mortality, morbidity, treatment success and procedure time. Length of stay was reported shorter in three trials but not subjected to analysis. Clayton et al. [30] found similar outcomes in the combined endoscopic and laparoscopic treatment. A recent review by Alexakis et al. [31] though currently in abstract form, suggests equivalent outcomes between single stage and two-stage management of CBD stones.

Various treatment algorithms have been developed regarding the management of gallstones with associated CBD stones [32]. It is pertinent to note that choledocholithiasis could be discovered before, during or after cholecystectomy. Our review on an intention-to-treat basis shows clearance rate of 71% in the laparoscopic treatment group compared to 69% in the endoscopic treatment cohort. On further analysis according to the actual rate of stone clearance, there is improvement in clearance rates of 87.5% to 86% between the laparoscopic to endoscopic treatment respectively. This compares favourably with various consecutive series of efficacy in the treatment of CBD stones that report bile duct clearance rates in the laparoscopic single treatment ranging from 85% to 95% and 87% to 97% in the endoscopic group [5, 6]. Interestingly, only one study in our review shows a statistical significance of laparoscopic clearance over the endoscopic clearance [23].

The endoscopic management of choledocholithiasis has a relatively low failure rate, however it has the advantage that it can be repeated multiple times and requires only sedation rather than general anaesthesia. Also delaying stone clearance should not delay gall bladder surgery as a stent could be utilised in the short-term period. This is supported by a RCT by Chang et al. [33] which demonstrated no superior outcome in pre- versus post-operative endoscopic management of choledocholithiasis.

Mortality in either treatment arms is less than 1%, which is consistent with the literature and also with previous reviews. Our review shows a morbidity rate of 20% to 16.5% in the laparoscopic and endoscopic treatment respectively. Since the LCBDE was first reported in early 90's, long term reviews of this procedure have now been reported. Waage et al. [34] conducted a long term review of 152 patients over a period of 6–72 months and also, a review by Andrew et al. [35] of 116 patients over 63 months, both demonstrate no long term biliary tract complications apart from small recurrence of CBD stones. This is similar to a study by Tranter et al. that reviewed medium to long term complications of ERCP/ES and reported recurrent CBD stone rate of 2–16%, cholangitis 1–6%, and potential risk of biliary tract cancer due to destruction of the sphincter of Oddi [28].

Cost is an important variable in health care decision making processes, and only one study compared cost between the two treatment strategies. This study reported a statistical significance in favour of the single stage treatment in regard to professional fees. Some observational studies have evaluated this variable in determining the optimum modality of treatment. Topal et al. [36] reported a consecutive series of 53 cases and demonstrated a reduction in favour of hospital cost for single stage treatment. Other studies examining healthcare costs have used different methodologies to analyse this parameter, and the conclusions are mixed [37–39]. Some important factors affecting hospital cost are; length of hospital stay, cost of operating theatre and professional fees. In this review there was no statistical difference in length of hospital stay, however two studies reported a statistical significance in this variable of between 2–3 days difference.

A limitation of this meta-analysis is that it included mostly patients who were low anaesthetic risk with ASA grades I and II, and an age range of 18–89 years. The exception is the study by Noble et al. [23] that specifically examined higher risk patients (elderly patients with co-morbidities and ASA grade I–III). Therefore a limitation of this study is that the findings may not be applicable to elderly patients with significant competing medical co-morbidities presenting with choledocholithiasis.

Further limitations of this meta-analysis are that none of the studies address the issue of performance and detection bias, but since the outcomes in the review are objectively measured, its impact on the intervention effects maybe relative. Though sample size calculation was done in three studies, this review by pooling together data has increased the power of previous published research where a clear conclusion was not possible. The population of patients in this review is still small for a common disease that affects millions of

people. The qualities of the continuous variable data are mostly non-parametric and our calculations to parametric data may be prone to errors and may affect the meta-analysis.

In conclusion, this meta-analysis demonstrates an equivalent comparison between laparoscopic and endoscopic treatment of common bile duct stones in terms of bile duct clearance rates, morbidity, mortality and length of hospital stay, but a difference in duration of the procedure. These results should be helpful to appropriately inform patients regarding the risks, benefits and alternative treatment strategies of this clinical entity.

Figure 1. Number of articles identified and screened in the systematic review.

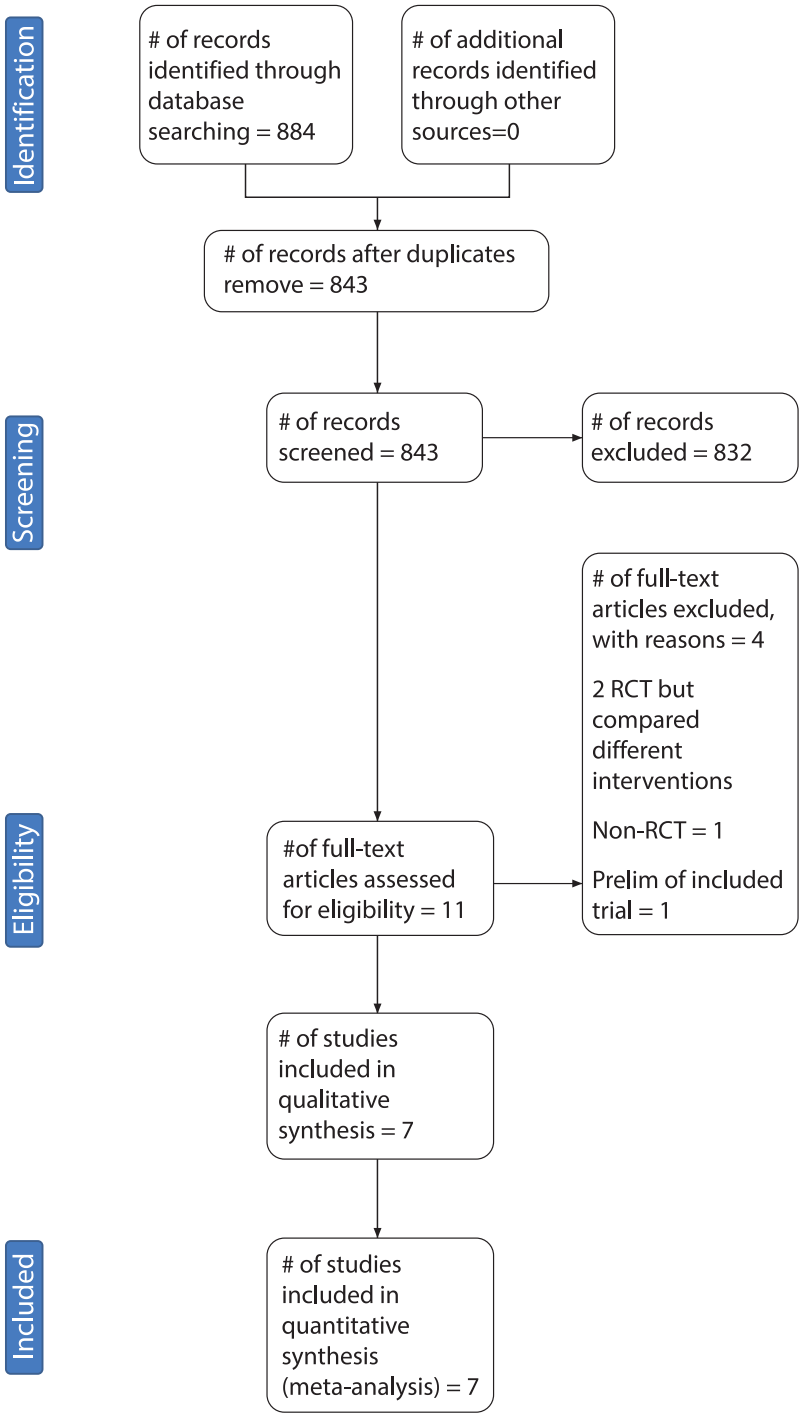

Figure 2. Forest plot of odds ratio of successful ductal stones clearance in LC + LCBDE vs ERCP/ES + LC.

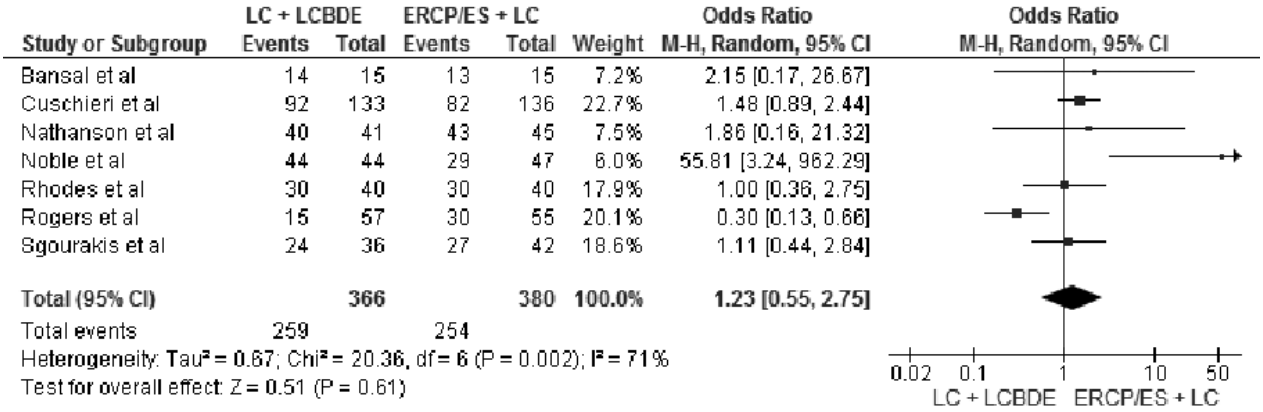

Figure 3. Funnel plot, illustrating the lack of publication bias.

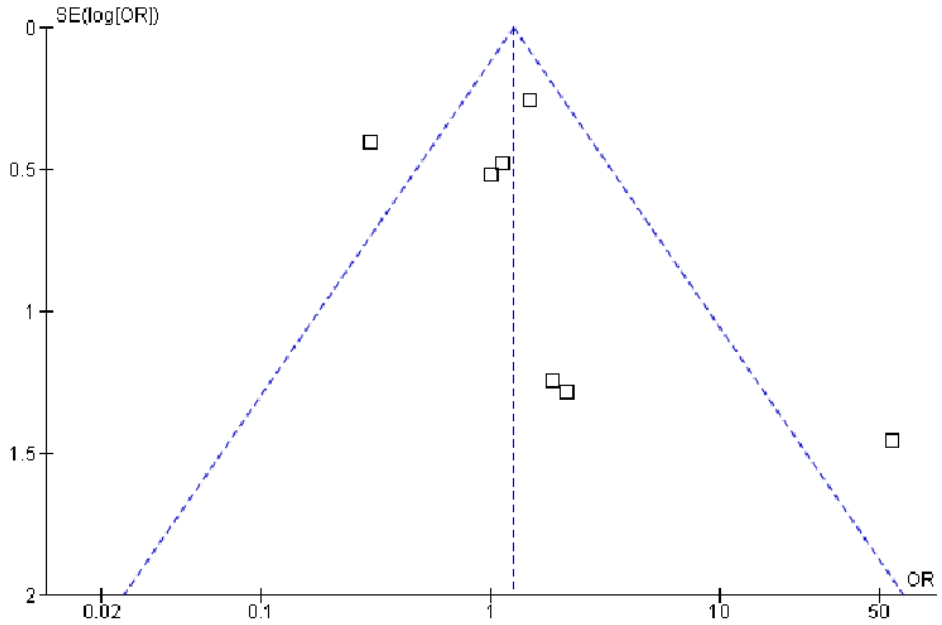

Figure 4. Forest plot of total post-operative morbidity b/w LC + LCBDE versus ERCP/ES + LC.

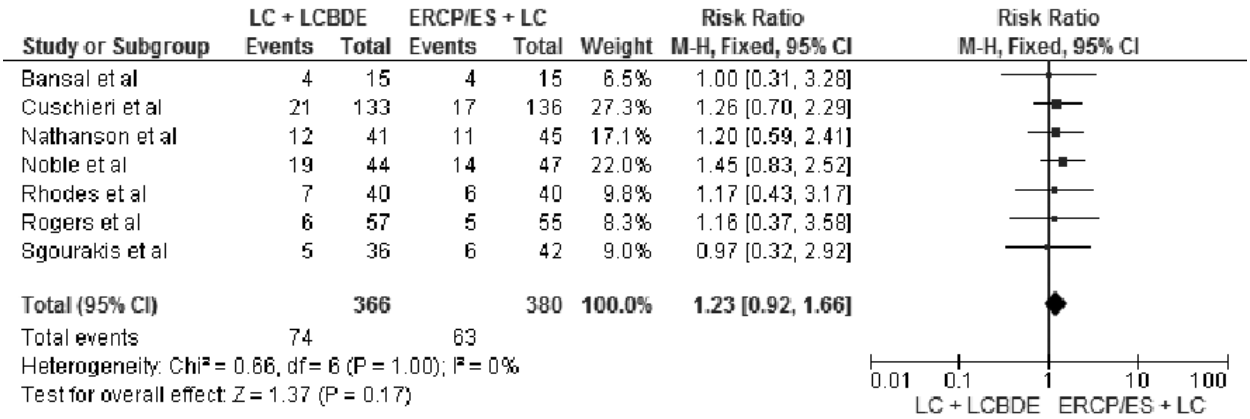

Figure 5. Forest plot of post-operative mortality b/w LC + LCBDE Versus ERCP/ES + LC.

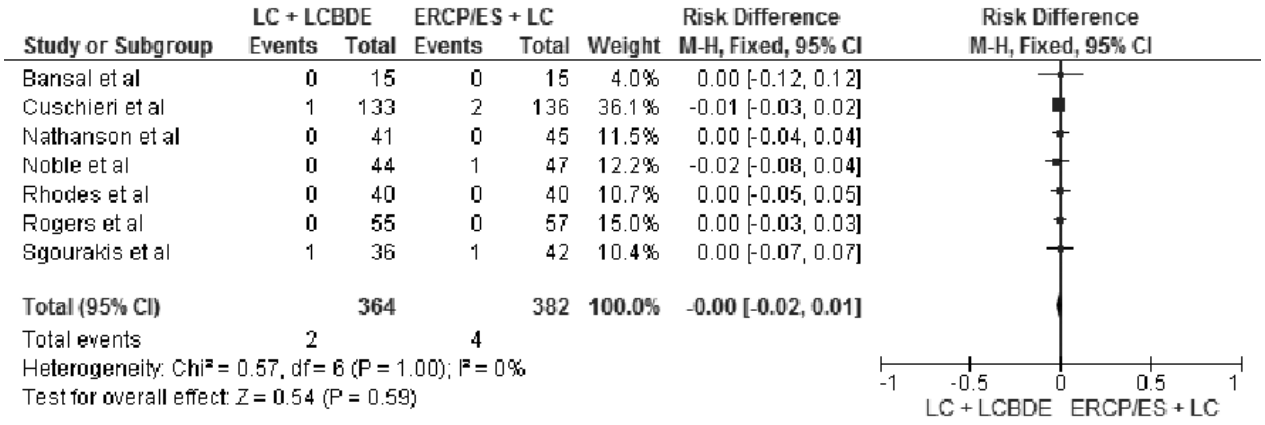

Figure 6. Forest plot of the length of hospital stay b/w LC + LCBDE Versus ERCP/ES +LC.

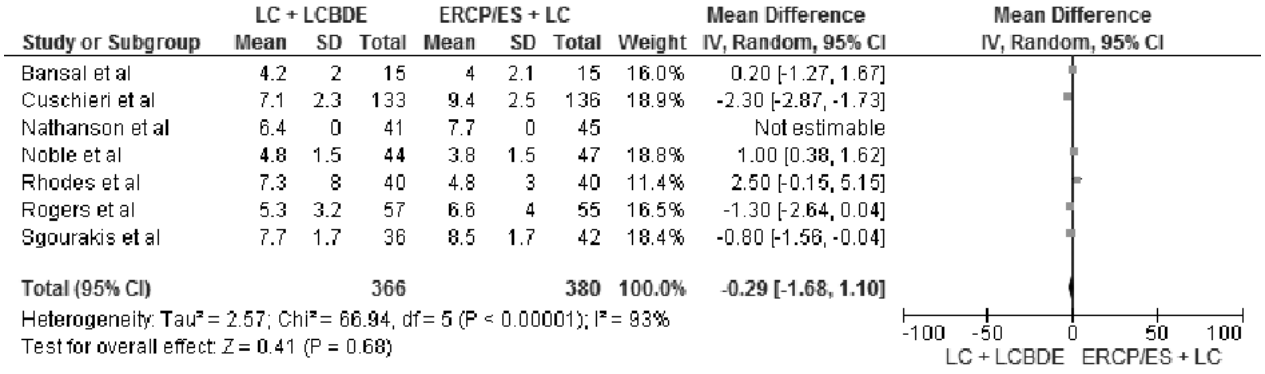

Figure 7. Forest plot of the duration of procedure b/w LC + LCBDE Versus ERCP/ES + LC.

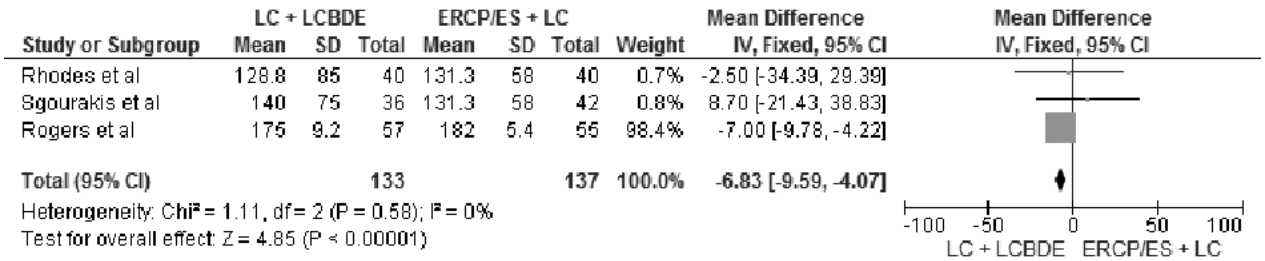

Table 1. Summary of randomized trials comparing laparoscopic against endoscopic clearance of common bile duct stones.

First author, Year of publication	***Treatment***	Number of participant s	***Age (years)***	***Gender M:F***	Successful ductal clearance n (%)	Post- operative morbidity	Post- operative mortality	Length of hospital stay (days)	Duration of procedure (mins)
Bansal 2010	Laparoscopic	15	47.1	4:11	14	4	0	4.2[a]	n/a
	Endoscopic	15	39.1	5:10	13	4	0	4[a]	n/a
Rogers 2010	Laparoscopic	57	39.9	17:40	15	6	0	4	160
	Endoscopic	55	44.6	16:39	30	5	0	5	178
Noble 2009	Laparoscopic	44	75.9	16:28	44	19	0	5	n/a
	Endoscopic	47	74.3	22:25	26	14	1	3	n/a
Nathanson 2005	Laparoscopic	41	56.1	16:25	40	12	0	6.4	158.8
	Endoscopic	45	59.6	17:28	43	11	0	7.7	147.9
Sgourakis 2002	Laparoscopic	36	43-88	15:21	24	5	1	7.4	90
	Endoscopic	42	46-89	17:25	27	6	1	9	105
Cuschieri 1999	Laparoscopic	133	19-88	6:9	92	21	1	6	n/a
	Endoscopic	136	18-89	7:18	82	17	2	9	n/a
Rhodes 1999	Laparoscopic	40	62	12:28	30	7	0	1	90
	Endoscopic	40	68	14:26	30	6	0	3.5	105
Total	Laparoscopic	366			259(70.8%)	74	2		
	Endoscopic	380			254(66.8%)	63	4		

(a) Value in mean

Table 2. Quality check of all trials.

Reference	Sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective outcome reporting
Bansal et al	+	?	-	-	+	+
Cuschieri et la	+	+	-	-	?	+
Nathanson et al	+	+	-	-	+	?
Noble et al	+	?	-	-	?	+
Rhodes et al	?	-	-	-	+	+
Rogers et al	?	+	-	-	?	+
Sgourakis et al	?	-	-	-	+	+

Note: (?) Unclear risk of bias; (-) high risk of bias; (+) low risk of bias.

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COULD RISK FACTORS BE BETTER PREDICTORS OF EARLY ACUTE MESENTERIC ISCHEMIA THAN LABORATORY AND IMAGING STUDIES? RETROSPECTIVE STUDY AND ALGORITHM FOR THE EARLY INTERVENTION

Mogu li faktori rizika biti bolji prediktori rane akutne mezenterijalne ishemije od laboratorijskih i slikovnih pretraga? Retrospektivna studija i algoritam za ranu intervenciju

Zlatko Fiolić, Goran Augustin, Željko Jelinčić, Petar Matošević

Abstract

Objectives. The aim is to delineate relevant risk factors and construct an algorithm for earlier performance of selective mesenteric angiography, thus lowering mortality rates of acute mesenteric ischemia.

Methods. During a 5-year period 31 patients were examined. Thirteen risk factors were analysed and compared to standard diagnostic procedures.

Results. Only one patient did not have arterial hypertension. The second most common risk factor is atrial fibrillation with the incidence rate of 64.5%. The largest group of patients (38.7%) had two risk factors and there were 6.5% patients with six risk factors and 87.2% of all patients had two or more risk factors. In 67.7% of the patients we only performed emergency laparotomy due to inoperable state. Hospital mortality was 74.2%.

Conclusions. Combination of age over 70, hypertension and two or more risk factors associated with elevated D-dimers, in a patient with severe abdominal pain and minimal clinical findings with nonspecific laboratory findings and plain abdominal radiographs, could be an indication for early selective mesenteric angiography.

Keywords

acute mesenteric ischemia, risk factors, selective mesenteric angiography, algorithm

Sažetak

Ciljevi. Cilj je naznačiti relevantne faktore rizika i izraditi algoritam za ranije slučajeve selektivne mezenterijalne angiografije te na taj način smanjiti stopu smrtnosti akutne mezenterijalne ishemije.

Metode. Tijekom petogodišnjeg razdoblja pregledan je 31 pacijent. Analizirano je 13 faktora rizika koji su uspoređeni sa standardnim dijagnostičkim postupcima.

Rezultati. Samo jedan pacijent nije imao arterijsku hipertenziju. Drugi najčešći faktor rizika je atrijalna fibrilacija s učestalošću od 64,5%. Najveća skupina pacijenata (38,7%) imala je dva faktora rizika, 6,5% pacijenata imalo je šest faktora rizika, a 87,2% svih pacijenata imalo je dva ili više faktora rizika. U 67,7% pacijenata izveli smo samo hitnu laparotomiju zbog neoperabilnog stanja. Bolnička smrtnost bila je 74,2%.

Zaključci. Kombinacija dobi iznad 70, hipertenzije i dva ili više faktora rizika povezanih s povišenim D-dimerima, kod pacijenta sa znatnom abdominalnom boli i minimalnim kliničkim zaključcima s nespecifičnim laboratorijskim zaključcima i uobičajenim abdominalnim radiografima mogu biti indikacija za ranu selektivnu mezenterijalnu angiografiju.

Ključne riječi

akutna mezenterijalna ishemija, faktori rizika, selektivna mezenterijalna angiografija, algoritam

Introduction

Acute mesenteric ischemia (AMI) is a potentially fatal vascular emergency with the overall mortality rate of 60% to 80% [1–3]. Although AMI accounts for only about 1–2% of gastrointestinal diseases, the incidence has been increasing considerably [1, 4, 5]. Early clinical presentation is nonspecific in most cases and is characterized by an initial discrepancy between severe abdominal pain and minimal clinical findings. There is

Department of Surgery, University Hospital Centre Zagreb, Zagreb, Croatia

Correspondence: Goran Augustin, MD, PhD, Department of Surgery, Kišpatićeva 12, 10 000 Zagreb, Croatia, e-mail: augustin.goran@gmail.com

no confirmatory laboratory test for *early AMI* and even leukocytosis may not be present. Abdominal X-rays are normal in 25% of patients or nonspecific and cannot confirm the diagnosis [6–8]. Duplex Doppler ultrasound has a limited role in patients with distended bowel loops [8, 9]. Computed tomography, not very useful in diagnosing acute embolic events, is the study of choice only in patients with mesenteric vein thrombosis [10, 11]. In the absence of a clinical indication for emergency laparotomy, biplanar mesenteric angiography remains the examination of choice in suspected AMI [12].

The problem is that the latter diagnostic modality is invasive, time-consuming and must be performed by a highly educated team which means that indications for emergency mesenteric angiography are strict. Therefore the aforementioned observations leave only the risk factors as parameters that could direct the clinician, who has a patient with severe abdominal pain, to the diagnosis of AMI.

The aim of this study is to delineate potentially relevant risk factors and construct an algorithm which could lead to earlier performance of selective mesenteric angiography with low incidence of negative results. Earlier performance of angiography could lead to diagnosis of AMI early in the disease process when the disease is potentially curable. The final result could be lowering the mortality rates of AMI.

Patients and methods

During a 5-year period (2001–2005), we retrospectively examined 31 patients with intraoperative verification of AMI at the University Hospital Centre Zagreb. No intraoperative diagnostic test has yet been described that is superior to the clinical judgement of experienced surgeons in determining intestinal viability [13]. The study included patients who came to the surgical or internal medicine emergency department from their home. The analysed parameters were age, sex, duration of symptoms, examination to treatment time (diagnostic period), peritoneal irriation (acute abdomen), leukocyte count, hematocrit, C-reactive protein, plain abdominal radiographs, abdominal sonography, abdominal computed tomography (CT), second-look operation and risk factors for AMI. The risk factors included hypertension (≥ 140/90 mmHg), atrial fibrillation, digitalis use, previous abdominal operation, previous pulmonary embolism, renal insufficiency, previous myocardial infarction, previous deep venous thrombosis, valvular/structural cardiac disease, previous stroke, intraabdominal neoplasm and portal hypertension (Table 1). The last row in Table 1 (bold letters) represents average values or percentage of patients with specific signs or risk factors. Table 2 contains a percentage of patients with specific risk factors and a percentage of patients with the combination of these risk factors. All currently identified risk factors for AMI are listed in Table 3.

Results

Female to male ratio was 1.2:1 (17 women and 14 men). The average age was 77 years, but 29 out of 31 patients (93.5%) were 68 years old or older. The average age of female population was 82.2 and of male population 71.6 years. The average duration of abdominal pain was 4.6 days (range 5 hours to 10 days). Almost all the patients had diarrhea (bloody diarrhea was not noted in most patients probably due to the inadequate clinical examination or insufficient medical documentation) or were vomiting. The average examination to treatment time (diagnostic period) was 12.2 hours (range 4–36 hours). Peritoneal irritation (acute abdomen) was found in 25 patients (81%). The average leukocyte count was 17.2 (range 5.0–31.0) and C-reactive protein 125 (range 13–384). Plain abdominal radiographs showed distended loops of small and large intestine with aero-liquid levels in 30 patients (96.8%) and only one of normal finding. Abdominal sonography was done in 27 patients (87.1%) and revealed only distended loops of small intestine without the possibility of accurate delineation of other structures. Abdominal CT or CT angiography was not done in these patients.

None of the patients had intraabdominal neoplasm or portal hypertension (therefore these risk factors are not presented in Table 1). Only one patient did not have arterial hypertension (incidence of hypertension was 96.8%), but had two other risk factors (previous abdominal operation and renal insufficiency). Second most common risk factor was atrial fibrillation with the incidence rate of 64.5%. The occurrence of other risk factors is presented in Table 2 in their decreasing incidence. Table 2 also contains cumulative incidence of risk factors. The largest group of patients (38.7%) had two risk factors and there were patients (6.5%) with even six risk factors. It is important to note that patients with two or more risk factors made the total of 87.2% of patients with AMI. It has to be noted that arterial hypertension was excluded from risk factors group because it is a widespread sign in general population and almost all the patients (96.8%) had hypertension.

Only exploratory laparotomy, without the possibility of performing resectional procedures due to the inoperable state, was made in 21 patients (67.7%). Thrombendarterectomy with a patch on the superior mesenteric artery was done on one patient and the other nine patients (29.0%) had resections of necrotic small or large bowel. Second-look operation was performed on only six patients (19.4%). Hospital mortality was 74.2% (23 patients; 13 women and 10 men).

Discussion

Despite the advances of diagnostic and therapeutic modalities, AMI is still a vascular emergency with high

mortality ranging from 60 to 80% [1–3]. High mortality rate of 74.2% was present in our study as well. This is attributed to the diagnosis of *advanced AMI*, which, in fact, is not a diagnosis of AMI but of acute abdomen and therefore is the indication for emergency laparotomy. In our study, 81% of patients presented with acute abdomen or developed acute abdomen during the diagnostic period. Another element indicating that diagnosis was made too late is that only exploratory laparotomy, without the possibility of performing resectional procedures, embolectomies or thrombectomies due to the inoperable state, was performed on 67.7% of patients. Second-look operation was performed in six patients (19.4%) and three (50%) of these patients died. This, unfortunately, presents a low percentage of second-look operations. Low percentage of these operations is also an indicator that patients presented with an advanced disease without even the possibility of second-look operations. The mortality rate in this group was 50%, which is significantly lower than 74.2% in the overall group. This only confirms that emergency laparotomy is mandatory in acute abdomen and objectively we cannot state that second-look operation by itself is therapeutic, rather that these patients had a potentially curable disease at the time of initial operation.

Survival rates are significantly higher once AMI is diagnosed and treated in early stages (≤ 24 h), especially using mesenteric angiography and splanchnic vasodilators [2]. Selective catheter angiography is the gold standard for the diagnosis of *early AMI*. Sensitivities range between 90 and 100% and specificity is almost 100% [2]. High sensitivity and therapeutic potential of early angiography significantly lowered the mortality rate with a reported range of 18–53% [2]. Therefore it is imperative to make a diagnosis of *early AMI* to lower the mortality rate as well as the number of abdominal explorations which are the risk factors for morbidity and mortality in patients with significant comorbid diseases. It is apparent that clinical examination, laboratory findings, plain abdominal radiographs or abdominal sonography could not establish the diagnosis of AMI in early stages when the process is potentially curable. The levels of plasma D-dimers were shown to have increased in instances of deep venous thrombosis, pulmonary embolism, ischemic cardiac diseases, vasculitides with disseminated intravascular coagulation, trauma and surgical interventions [14]. It must be stressed that coagulation and fibrinolysis activity are increased in the elderly without evident diseases, especially in those with atherosclerotic disease and long-term immobilization [15]. Acute intraabdominal conditions such as severe acute pancreatitis are complicated with disseminated intravascular coagulation with subsequent elevation of D-dimers [16]. Even patients with intraabdominal malignancies have elevated levels of D-dimers [17, 18]. A study performed by Acosta et al. compared two groups (bowel ischemia with thromboembolic incident of superior mesenteric artery and bowel ischemia with causes other than thromboembolic incident of superior mesenteric artery) with a small number of patients and concluded that patients with thromboembolic incidents have significantly higher levels of D-dimers [19]. This study has some shortcomings. The compared groups included patients with acute abdomen which is a sign of advanced disease. Second, the control group had patients with mechanical obstruction, but not caused with malignancy which causes elevation of D-dimer levels. Furthermore, D-dimer values are lowered by therapeutic doses of warfarin and heparin [20, 21]. Atrial fibrillation is another specific problem. Patients with at least one risk factor for embolism (which includes hypertension and age over 75) had elevated levels of D-dimer compared with patients without any risk factors and with control subjects [22]. Therefore, elevated D-dimers are present in patients with atrial fibrillation without abdominal or other pathology. All these observations made D-dimers not specific for acute mesenteric ischemia as isolated predictor of *early AMI*. In our study 96.8% of patients had aero-liquid levels on plain abdominal radiographs, but it must be remembered that 81% of patients presented with acute abdomen. Therefore, plain abdominal radiographs are diagnostic only in the advanced disease. Ankle brachial index (ABI) less than 0.90 has been used as a sensitive and specific diagnostic tool for peripheral arterial disease with a 5% false-negative rate due to calcification of lower-extremity arteries. The presence of a low ABI was predictive of 3- to 4-fold increase of total and cardiovascular mortality [23–26]. These studies lack the direct correlation between ABI and AMI which could only be assumed by the fact that atherosclerosis is a generalized disease. Prospective studies are necessary to define the correlation between ABI and AMI in patients with severe abdominal pain. Duplex Doppler ultrasound results have been disappointing. The wide range of normal superior mesenteric artery flows (300–600 cc/min) limits its diagnostic value in the acute setting, where no baseline study for comparison is generally available [27]. CT findings suggestive of intestinal ischemia include atherosclerotic disease of intestinal arteries and thrombosis of proximal intestinal arteries, as well as intestinal distention, intestinal wall thickening, intraabdominal fluid and intestinal perforation. These findings may also be present in patients without intestinal ischemia. Findings suggestive of intestinal ischemia include pneumatosis intestinalis and portal venous air, both of which are late findings. Because CT scanning for evaluation of abdominal pain requires administration of intravenous iodinated contrast material, which may affect later arteriography, this test is not the best initial examination

for suspected AMI [28]. A study performed by Taourel et al. is the most comprehensive evaluation of the usefulness of CT in the diagnosis of AMI with sensitivity of 64% and specificity of 92% [29]. Abdominal CT has a limited role and is the study of choice only in patients with superior mesenteric vein thrombosis with sensitivity exceeding 90% [10, 11]. Unfortunately the subset of these patients is the smallest (5–10%) [30]. These conclusions are confirmed in practice guidelines published by the American Gastrointestinal Association [2].

It is well established that angiography is the gold standard for the diagnosis and in some cases treatment of AMI, but the main problem, how to, objectively, make an early suspicion of AMI, remains unsolved. Even ACC/AHA 2005 practice guidelines for the management of patients with peripheral arterial disease only state the following: *patients with acute abdominal pain out of proportion to physical findings and who have a history of cardiovascular disease should be suspected of having acute intestinal ischemia (Level of Evidence: B)* [28]. Since the publication of guidelines of the American Gastrointestinal Association in 2000, CT diagnosis of AMI was significantly improved by using multiple detector row computed tomography angiography (MDCTA) with a sensitivity of 96% and specificity of 94% [31]. Another diagnostic modality is 3D contrast-enhanced magnetic resonance (MR) angiography. MR angiography is not indicated in patients with acute symptoms of mesenteric ischemia because this modality does not yet offer sufficient resolution to demonstrate nonocclusive low-flow states or distal emboli [32]. CT seems to be more appropriate because it can simultaneously demonstrate the level of occlusion (arterial or venous) and its ischemic consequences on the bowel [29]. Unfortunately vasospastic ischemia (NOMI) still remains a diagnostic dilemma even with mesenteric MDCTA. A disadvantage of MDCTA is that it depicts the vessels at a single point in time, and the temporal changes in vascular filling that are seen on catheter angiographic images cannot be appreciated. A patient may demonstrate poor opacification of distal SMA branches at CT for a number of reasons, including generalized slow blood flow (as seen, for example, in cardiac disease) or diffuse spasm related to nonocclusive ischemia. Since NOMI follows severe microvascular vasoconstriction, angiography is the only diagnostic modality which reliably establishes an early diagnosis. It is a very important observation because NOMI represents 20% of causes of AMI.

Despite all these advances in noninvasive diagnostic procedures, angiography is still the gold standard because it is reserved for NOMI and equivocal cases and is also used in conjunction with transcatheter therapeutic techniques (PTA/stent placement, thrombolysis and papaverin infusion). Disadvantages of traditional angiography are its limited availability and potential renal toxicity.

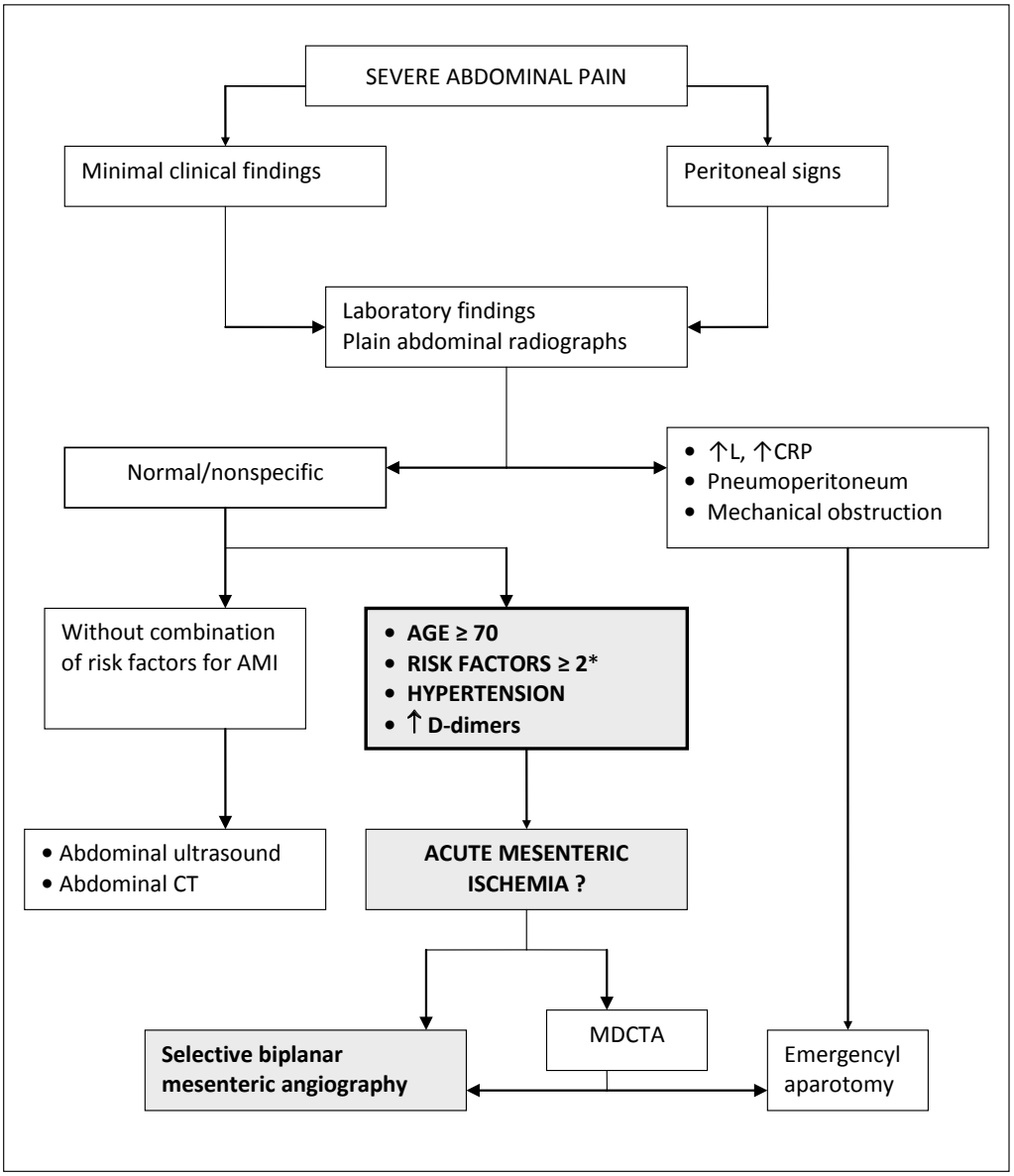
Since all clinical, laboratory and imaging diagnostic modalities are not sufficiently helpful, we analysed the known risk factors for AMI. One of the contributing factors of AMI is advanced age. The average age in our study was 77 years (average female age was 10 years higher than average male age; 82 compared to 72 years of age). It is important to take into consideration that 93.5% of patients were 68 years old or older, thus making the age over 70 the first predictor of *early AMI*. Almost all the patients (96.8%) had hypertension and there was only one patient without any other risk factor except hypertension (Table 1). We made hypertension the second predictor of *early AMI*, but it must be present with two other predictors to justify clinical suspicion of *early AMI*.

The main topic of this retrospective study were risk factors for AMI. Unfortunately the patients' medical records showed no subcategorization of AMI. All these categories have slightly different risk factors, so we included all of them in this group of our patients. It is difficult to analyse the impact of a single risk factor on *early AMI*. Obviously, previous abdominal operations or renal insufficiency could not be compared to previous atrial fibrillation, deep vein thrombosis or pulmonary embolism. Also, until prospective, randomized, multicentric studies are made, it is impossible to compare the impact of specific combinations of risk factors on *early AMI*, but our results point out that two or more risk factors were present in 87.2% of patients, thus making the combination of two or more risk factors the third predictor of *early AMI*. Another three patients (9.7%) had a single risk factor present and only one patient was without risk factors. This patient had hypertension and was only 61 years old. Unfortunately analysis of possible etiology including hypercoagulable states was not made on this patient/cadaver. Based on these data, an algorithm for detection of *early AMI* was constructed (Figure 1). This is not the complete algorithm for the diagnosis and treatment of AMI but a part of algorithm which is missing in all algorithms found in literature. A detailed algorithm for AMI from the time of performing selective mesenteric angiography to definite treatment is excellently described in the review by Oldenburg et al. [12].Using this algorithm the number of selective mesenteric angiographies would increase and the number of negative results would be present, but it is necessary to evaluate this algorithm prospectively for conclusions. The problem is that the number of patients with AMI in hospitals is relatively small and prospective studies should be multicentric to obtain statistically significant results and conclusions.

Despite this algorithm with four predictors, there are some shortcomings and limitations. All patients came to the emergency department from home. The patients who had aortoiliac (AMI incidence of 2.8%) or cardiac

surgical operations were excluded because of specific pathophysiologic and pathologic conditions [33]. It is well known that AMI should be suspected early in these patients, especially if they are elderly or on intraaortic balloon counterpulsation and having abdominal pain without laboratory or imaging confirmation of other acute abdominal conditions. Also, an identifiable coagulopathy was not searched for in our group of patients. It would be valuable to have these specific coagulation tests and possible deficiencies of coagulation factors, especially in patients with a small number of risk factors and age under 70. Also, re-establishment of flow to infarcted bowel may cause a sudden systemic release of endotoxins, which may be associated with the sudden onset of disseminated intravascular coagulation, adult respiratory distress syndrome and sudden cardiovascular collapse. Therefore, in the presence of infarcted bowel or markedly elevated lactic acid levels, initial angiographic treatment should be weighed against surgical options in which control of the venous outflow (and the endotoxins) from the infarcted bowel segment can be achieved. Another problem exists. The average examination to treatment time (diagnostic period) in our study (and our emergency department) was 12.2 hours (range 4–36 h). If this algorithm is correct then this diagnostic period could be significantly shortened and a part of patients with *early AMI* able to be treated angiographically or surgically. More importantly, a significantly longer period of disease progression is from the onset of abdominal pain to clinical examination in the surgical unit. In our study the average duration of symptoms was 4.6 days (range 5 hours to 10 days with the remark that only two patients

Figure 1.



had symptoms lasting less than 24 hours). This period from when the patient is at home or examined by general physician to being sent to hospital or sequentially examined by the same physician, could be shortened knowing this combination of risk factors for AMI. The importance of this possible algorithm is even more evident when the following facts are known: in one prospective study of acute thromboembolism of the superior mesenteric artery 20 out of 24 patients were evaluated by a total of 48 doctors at their first consultation, of whom 23 were surgical specialists. Sixteen of these patients had to wait a median of 33 h (range 8±188 h) for diagnostic laparotomy and four patients were diagnosed post-mortem [34].

Algorithm for establishing clinical predicament and early diagnosis of acute mesenteric ischemia. L – leukocyte count, CRP – C-reactive protein, AMI – acute mesenteric ischemia, MDCTA – multiple detector row computed tomography angiography.

* See Table 3 for details.

Table 1. Clinical, laboratory parameters and risk factors.

Age	Sex	Duration	Diag. period	Perit. irrit.	WBC	Hct	CRP	H	AF	MI	VD	Abd. op.	DVT	PE	RI	Digitalis	Stroke	Second look
99	F	12 h	8 h		12.9	0.50	20	1				C				1		
79	M	10 d	9 h	1	13.1	0.32	225					PVU			1			
85	F	2 d	30 h	1	20.4	0.31	16	1	1									
81	F	10 d	10 h	1	19.5	0.35	50	1	1							1		
89	F	8 d	15 h	1	16.5	0.40	30	1	1								1	
87	F	24 h	9 h	1	19.5	0.40	25	1	1	1	1					1		
80	M	30 h	30 h	1	5.0	0.38	280	1	1					1	1	1	1	
78	F	3 d	36 h	1	27.9	0.38	384	1	1							1		
83	M	24 h	11 h	1	27.5	0.38	211	1	1	1			1					
78	F	36 h	10 h	1	12.5	0.38	143	1	1			C, S				1		
61	M	3 d	36 h	1	30.5	0.35	101	1		1		C	1		1		1	
61	M	3 d	10 h		9.5	0.45	13	1										
42	M	10 d	15 h	1	31.0	0.40	58	1						1				1
78	F	3 d	15 h	1	15.0	0.49	290	1	1							1		
71	F	1 d	6 h	1	20.0	0.36	158	1						1			1	
72	M	8 d	8 h	1	18.6	0.45	89	1					1					
71	M	6 d	10 h	1	17.9	0.35	60	1	1						1	1		1
90	F	8 d	5 h	1	16.7	0.40	222	1	1			C	1					
98	F	10 d	6 h	1	6.5	0.30	189	1		1		A		1	1	1	1	
68	M	10 d	8 h	1	13.3	0.35	170	1		1				1				
70	M	10 d	4 h		15.5	0.40	90	1		1		C			1			
77	F	3 d	8 h	1	31.0	0.35	90	1	1			C						
81	F	5 d	8 h	1	6.5	0.40	70	1	1				1	1			1	
86	M	5 h	20 h		28.6	0.35	35	1	1		1	A						1
82	F	5 d	10 h	1	16.4	0.51	150	1	1			C		1		1		
79	F	10 d	10 h		18.8	0.35	56	1	1					1		1		1
69	F	3 d	6 h	1	5.9	0.33	36	1	1			A	1		1	1	1	1
73	M	1 d	6 h		6.3	0.35	89	1	1	1								1
70	M	3 d	8 h	1	18.3	0.38	130	1						1	1			
76	F	1 d	6 h	1	16.3	0.40	228	1	1	1			1		1		1	
86	M	1 d	6 h	1	15.4	0.30	160	1	1			G						
77	M 45.2%	4.6 d	12.2 h	81%	17.1	0.38	125	96.8%	64.5%	25.8%	6.5%	32.2%	22.6%	29.0%	29.0%	38.7%	25.8%	19.4%

Abbreviations: WBC, white blood count; Hct, hematocrit, CRP, C-reactive protein; H, hypertension (> 140/90 mm Hg); AF, atrial fibrillation; MI, myocardial infarction; VD, ventricular/structural cardiac defect; DVT, deep vein thrombosis; PE, pulmonary embolism; RI, renal insufficiency; C, cholecystectomy; A, appendectomy; G, gynecologic operation; S, splenectomy; PVU, perforated ventricular ulcer; Average values are in the last row and bold type.

Table 2. Risk factors with their occurance rate and combination of risk factors with incidence and cumulative incidence of ≥ 2 risk factors.

Risk factors	Incidence	Combination	Incidence
Arterial hypertension	96.8% (30/31)	2 risk factors	38.7% (12/31)
Atrial fibrillation Digitalis	64.5% (20/31)	3 risk factors	19.4% (6/31)
Abdominal operation	38.7% (12/31)	4 risk factors	12.9% (4/31)
Pulmonary embolism Renal insufficiency	32.2% (10/31)	5 risk factors	9.7% (3/31)
Myocardial infarction Stroke	29.0% (9/31)	6 risk factors	6.5% (2/31)
Deep venous thrombosis	29.0% (9/31)		
Valvular/structural Cardiac disease	25.8% (8/31)	**≥ 2 risk factors**	**87.2%**
	25.8% (8/31)		
	22.6% (7/31)		
	6.5% (2/31)		

Table 3. Risk factors distribution according to underlying cause of acute mesenteric ischemia.*

Cause	Arterial embolism	Arterial thrombosis	Nonocclusive	Venous thrombosis
Incidence, %	40–50	25	20	10
Risk factors	Dysrhythmia Myocardial infarction Rheumatic valve disease Endocarditis Cardiomyopathies Ventricular aneurysms Previous embolic events Recent angiography Renal insufficiency Stroke	Atherosclerosis Prolonged hypotension Estrogen Hypercoagulability Stroke	Hypovolemia Hypotension Lw cardiac output status α-adrenergic agonists Digoxin β-blocking agents Cardiopulmonary bypass Renal insufficiency Hemodialysis Critcally ill Cocaine use Stroke	Right-sided heart failure Previous deep vein thrombosis or pulmonary embolism Portal hypertension Intraabdominal malignancy Hepatitis Pancreatitis Recent abdominal surgery or infection Splenectomy Estrogen Polycythemia Sickle cell disease Vasculitides Hypercoagulability Nephrotic syndrome Blunt abdominal trauma

** Some risk factors are present in more than one etiology of AMI making the precise diagnosis of the underlying cause of acute mesenteric ischemia difficult.*

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KIRURŠKI TRETMAN STRES PRIJELOMA VRATA BEDRENE KOSTI BEZ NAZOČNOSTI ENDOKRINOLOŠKOG KOMORBIDITETA KOD AMATERSKE SPORTAŠICE

Surgical treatment of a femoral neck stress fracture without endocrinal comorbidity in an amateur sportswoman

Nikica Daraboš[1], Ivan Vlahović[2]

Sažetak

Stres prijelomi nisu česte ozljede te većinu pacijenata čine vojnici i sportaši koji su podvrgnuti teškim fizičkim naporima. Stres prijelomi vrata bedrene kosti najčešće se događaju u dobi od 18 do 35 godina i takvi pacijenti često boluju od nekog endokrinološkog poremećaja. Inicijalne rentgenske snimke kostiju kuka su uredne. MR dijagnostika kuka imperativ je za dijagnostiku takvog prijeloma. Vrsta tretmana ovisi o tipu prijeloma – kompresivni zahtijeva konzervativno liječenje, a tenzijski operativno liječenje.

U našem prikazu slučaja prezentirali smo tridesetpetogodišnju sportašicu amaterku u vožnji na koturaljkama koja je unatrag šest mjeseci patila od neprepoznatih simptoma stres prijeloma vrata bedrene kosti. Klinički pregledi, RTG slike bolnog kuka, endokrinološka i denzitometrijska testiranja nisu pokazivala patološke rezultate. Na kraju je MR dijagnostika bolnog kuka pokazala značajan stres prijelom vrata bedrene kosti koji je bio indikacija za hitan operacijski tretman. Oporavak pacijentice nakon minimalno invazivnog operacijskog tretmana osteosinteze prijeloma kanuliranim vijcima bio je vrlo brz. Liječenje je završilo devet mjeseci nakon operacije, s potpuno urednim kliničkim statusom i punom sportskom aktivnošću.

U slučaju nejasnih opetovanih bolova u ingvinalnoj regiji imperativ je, unatoč urednim nalazima RTG slika kuka, endokrinoloških laboratorijskih testova i denzitometrije kostiju, zbog sumnje na stres prijelom vrata bedrene kosti, pravovremeno napraviti MR dijagnostiku bolnog kuka. Takvim pristupom ovom patološkom problemu postiže se najbolji rezultat liječenja i izbjegavaju se dalekosežne posljedice tretmana komplikacija takvog prijeloma zbog previda.

Ključne riječi

stres prijelom, vrat bedrene kosti, MR, osteosinteza, kanulirani vijci

Abstract

Stress fractures are not frequent injuries and mostly soldiers and sports people faced with severe physical exertion suffer from this kind of pathology. Most patients with femoral neck stress fracture are 18–35 years of age and often suffer from a certain endocrinal comorbidity. The clinical status of this pathology is often not followed by positive x-ray signs of fracture. MRI is an imperative in diagnostics of this pathology. These fractures are treated according to type of fracture – compression fracture is treated conservatively and tension fracture operatively.

In our report we present a case of a 35-year-old roller skating amateur sportswoman who suffered from unrecognized symptoms of femoral neck stress fracture over six months. There was no sign of pathology according to the repeated clinical exams, x-rays of the painful hip, endocrinal and densitometry tests. Finally, MRI diagnostics detected a remarkable femoral neck tension stress fracture which was an indication for urgent operative treatment. The patient's recovery after the minimally invasive osteosynthesis with cannulated screws was very fast. Her treatment was finished after nine postoperative months with a regular clinical status and full sports activity.

In case of undefined recurrent pain in the inguinal region, despite a regular x-ray of the hip, endocrinal lab

[1] *Klinika za traumatologiju, KBC Sestre milosrdnice Zagreb*

[2] *student 5. godine, Medicinski fakultet, Sveučilište u Zagrebu*

Korespondencija: Dr. sc. Nikica Daraboš, dr. med, specijalist kirurgije, Klinika za traumatologiju, KBC Sestre milosrdnice Zagreb, Draškovićeva ulica 19, 10 000 Zagreb, Hrvatska, tel.: +385 98 297 970, e-mail: darabos.dr@vz.t-com.hr

tests and densitometry results, it is imperative to perform an MRI of the painful hip because of suspicious femoral neck stress fracture. The described approach to this pathologic problem will lead to the best results of therapy and avoid far-reaching consequences of treating complications of such a fracture caused by a mistake.

Keywords

stress fracture, femoral neck, MRI, osteosynthesis, cannulated screws

Uvod

Stres prijelomi nisu česte ozljede te većinu pacijenata čine vojnici i sportaši koji su podvrgnuti teškim fizičkim naporima. Susrećemo ih u 10% ozljeda kod sportaša. U 95% slučajeva radi se o stres prijelomima kostiju donjih udova. Stres prijelomi vrata bedrene kosti najčešće se događaju u dobi od 18 do 35 godina. Nastaju uslijed povećanja opterećenja u kratkom vremenu kada dolazi do oštećenja koštanog tkiva – mikrofraktura. Ako uzrok mikrofraktura ne nestane, nastat će makrofrakture [1–4].

Standardan način liječenja je korekcija aktivnosti uz rasterećenje ozlijeđenog uda, sa ili bez imobilizacije u trajanju od pet do šest tjedana. Ako se radiološkom dijagnostikom utvrdi da prijelomna pukotina zahvaća oba korteksa ili perzistira prolongirana koštana sanacija prijeloma, indiciran je operacijski tretman osteosinteze loma [5].

Prikaz slučaja

Tridesetpetogodišnja službenica idealnog indeksa tjelesne mase (BMI 20,3 kg/m^2) više se godina bavi amaterskim sportom – vožnjom na koturaljkama. U proteklih šest mjeseci u više je navrata, prilikom izrazitog opterećenja na treninzima, osjećala bol u području desne ingvinalne regije, koja bi se smirivala u mirovanju. Tijekom istog razdoblja više je puta bila pregledavana od strane specijalista kirurga i fizijatra, te radiološki obrađivana rentgenom desnog kuka i tretirana fizikalnom terapijom uz preporuku smanjenja opterećenja bolne noge. Pacijentica je negirala probleme s prehranom i menstrualnim ciklusom. Također, dotadašnji laboratorijski endokrinološki testovi izvođeni u sklopu godišnjih sistematskih pregleda nisu odstupali od granica normalnih vrijednosti. U traumatološku kiruršku ambulantu javila se nakon posljednjeg treninga vožnje na koturaljkama, a zbog simptoma pojačane, perzistirajuće tupe boli u regiji desnog kuka kod jačeg oslanjanja na istu nogu.

Tijekom kliničkog pregleda nisu nađeni vidljivi vanjski znakovi traume u regiji desne prepone i zgloba kuka, no perzistiraju simptomi terminalnog ograničenja pokreta fleksije natkoljenice u zglobu kuka te bolnih i ograničenih kretnji abdukcije, unutarnje i vanjske rotacije do 1/2 normalne pokretljivosti. Dijagnostičkom obradom na standardnim radiološkim snimkama kostiju kuka nisu verificirani znakovi koštanog prijeloma (sl. 1, sl. 2). Pacijentica je upućena na magnetsku rezonancu (MR) desnog kuka, na kojoj je verificiran stres prijelom u području vrata bedrene kosti s prikazom frakturne linije u srednjoj trećini vrata koja zahvaća oba korteksa (sl. 3).

Postavljena je indikacija za hitan operacijski tretman prijeloma perkutanom intramedularnom osteosintezom s tri kanulirana vijka promjera 7,3 mm djelomično tretiranih navojem dužine 16 mm i izrađenih od titanija (DePuy Synthes) pod kontrolom intraoperacijskog rentgen pojačivača. Prvog poslijeoperacijskog dana započelo se s fizikalnom terapijom na odjelu te je pacijentica otpuštena dalje na ambulantnu rehabilitaciju uz preporuku rasterećenja operirane noge prilikom hoda uz pomoć pomagala tijekom sljedeća dva tjedna. Također, na našu preporuku učinjena je kompletna endokrinološka laboratorijska obrada i denzitometrija kostiju te su rezultati svih pretraga bili negativni. Šest tjedana od operacijskog zahvata kliničkim pregledom utvrđen je uredan status desnog kuka, a radiološkim snimanjem uredan položaj vijaka bez zamjetljivih promjena u regiji tretiranog prijeloma (sl. 4). Pacijentica započinje s treninzima lakšeg intenziteta, postupno ga povećavajući do punog opterećenja u naredna tri tjedna. Tada se kontrolnim kliničkim pregledom i radiološkim snimanjem desnog kuka verificira u potpunosti uredan rezultat završetka liječenja. Danas, šest godina nakon operacije, implantati u regiji vrata desne bedrene kosti ne predstavljaju joj problem, pacijentica se i dalje amaterski bavi sportom, a testovi endokrinoloških laboratorijskih pretraga i denzitometrije kostiju izvođeni u sklopu godišnjih sistematskih pregleda ne odstupaju od granica normalnih vrijednosti.

Rasprava

Nastanak stres prijeloma kosti bazira se na slabosti fokalne strukture koštanog tkiva, slabosti mišića regije i čestim ponavljajućim mišićnim trzajima. Česti su kod sportaša, osobito bjelkinja srednje dobi, a naročita predispozicija za njihov nastanak je postojanje metaboličke bolesti kostiju. Predisponirajući faktori za nastanak stres prijeloma kosti su neredovita menstruacija, osteoporoza, dijabetička i idiopatska neuropatija, pušenje, alkoholizam, hipotireoza, Pagetova bolest, anoreksija i reumatoidni artritis [6]. Stoga je u tretmanu takvih prijeloma posebice važno dijagnostički obraditi moguće poremećaje prehrane, amenoreju, uključujući i mjerenje gustoće kostiju zbog moguće osteoporoze. Pacijenti sa stres prijelomom vrata bedrene kosti najčešće primijete bol u preponama koja se pogoršava povećanjem fizičke aktivnosti, a smanjuje mirovanjem. Inicijalne rentgenske snimke kostiju kuka su uredne, ali čak i kasnije snimke neće uvijek pokazati reaktivne promjene. Scintigrafija kosti

ili MR nužni su za dijagnozu prijeloma. MR je alternativa scintigrafiji kosti i omogućuje ranu dijagnozu, a potrebno je tražiti smanjenje intenziteta signala u T1 snimci i povećanje intenziteta u T2 snimci. Radiološki dokaz loma oba korteksa ili proširenja frakturne pukotine indikacija je za hitnu unutarnju fiksaciju kako bi se spriječio pomak frakturnih ulomaka [7]. Stres prijelomi se klasificiraju kao kompresijski ili tenzijski prijelomi. Kompresijski prijelomi se javljaju na donjem dijelu vrata femura te je prilikom radiološke obrade bitno tražiti unutarnji kalus na donjem dijelu vrata femura. Tenzijski prijelomi se javljaju na gornjem i srednjem dijelu vrata femura te uzrokuju transverzalne prijelome kroz vrat femura. Kod ovog tipa prijeloma postoji veća vjerojatnost da će doći do progresije ili pomaka ulomaka [8]. Ako se stres prijelom vrata femura ne dijagnosticira na vrijeme, kao komplikacija postoji mogućnost nastanka avaskularne nekroze glave femura [9].

Terapija stres prijeloma vrata bedrene kosti ovisi o tipu loma. Kompresijski prijelomi su stabilniji nego tenzijski prijelomi i mogu biti liječeni konzervativno ako ne postoji radiološki utvrđena frakturna linija. Konzervativan tretman uglavnom uključuje mirovanje, pasivno održavanje tonusa muskulature, postepeno uspravljanje uz rasterećenje ozlijeđene noge te opetovanu radiološku opservaciju kako bi se uočile promjene oblika prijeloma ili pomak ulomaka. Tenzijski prijelomi se javljaju na gornjem i srednjem dijelu vrata femura, potencijalno su nestabilni te najčešće zahtijevaju operacijsko liječenje. Kod radiološki vidljive frakture oba korteksa kosti indicirana je osteosinteza prijeloma [8].

U prikazanom slučaju unatoč postojanju kliničkih simptoma patologije u regiji zgloba bolnog kuka, te provedenoj radiološkoj rentgenskoj i endokrinološkoj laboratorijskoj dijagnostici, nije bilo drugih patoloških nalaza. Pacijentica je tijekom šest mjeseci prije operacije uzastopnim ponavljajućim opterećenjem desne noge, naročito prilikom vožnje na koturaljkama, riskirala pogoršanje prijeloma vrata bedrene kosti s pomakom ulomaka ili avaskularnu nekrozu glave femura. Oba neželjena ishoda mogla su tragično rezultirati potrebom za jednim od radikalnijih operacijskih tretmana takvog prijeloma kao što su dekompresija otklanjanjem nekrotične kosti [10], osteotomija [11] umetanje vaskulariziranih transplantata lisne kosti na peteljci [12, 13] pa do ugradnje umjetnog zgloba kuka [14]. No, provedena MR dijagnostika desnog kuka ukazala je na tenzijski stres prijelom srednje trećine vrata bedrene kosti koji uključuje oba korteksa te je sukladno indikaciji napravljen hitan minimalno invazivan operacijski tretman osteosinteze ulomaka s tri kanulirana vijka. S obzirom na to da su i šest godina poslije operacije hormonalne laboratorijske pretrage te nalazi denzitometrije kostiju konstantno uredni, u ovom slučaju iznimno nije bilo povezanosti stres prijeloma i endokrinološkog statusa pacijentice.

No, na kraju uspješnog liječenja važno je naglasiti da odsutnost boli nije znak potpunog zarastanja prijeloma, a refraktura je česta naročito kod sportaša koji se prerano vrate sportu.

Spoznaje i zaključak

Stres prijelomi vrata bedrene kosti predstavljaju vrstu prijeloma koja se, zbog previda, vrlo često nepravovremeno tretira.

Kod nejasne etiologije opetovanih bolova u ingvinalnoj regiji potrebno je, unatoč urednim nalazima rentgenskih slika kuka, endokrinoloških laboratorijskih testova i denzitometrije kostiju, zbog sumnje na stres prijelom vrata bedrene kosti pravovremeno napraviti MR dijagnostiku kuka.

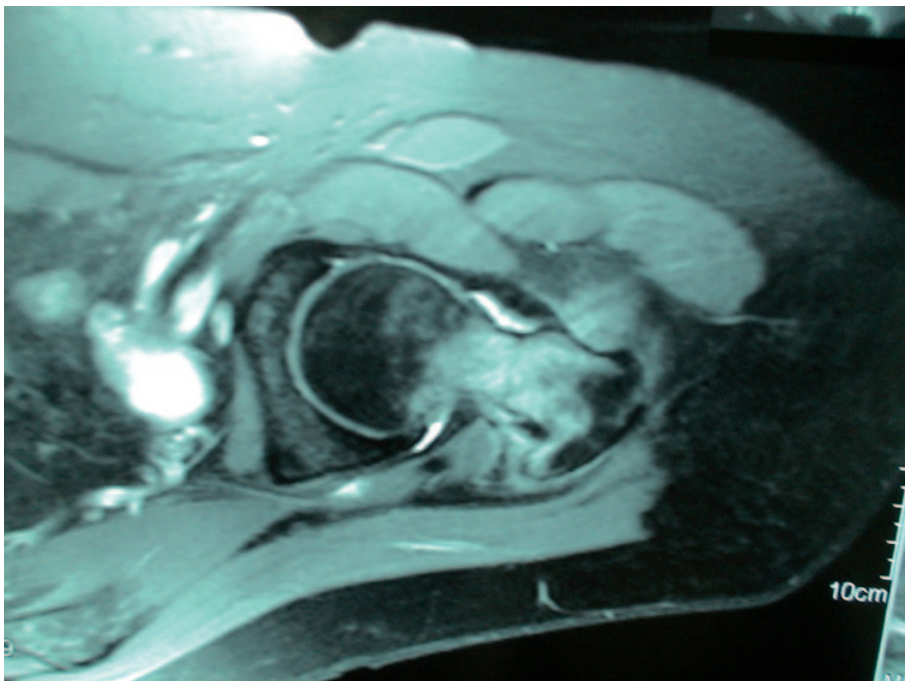
Na taj način postiže se najbolji rezultat liječenja i izbjegavaju dalekosežne posljedice tretmana komplikacija takvog prijeloma zbog previda.

Slika 1. Rentgen (AP) desnog kuka, prije operacije – bez znakova prijeloma.

Slika 2. Rentgen (LL) desnog kuka, prije operacije – bez znakova prijeloma.

Slika 4. Rentgen (AP) desnog kuka, šest tjedana od operacijskog zahvata – uredan položaj vijaka bez zamjetljivih promjena u regiji tretiranog prijeloma.

Slika 3. MR desnog kuka, prije operacije – stres prijelom u području vrata bedrene kosti s prikazom frakturne linije u srednjoj trećini vrata koja zahvaća oba korteksa.



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OPERATIVE TREATMENT OF INGUINAL HERNIA ON CHILDREN USING MINIMALLY INVASIVE PIRS TECHNIQUE

Operativno liječenje ingvinalne hernije kod djece pomoću minimalno invazivne pirs tehnike

Katarina Golc[1], Nuša Skutnik[2]

Abstract

Inguinal hernia repair is one of the most frequently performed operative procedures in pediatric population and one of the most common reasons for pediatric surgical referral. The golden standard of treatment is an open surgical approach through a groin incision, however in recent years laparoscopic inguinal hernia repair in children has become more and more popular. In our case, we decided to perform the PIRS technique, invented by professor Dariusz Patkowski, which has not been successfully performed in our country so far. The advantages of this technique include the use of only one umbilical port, resulting in short operative times, relative simplicity of the procedure and excellent cosmetic results. The PIRS technique is already routinely performed in Poland on children aged up to 14.5 years.

Keywords

inguinal hernia, PIRS technique, minimally invasive surgery, children

Sažetak

Liječenje ingvinalne hernije jedan je od najčešće izvođenih operativnih zahvata u dječjoj dobi i jedan od najčešćih razloga za kirurško liječenje kod djece. Zlatni standard liječenja je otvoreni kirurški pristup kroz preponski rez, iako posljednjih godina laparoskopski pristup postaje sve popularniji. U našem slučaju, odlučili smo se za PIRS tehniku, koju je osmislio professor Dariusz Patkowski i koja dosad u našoj zemlji nije bila uspješno izvedena. Prednosti ove tehnike uključuju korištenje samo jednog umbilikalnog porta, što rezultira kratkim vremenom operacije, relativnom jednostavnošću zahvata i izvrsnim kozmetičkim rezultatima. PIRS tehnika već se rutinski izvodi u Poljskoj na djeci starosti do 14,5 godina.

Ključne riječi

ingvinalna hernija, PIRS tehnika, minimalno invazivna kirurgija, djeca

Introduction

Inguinal hernia is a protrusion of contents of the abdominal cavity through the inguinal canal. Most hernias diagnosed in childhood are indirect and a result of a patent *processus vaginalis* in boys or its analogue in girls – canalis Nucki [1]. The exact incidence is unknown, it ranges from 0.8% to 4.4% [2], of these 60% are right-sided [1]. In order to avoid complications (incarceration, strangulation) operative treatment is indicated [1, 3]. The traditional surgical approach is through an inguinal incision. In children we do not open the inguinal canal. The hernia sac is resected from the spermatic cord or *lig. teres uteri* and other structures [3, 4]. Despite excellent results of this classical approach, laparoscopic hernia repair is becoming more and more popular with the progress in pediatric surgery in recent years. It mostly involves only the suturing of the internal inguinal ring. There are many different techniques described [1–6]. In our case, we chose a minimally invasive PIRS technique (Percutaneous Internal Ring Suturing), invented by professor Dariusz Patkowski from the Medical University of Wroclaw in Poland. It was for the first time successfully performed in 2004. The advantage of this method is that it requires only one umbilical port and the suture is placed at the level of the internal inguinal ring through the puncture-point access with an injection needle [6]. This way intra-abdominal suturing is avoided and the procedure leaves only a minimal scar in the area of the umbilicus

[1] *Department of Pediatric Surgery, General Hospital Celje, Slovenia*

[2] *Faculty of Medicine, University of Ljubljana, Slovenia*

Correspondence: Katarina Golc, MD, Department of Pediatric Surgery, General Hospital Celje, Oblakova ulica 5, 3000 Celje, Slovenia, e-mail: katarina.golc@sb-celje.si

[ibid 6]. The procedure is simple and operative times are short [ibid 6]. This procedure has not been successfully performed in Slovenia so far.

Case report

Four-year-old L. C. was admitted to the Department of Pediatric Surgery in the General Hospital Celje on the 17th of December 2013 at 6.30 am for operative treatment of a bilateral inguinal hernia and an umbilical hernia. The patient had no other problems and did not receive any regular therapy. Preoperative laboratory results were within normal limits.

Beforehand, the patient was examined at our clinic on the 13th of November, 2013, for a right inguinal hernia. She was referred to our clinic by her pediatrician. At the examination we also noticed a left inguinal hernia and an umbilical hernia (0.5 x 0.5 cm). All the hernias were easily reducible.

The procedure was performed on the day of the admission. It started at 9 am. The patient was put under general endotracheal anesthesia. We used a 40% mixture of oxygen/air, sevoflurane, fentanyl and a muscle relaxant rocuronium. For postoperative analgesia the patient was given a diclofenac suppository, paracetamol and piritramide i.v. During the operation a complete standard monitoring was performed; blood pressure, electrocardiogram (ECG) monitoring, pulse, saturation, exhaled carbon dioxide, body temperature). From the anesthesiological point of view, the procedure was carried out without any complications.

After a sterile preparation of the operative field and sterile covering, we made a 5 mm transverse incision in the upper part of the umbilicus. Then we dissected subcutaneous tissue and placed Mikulicz clamps on the fascia. We entered the abdominal cavity using the Hasson technique for trocar insertion. For the repair of umbilical hernia and simultaneous fixation of the port, which we inserted without a cannula, we placed a purse-string suture (Vicryl Rapide 3.0, UCL needle 13 mm, Johnson & Johnson). We used a 5 mm port (Dexide 5 mm Threaded Trocar, MM SURGICAL). We insufflated the abdominal cavity with a pressure of 6–10 mmHg. After the inspection of the whole peritoneal cavity with a 5 mm telescope (zero degree optics, Olympus) we located the internal inguinal rings. The procedure was first performed on the right and then on the left side. To assess the location for the needle puncture we pressed the tip of a Pean forceps against the inguinal region from the outside. Then we introduced an injection needle (18G, 1.2 x 40 mm BD Microlance) into the abdominal cavity. Beforehand, the injection needle was curved into an appropriate shape to enable easier manipulation. Inside the barrel of the needle we inserted a nonabsorbable thread (Ethibond Excel 0, Johnson & Johnson) in the shape of a loop. By moving the tip of the needle we passed the thread under the peritoneum and included a part of the lateral wall under the *lig. teres uteri*. The second thread was inserted into the barrel of the needle and introduced into the peritoneal cavity, this time medially under the peritoneum and through the loop of the first thread. The loop was then pulled out of the abdomen. This way only one thread was placed around the inguinal ring under the peritoneum and both ends of the thread excited the skin through the same puncture point. We tied the ends of the thread and hid the knot under the skin. The same procedure was performed on the contralateral side. During the introduction of the second thread on the left side we were a little imprecise, which led to a formation of a 1 mm skin bridge. We had to interrupt it with a scalpel. After completing the hernioplasty we inspected the whole abdominal cavity once more, removed the umbilical port, and tied the purse-string suture. Puncture points were locally infiltrated and the umbilical wound was closed with absorbable stitches. All the wounds were covered with dressings.

The entire operative time was 80 minutes. The patient did not receive any antibiotic treatment. She was monitored for one hour in the recovery room and then moved to the ward. Three hours after surgery, the patient normally urinated and defecated in the ward.

With a consent from the anesthesiologist, the patient was discharged from the hospital on the same day at 4 pm. At the time of the discharge, the patient's abdomen was soft and minimally tender to palpation in the area of postoperative wounds. At home, she required analgesic therapy (on the first day diclofenac suppository every eight hours, on the second day only one small spoon of paracetamol suspension).

On the third day after surgery, the patient came for a check-up. The wounds were minimal and without any complications (Fig. 1, Fig. 2). The inguinal area was a little tender to palpation on both sides. The patient had no problems at home.

Figure 1. Postoperative wounds at check-up on the third day after surgery (with dressings).

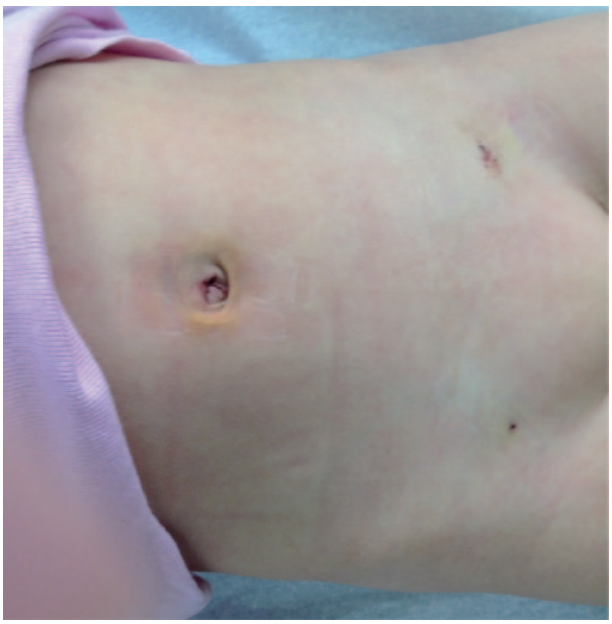

Figure 2. Postoperative wounds at check-up on the third day after surgery (without dressings).

On the tenth day after surgery, we contacted the patient's parents over the phone. In their opinion, the child looked completely healthy on the third day after surgery. She began with her normal activities about a week after surgery.

Discussion

The advantages of the PIRS technique in comparison with the open surgical approach, which is the golden standard for inguinal hernia repair in children, are numerous. The procedure is minimally invasive and does not require an inguinal incision, which is the main cause of postoperative pain [6]. It also enables a diagnosis of a possible contralateral hidden hernia and its repair within the same procedure [ibid 6]. The risk of cord structures injury is minimal and the cosmetic results are far better than with an open approach or other standard laparoscopic techniques [ibid 6].

In comparison with other laparoscopic techniques, the PIRS technique avoids the need for intra-abdominal suturing, which requires a very skilled surgeon with a lot of experience and is very time consuming [ibid 6]. In Poland, the PIRS technique is one of the first laparoscopic procedures on children that surgical residents learn. This technique is also much cheaper than other laparoscopic techniques for inguinal hernioplasty [ibid 6].

Recurrence rate for open hernia repair ranges from 0.8 to 3.8 % [4]. The numbers are a bit higher for laparoscopic repair techniques, from 0.7 to 4.5 % [ibid 4]. When using the PIRS technique recurrence rate is 2.5 %, but it significantly decreases with refinement of the technique and gaining experience to 1% *.

Due to the proximity of the vessels, there is a risk of puncturing them with the tip of the injection needle. These bleedings are limited and can be stopped by applying pressure to the abdominal wall from the outside in the inguinal area. We try to avoid this risk by curving the shape of the needles before the procedure and by constantly following the movement of the tip of the needle [6]. In boys, transient hydrocele may develop occasionally after surgery. It spontaneously reabsorbs within a couple of months [ibid 6]. In literature, one case of adhesive ileus has been described as a complication of the PIRS procedure [ibid 6].

The first attempt of performing the PIRS technique in Slovenia was made at the University Medical Centre in Ljubljana on the 18th of October, 2012. The patient was 16 years old at the time and her abdominal wall was too thick for the attempt to be successful. During the procedure we punctured a vein in the abdominal wall and a hematoma was formed. The procedure was completed as a laparoscopic hernioplasty with intra-abdominal suturing of the internal inguinal ring. The patient was discharged the next day.

We then waited for the "perfect" patient. We decided to try to perform the technique on smaller children, and girls first. The technique is easier to perform on a patient with a thinner abdominal wall.

In the case of L. C. the entire procedure went smoothly without any complications. It was performed as a day surgery, the patient was discharged the same day. The results were excellent. The scar in the area of the

** current data from Prof. Patkowski, December 2013*

umbilicus was barely visible and we expect it to continue shrinking with time.

With the successful performance of the technique we would like to share some of our observations. If the patient is older and has a thicker abdominal wall, the procedure can still be performed using longer injection needles (18G, 1.2 x 50 mm, BD Microlance). When inserting the second thread into the

barrel of the needle, a short portion of the thread should pass through the opening of the tip of the needle. This way there is less chance for the thread to become stuck in the abdominal wall when manipulating the needle. When placing the second thread, caution should be put on entering the abdominal cavity always through the same puncture point and this way avoiding the formation of skin bridges. If placement of the second thread is not successful in the first attempt, the procedure does not need to be performed from the beginning. The loop of the first thread can be released with manipulation of the second needle if the first thread gets stuck in the medial part.

Conclusion

The PIRS technique was successfully performed in Slovenia for the first time. The results were extremely satisfying for us as well as for the patient and her parents. We believe that this technique could be a valuable alternative to an open surgical approach in inguinal hernia repair due to its simplicity, short operative times, minimal invasiveness and excellent cosmetic results.

Acknowledgement

We would like to take this opportunity to sincerely thank everyone who contributed to the operation: Milena Osole, Vesna Papuga, Zdenka Filipič, Magdalena Istenič, Vlasta Kaučič and Melita Lončarič.

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NEKROTIZIRAJUĆI SOLITARNI DIVERTIKULITIS CEKUMA

Necrotizing solitary cecal diverticulitis

Zrinka Sudar Magaš[1], Saša Magaš[2], Branko Fila[1]

Sažetak

Nekrotizirajući divertikulitis cekuma vrlo je rijetko stanje koje se klinički prezentira bolnošću u desnom donjem kvadrantu trbuha, sliči akutnoj upali crvuljka, a liječi se kirurški.

Prikazan je slučaj 40-godišnjeg muškarca s kliničkom slikom bolova u desnom donjem kvadrantu trbuha, visokim upalnim parametrima i ultrazvučno dokazanom kolekcijom tekućeg sadržaja ileocekalno uz uredan crvuljak. Intraoperativno je pronađen sekundarno upaljen crvuljak i nekrotična tvorba cekuma. Nakon *ex tempore* patohistološke dijagnoze koja je isključila malignitet, napravljene su divertikulektomija i apendektomija. Naknadna patohistološka dijagnostika verificira nekrotizirajući divertikulitis cekuma. Ultrazvučne i endoskopske kontrole pokazuju uredan nalaz.

Ključne riječi

akutni abdomen, nekrotizirajući divertikulitis cekuma, divertikulektomija

Abstract

Necrotizing cecal diverticulitis is an extremely rare condition. Its clinical presentation involves pain in the right lower abdominal quadrant, it is similar to acute appendicitis and should be treated surgically.

We present a case of a 40-year-old male with clinical presentation of pain in the right lower abdominal quadrant, high inflammatory parameters and collection of liquid content ileocecally visible by ultrasound, with non-symptomatic appendix. Intraoperatively, secondary inflammation of the appendix was found along with necrotic cecum. Following *ex tempore* pathohistological diagnosis, which excluded the possibility of malignancy, diverticulectomy and appendectomy were performed. Subsequent pathohistological diagnosis verified necrotizing cecal diverticulitis. Follow up included ultrasound and endoscopic check ups resulting in an uneventful postoperative course.

Keywords

acute abdomen, necrotizing cecal diverticulitis, diverticulectomy

Uvod

Solitarni divertikulitis cekuma prvi je opisao Potier 1912. godine [1]. Etiologija ovog stanja nije posve jasna, no uglavnom se smatra kongenitalnim stanjem. Smatra se da je učestalost divertikulitisa cekuma 1:300 apendektomija, odnosno da se među divertikulima kolona 3,6% nalazi na cekumu [1–2]. Divertikuloza desnog kolona je rijetka. Američka i europska literatura navode učestalost 1–2%. S druge strane, u azijskoj populaciji izvješćuje se o učestalosti koja iznosi 43–50% [3]. Pojavnost cekalnog divertikulitisa češće se javlja u mlađim dobnim skupinama. Mnogobrojni dokazi navode na zaključak da ove razlike imaju svoje porijeklo u nasljeđivanju [3]. Problematično je što ovo stanje pokazuje jake kliničke sličnosti s akutnom upalom crvuljka te ga je vrlo teško dijagnosticirati preoperativno. Zato se i vrlo često pogrešno dijagnosticira kao akutna upala crvuljka [1]. Kod većine se pacijenata javlja tupa bol u donjem desnom abdominalnom kvadrantu dužeg trajanja uz rjeđu pojavu mučnine i povraćanja [3]. Većina opisanih slučajeva u literaturi naglašava problematičnu preoperativnu dijagnozu ovog stanja kod pacijenata koji se prezentiraju ovakvom kliničkom slikom [3]. Divertikulitis cekuma ponekad se pogrešno dijagnosticira i kao tumor cekuma, naročito ako se prezentira masom u desnoj ilijačnoj fosi, pogotovo kod starijih pacijenata [4]. U literaturi postoje dvojbe o metodi optimalnog liječenja simptomatskog solitarnog divertikulitisa cekuma. Neke studije predlažu i konzervativni pristup, dok se drugi zalažu za divertikulektomiju ili desnostranu hemikolektomiju [4]. Naročito je teško dijagnostičkim metodama utvrditi radi li se o nekrotizirajućem divertikulitisu koji se obligatno mora rješavati kirurškim zahvatom.

[1] *Odjel kirurgije, OB Bjelovar*

[2] *Interni odjel, OB Bjelovar*

Korespondencija: Zrinka Sudar Magaš, Opća bolnica Bjelovar, Odjel kirurgije, Mihanovićeva 8, 43 000 Bjelovar, e-mail: zrinka.sudarmagas@gmail.com

Prikaz slučaja

Pacijent star 40 godina primljen je u hitnu službu zbog tupih bolova u trbuhu koji su započeli dan ranije. U statusu abdomena zamijećena je bolnost i defans trbušne stijenke u ileocekalnom području. Napravljeni hitni laboratorijski nalazi ukazuju na leukocitozu ($11,21x10^9$/L sa 67% segmentiranih granulocita). Ultrazvučni pregled abdomena u ileocekalnoj regiji verificira interintestinalnu slobodnu tekuću kolekciju veličine 25x11 mm, dok se sigurnih znakova samog zadebljanja apendiksa nije uspjelo izdiferencirati. Zbog anemnestičke i kliničke sumnje na akutnu upalu crvuljka pristupi se operativnom zahvatu. U općoj anesteziji naizmjeničnim rezom uđe se u trbušnu šupljinu. Nađe se sekundarno upaljen crvuljak koji je fiksiran uz nekrotičnu tvorbu cekuma koja se nalazi oko 1,5 cm od ileocekalnog ušća te dosta zamućenog eksudata. Napravi se hitna biopsija tvorbe. Nalaz biopsije *ex tempore* opisuje mekani sivkasto crveni uzorak tkiva. Histološki se na dijelu površine uzorka nalazi sluznica debelog crijeva urednog izgleda, a u podležećem rastrganom vezivnom i masnom tkivu žarišta nekroze i svježeg krvarenja, te vrlo gusti miješani upalni infiltrat mono- i polimorfonukleara. Budući da je nalaz ukazivao na benignu tvorbu, napravi se ekscizija tvorbe koja klinički djeluje kao nekrotični divertikul cekuma. Cekum se zatvori dvoslojno uz provjeru prohodnosti ileocekalnog ušća. Napravi se i tipična apendektomija. Uzet je bris iz trbušne šupljine, a preparat se pošalje na patohistološku dijagnostiku. Postoperativni tijek protiče uredno. Od drugog je dana čujna peristaltika, a rana cijeli *per primam*. Naknadno pristigli patohistološki nalaz ukazuje na sluznicu debelog crijeva uredne strukture, žlijezde su s održanom produkcijom sluzi, a na više mjesta vidljivi su invaginati sluznice u podležeće masno tkivo okruženi tankim slojem mišićnog tkiva. Žarišno je sluznica nekrotična, prožeta krvlju i vrlo gustim miješanim upalnim infiltratom mono- i polimorfonukleara koji prožimaju i okolno masno tkivo, dok se granuloma nije našlo. Histološka slika diferencijalno dijagnostički najprije upućuje na nekrotizirajući divertikulitis.

Ultrazvuk abdomena napravljen četiri mjeseca nakon operacije bio je uredan. Šest mjeseci nakon operacije napravljena je kolonoskopija koja pokazuje uredan nalaz cijelom dužinom kolona do ulaza u terminalni ileum.

Rasprava

U prikazanom slučaju radilo se o nekrotizirajućem solitarnom divertikulitisu cekuma. Nekrotizirajući divertikulitis cekuma još je rjeđi oblik divertikulitisa, stoga se u literaturi vrlo rijetko navodi. U radu Uwechua i suradnika prikazan je slučaj staplerske laparoskopske operacije solitarnog, upaljenog i gangrenoznog cekalnog divertikula [5]. Jednako kao i u našem slučaju, zbog kliničke slike postavljena je radna dijagnoza apendicitisa, a konačna dijagnoza postavljena je intraoperativno. Ultrazvuk i kompjuterizirana tomografija (CT) dokazano su korisne metode za dijagnozu desnostranog, stoga i cekalnog divertikulitisa [6–7]. U radu Choua i suradnika prikazana su 934 pacijenta s povremenim bolovima u desnom donjem abdominalnom kvadrantu, koji su bili podvrgnuti ultrazvuku trbuha. Osnovna sonografska karakteristika upaljenog divertikula okrugla je hipoehogena struktura, a osjetljivost i specifičnost metode je gotovo apsolutna (91,3%, odnosno 99,8%) [6]. I u prikazanom slučaju napravljen je ultrazvuk trbuha koji verificira interintestinalnu slobodnu tekućinu u ileocekalnoj regiji bez zadebljanja crvuljka.

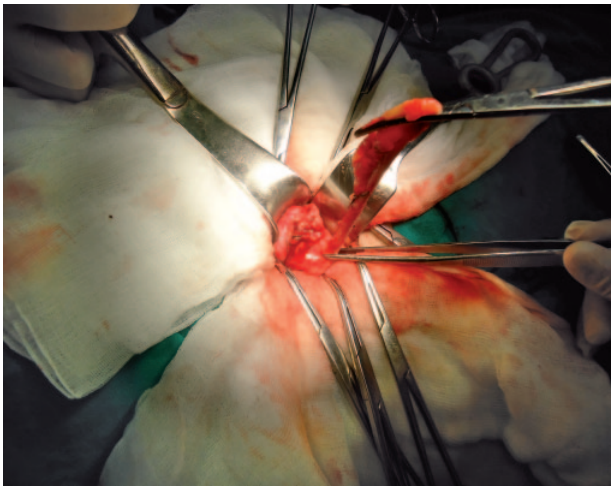
U literaturi se navode kontroverzni stavovi operativne strategije te ne postoji široko prihvaćen konsenzus [5]. Navode se opcije od divertikulektomije do desnostrane hemikolektomije [8]. U radu Altuna i suradnika navedena je i mogućnost preoperativne dijagnostičke laparoskopije kojoj je slijedila laparoskopska desnostrana hemikolektomija zbog sumnje na tumorsku bolest [8]. Fang i suradnici obradili su 85 pacijenata sa sigurnom dijagnozom cekalnog divertikulitisa. Samo medikamentozno je tretirano 18 pacijenata, a od toga je troje imalo relaps bolesti koji je ponovno u remisiju doveden medikamentoznim postupcima. Laparotomija je napravljena kod 67 pacijenata, a kod njih 47 (70%) akutni apendicitis je bio radna preoperativna dijagnoza. Kod 24 pacijenta učinjena je apendektomija, kod devet pacijenata divertikuletomija, a kod 14 desnostrana hemikolektomija [9]. Kod ostalih 20 pacijenata učinjena je desnostrana hemikolektomija zbog ponovljenih ataka divetikulitisa, zbog CT-om dokazane perforacije cekalnog divertikula ili sumnje na tumor [9]. U zaključku autori preporučuju agresivnu kiruršku resekciju za pacijente s definitivnom dijagnozom [9]. Iako se u navedenoj literaturi govori i o medikamentoznom liječenju pacijenata s cekalnim divertikulitisom, većina autora ipak smatra da se izolirani cekalni divertikulitis može liječiti samo kirurški jer je cekalni divertikulitis rijetko stanje koje se rijetko može dijagnosticirati preoperativno, rijetko se poboljšava samo na medikamentoznu terapiju i ima visoku stopu komplikacija kada se liječi na taj način [10]. Opsežnost zahvata (divertikulektomija, divertikulektomija s cekostomijom, desna hemikolektomija) ovisi o veličini i smještaju divertikula, stupnju upale i prisutnosti nekroze stijenke [10]. U našem slučaju nekrotizirajućeg divertikulitisa cekuma bilo je moguće napraviti navedeni operativni zahvat zbog dovoljne udaljenosti od ileocekalnog ušća te *ex tempore* potvrđene benignosti.

Zaključak

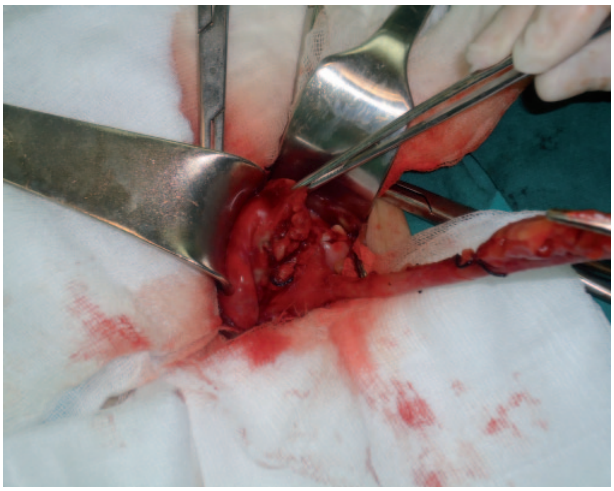
Iako je divertikulitis cekuma rijedak, a nekrotizirajući divertikulitis cekuma još rjeđi uzrok kliničke slike

akutnog abdomena, kirurg mora imati na umu da je to jedna od mogućih diferencijalnih dijagnoza bolova u desnom donjem kvadrantu trbuha te da mu je klinička slika vrlo slična akutnom apendicitisu. Uz rutinske laboratorijske nalaze, ultrazvuk i CT abdomena metode su koje mogu prije operacije s dovoljnom osjetljivošću i specifičnošću pomoći u dijagnostičkom postupku. Definitivna dijagnoza se postavlja intraoperativno, a opsežnost kirurške resekcije ovisi o intraoperativnom nalazu.

Slika 1. Divertikul cekuma te na pean podignut crvuljak.



Slika 2. Pincetom podignut divertikul s nekrozom na vrhu te udaljenost prema bazi crvuljka.



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ORBITAL CAVERNOUS HEMANGIOMA

Orbitalni kavernozni hemangiom

Rade Škarica[1], Boris Zdilar[2], Domagoj Rašić[2], Mladen Harapin[3], Tatjana Andabaka[4], Jurica Fudurić[5], Zvonko Zadro[2], Miran Martinac[2], Ana Šoštarić Zadro[6], Mario Kordić[7]

Abstract

The aim of this case report was to present a patient with a benign orbital tumor, cavernous hemangioma, who presented with symptoms of compressive orbital mass: unilateral axial proptosis, with motility restriction and sudden vision loss in the left eye. Ophthalmologic examination (visual acuity, applanation tonometry, Goldmann tonometer, visual field) and radiologic examination diagnosed a benign, well circumscribed, vascular, intraconal tumor that compresses the optic nerve. Treatment was operative: lateral orbitectomy Krönlein procedure and the tumor was removed. Pathologic and pathohistologic examination confirmed the previous diagnosis. Follow up examination, visual field and MRI of the orbit showed considerable improvement. Surgical treatment was also the final treatment and no adjuvant therapy was necessary. Prognosis for visual acuity and life is excellent.

Keywords

vascular orbital lesion, cavernous hemangioma, orbitectomy

Sažetak

Cilj ovog rada bio je prikazati slučaj pacijentice s benignim tumorom orbite, kavernoznim hemangiomom, koji se javlja sa simptomima kompresivne tvorbe u orbiti: unilateralnom proptozom, smetnjama motiliteta te naglim gubitkom vida lijevog oka. Oftalmološkom obradom (ispitivanje vidne oštrine, aplanacijska tonometrija, ispitivanje vidnog polja po Goldmannu) te radiološkom obradom (MR, MSCT, MSCT angiografija) postavlja se dijagnoza benigne, dobro ograničene, vaskularne tvorbe u konusu koja pritišće očni živac. Pristupilo se operativnom zahvatu, napravila se lateralna orbitektomija po Krönleinu i odstranio tumor u cijelosti. Patološka i patohistološka pretraga potvrđuju raniju dijagnozu. Postoperativni tijek protiče uredno te se na nalazu kontrolnog vidnog polja i kontrolnim snimkama MR-a utvrđuje značajno poboljšanje. Kod pacijentice je kirurško liječenje bilo i konačno te nije bila potrebna dodatna terapija. Prognoza za vidnu oštrinu i život je odlična.

Ključne riječi

vaskularna orbitalna lezija, kavernozni hemangiom, orbitektomija

Introduction

Vascular neoplasms make 4% of all orbital lesions. Cavernous hemangioma occurs in 50% of cases. Almost 75% are middle-aged patients (20–64), only 10% younger (0–20) and 15% older (over 65 years of age). Cavernous hemangioma is a benign, non-infiltrative, slowly progressive tumor, it is congenital, but it usually becomes symptomatic in middle-aged patients, when the tumor grows. Location is typically intraconal, rarely intraosseous. Unlike non-neoplastic vascular lesions which usually effect the hemodynamic functions of underlying structures, neoplastic vascular lesions typically manifest themselves with a mass effect. Symptoms of tumor are axial, unilateral proptosis and motility restriction. When the tumor is large it can indent the back of the eye causing choroidal folds and papilledema with decreased vision acuity. If the lesion is in the conal apex, it can compress the optic nerve without significant proptosis. The lesion may enlarge during pregnancy. Orbital imaging techniques confirm the diagnosis, which shows oval to round intraconal

[1] Department of Neurosurgery, General Hospital Zadar, Zadar, Croatia

[2] University Hospital Sveti Duh, University Department of Surgery, Zagreb, Croatia

[3] Department of Radiology, General Hospital Zadar, Zadar, Croatia

[4] Department of Anesthesiology, Reanimatology and Intensive Care, General Hospital Zadar, Zadar, Croatia

[5] Department of Surgery, General Hospital Karlovac, Karlovac, Croatia

[6] Department of Radiology, Special Hospital for Lung Diseases, Zagreb, Croatia

[7] Department of Urology, University Hospital Mostar, Bosnia and Herzegovina

Correspondence: Boris Zdilar, MD, University Hospital Sveti Duh, University Department of Surgery, 10 000 Zagreb, Croatia, e-mail: bzdilar@gmail.com

mass, well defined with slow contrast enhancement. Ultrasound of the eye and orbit shows a well defined, highly reflective tumor with regular acoustics. Prognosis is excellent, for visual acuity and life [1–4].

Case report

Patient, female, 67 years of age, with no previous significant medical history was admitted because of sudden vision loss in the left eye that occurred two days ago. Also in the past few weeks she had a temporary diplopia and left eye proptosis. Ophthalmologic examination showed a unilateral axial proptosis with motility restriction of the left bulbus, with regular palpebral closure.

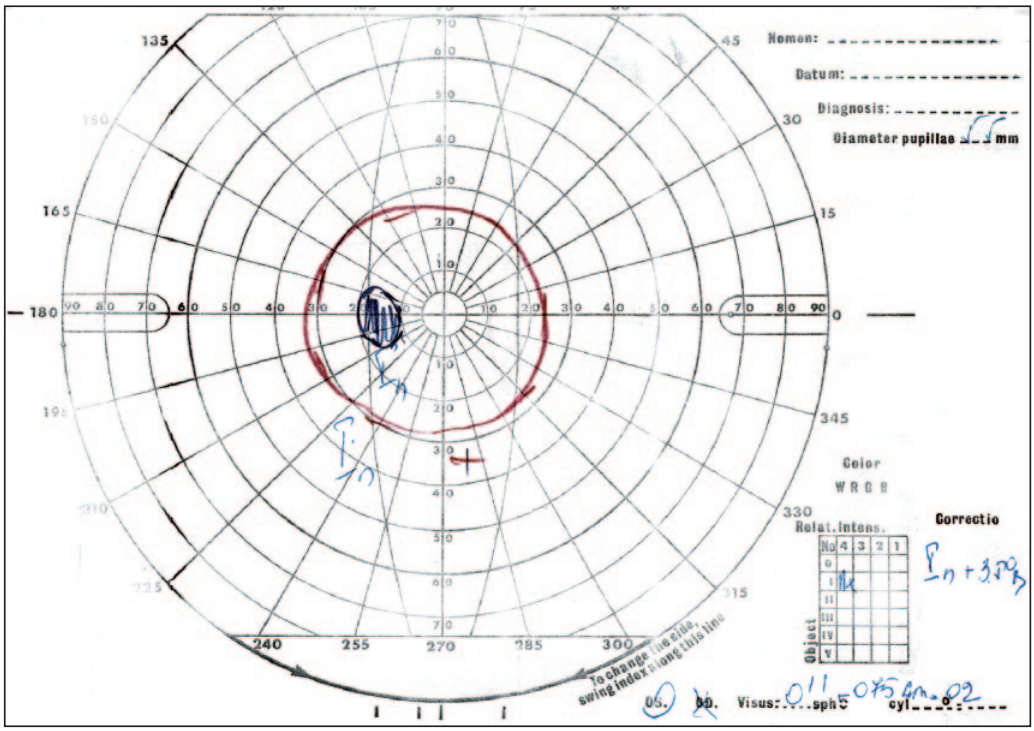
Visual acuity examination results showed visus oculi dextri (VOD): 1.0 n.c., visus oculi sinistri (VOS): 0.2 n.c., applanation tonometry – T apl. o. u. 14 mmHg. Biomicroscope (BM) found bilateral incipient cataract, fundus o.u. papilla nervi optici (PNO) round regular colored with no papillar edema, blood vessels regular, incipient senile macular degeneration. Visual field examination (VF) on Goldmann perimeter showed narrowed VF, 20-o, only 14 isopter registered, blind spot in 14 (Figure 1).

Radiology examination (magnetic resonance – MR, multi-slice computer tomography – MSCT, MSCT angiography) showed intraconal, expansive structure, with no infiltration, compressing the optic nerve, lateral rectus and bulbus causing axial proptosis (Figure 2). Angiography showed slow contrast enhancement. The diagnosis was a benign orbital vascular tumor, cavernous hemangioma and therapy is surgical excision. We performed an operative procedure, as mentioned earlier, and intraoperatively we found a tumor under lateral rectus, we dissected it from the orbital fat tissue and its insertion on orbital fascia. We performed an intraoperative biopsy *ex tempore*. The tumor was cystic, 2x1.2x0.5 cm, well circumscribed and incapsulated, filled with dark red, thick fluid, pathohistological diagnosis (PHD) – cavernous hemangioma. By surgical treatment the dislocated bulbus, optic nerve and surrounding tissues were decompressed and the bulbus returned to its anatomical intraorbital position. Our patient was recovering well after the procedure and on the 7th postoperative day was released on home care, with subjective visual acuity improvement and residual diplopia. VOS: 0.6 c.c., significant visual field improvement (Goldmann perimeter), still compressed in upper parts 20-o, but all isopters registered a blind spot in 12 (Figure 3) and no tumor on control MRI of the left orbit (Figure 4).

Discussion and conclusion

Cavernous hemangioma is the most common benign vascular neoplasm of the orbit, occurring in middle-aged patients, 70% in women. It has a good prognosis for visual acuity and life, surgical removal is usually the only necessary treatment. Our patient had a unilateral, left-axial proptosis, diplopia and sudden-onset disorders of vision in the left eye. Ophthalmological examination, Goldmann visual filed examination and

Figure 1. Visual field examination by Goldmann before surgical procedure.



radiological diagnosis showed vascular neoplastic lesions in the left orbit that presses on the optic nerve. Surgical procedure was performed and tumorous formation was removed in full. Pathological examination *ex tempore* and the subsequent histopathologic examination confirmed the diagnosis of cavernous hemangioma. Postoperative course ran properly and the patient was discharged home with significant improvement. Postoperative Goldmann visual filed examination showed significant improvement and control MR of the left orbit did not show any residual tumor mass.

In conclusion, our patient had a benign tumor of the orbit, cavernous hemangioma, a well-limited, encapsulated tumor with a very good prognosis. Surgical procedure was performed and the tumor was removed completely with no further treatment needed [5–11].

Figure 2. MRI of the tumor, arrow shows intraconal, non-infiltrative mass with compression on the surrounding tissue.

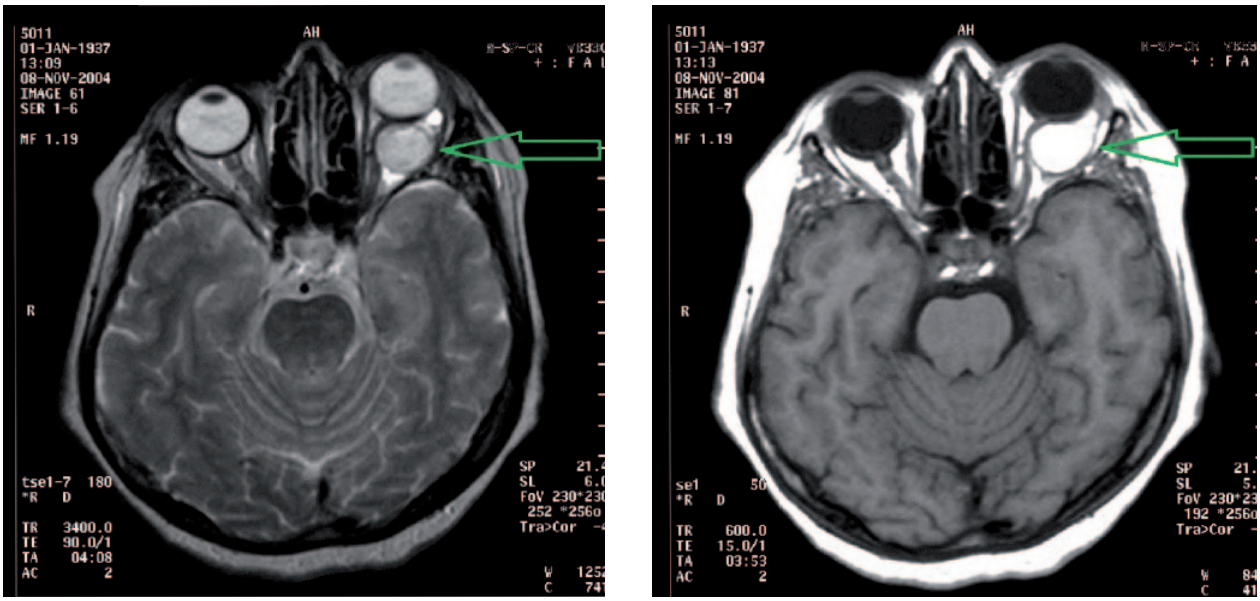


Figure 3. Visual field examination after operation, significant improvement.

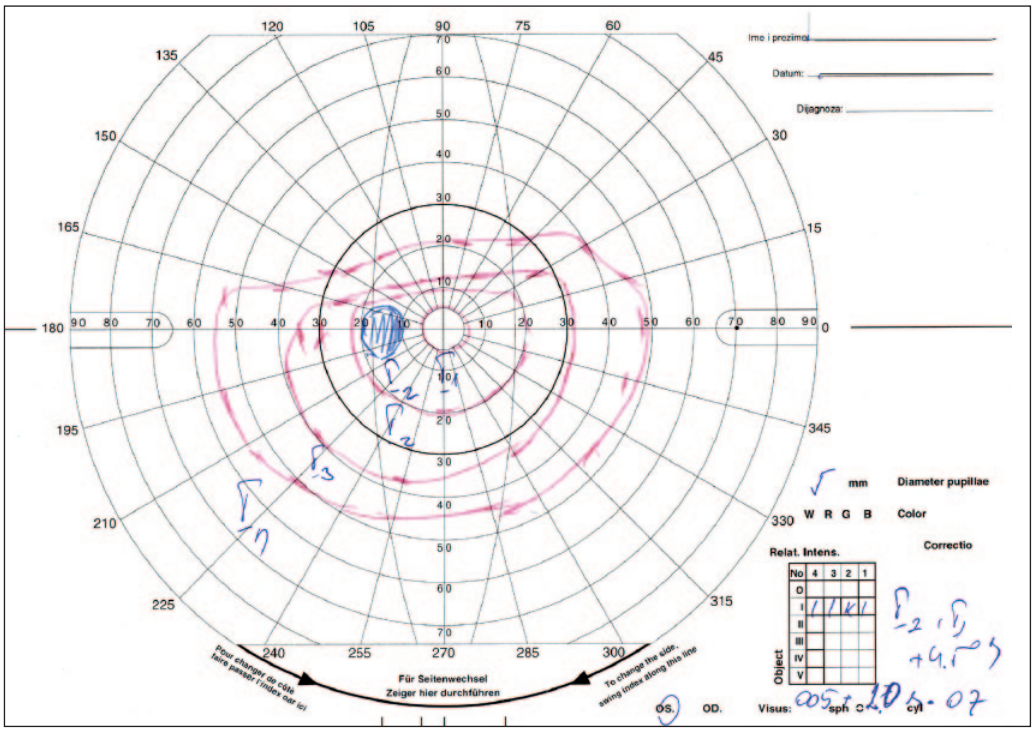
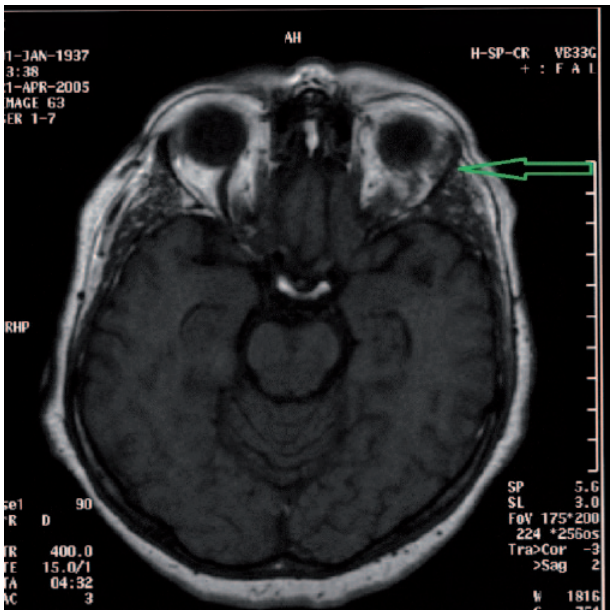


Figure 4. MRI after surgical removal of the hemangioma, arrow pointing to were the tumor was situated, no visible signs of tumor presence.



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HRVATSKI KIRURŠKI KONGRES
s međunarodnim sudjelovanjem
CROATIAN CONGRESS OF SURGERY
with International Participation

15. - 18. listopada 2014.
October 15 - 18, 2014
Zagreb, Hrvatska | Croatia
www.surgery2014.com

Organizator | Organizer: Hrvatsko kirurško društvo HLZ-a | Croatian Society of Surgery , CMA
Predsjednik Organizacijskog odbora | Organizing Committee President: Prof. Mate Majerović

U Zagrebu je od 15. do 18. listopada 2014. godine u hotelu Sheraton održan 6. hrvatski kirurški kongres koji je okupio preko 300 sudionika iz cijele Hrvatske i susjednih zemalja. Nastavljajući tradiciju organizacije stručnih kongresa svake četiri godine, Hrvatsko kirurško društvo i ovoga je puta okupilo velik broj autora koji su održali niz korisnih predavanja za liječnike svih kirurških specijalnosti ili predstavili svoje teme u obliku posterskih prezentacija.

Prvi dan Kongresa bio je rezerviran za predstavljanje dostignuća hrvatske kirurgije. Tijekom cjelodnevnih predavanja predstavila se većina hrvatskih bolnica sa zahvatima koji su najznačajniji u njihovom svakodnevnom radu i koje je trebalo istaknuti kao vrhunske postupke usporedive s onima koji se izvode u Europi i svijetu. Posljednja dva dana Kongresa bavila su se pojedinim specijalnostima podijeljenima u sekcije u sklopu kojih su kirurzi i liječnici srodnih struka mogli prisustvovati predavanjima detaljno vezanima uz problematiku s kojom se kontinuirano susreću.

Izuzetno mi je drago da je Kongres uz iskusne kolege zainteresirao i velik broj studenata, specijalizanata i mlađih liječnika, koji su radovima i interesom pokazali da hrvatska kirurgija ima svijetlu budućnost.

Zahvaljujem svim sudionicima koji su se odazvali pozivu na 6. hrvatski kirurški kongres i svima uključenima u organizaciju uz zadovoljstvo da smo zajedno pridonijeli uspješnom odvijanju još jednog u nizu kirurških kongresa. Siguran sam da ćemo za četiri godine biti još bolji te Vas stoga pozivam na aktivno sudjelovanje u radu Hrvatskoga kirurškog društva i objavljivanje svih dostignuća u našem časopisu Acta Chirurgica Croatica.

Prof. dr. sc. Mate Majerović
Predsjednik Organizacijskog odbora

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STRUČNI SASTANAK HRVATSKOGA KIRURŠKOG DRUŠTVA

Nova Gradiška, 24. travnja 2015.

Za stručni sastanak smo ovoga puta izabrali našu lijepu Slavoniju, točnije Novu Gradišku. Sastanak se održao 24. travnja 2015. godine i okupio preko 40 sudionika iz različitih hrvatskih bolnica. Sudionici su bili specijalisti iz raznih područja i to je upravo ono što želimo potaknuti – multidisciplinaran pristup za dobrobit naših pacijenata.

Održana su tri predavanja o laparoskopskim tehnikama i principima liječenja u onkološkoj kirurgiji nakon kojih su prisutni diskutirali o najnovijim saznanjima na području kirurgije. Stalan kontakt s liječnicima kirurzima i liječnicima drugih specijalnosti važan je zbog usavršavanja pristupa liječenju što je još jedan razlog zašto organiziramo stručne sastanke. Trudimo se biti prisutni u većim i manjim sredinama jer svaka ima svoje specifične kvalitete koje treba iskoristiti kako bi se postigla visoka razina liječničke skrbi.

Zahvaljujem svima koji su prihvatili naš poziv na ovaj stručni sastanak. Čekamo nove prijedloge za vrhunska predavanja, zanimljive radionice i sveukupno kvalitetnu stručnu edukaciju.

Prof. dr. sc. Mate Majerović

Predsjednik Hrvatskoga kirurškog društva

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IN MEMORIAM

Dr. Alexandar Nagy

1944. – 2015.

Dr. Aleksandar Nagy rođen je 12. kolovoza 1944. godine u Osijeku. Odrastao je u Gornjem gradu, u kući na uglu Podgoračke i Našičke ulice. U Osijeku je završio osnovnu i srednju školu, te 1964. upisao Medicinski fakultet u Novom Sadu i diplomirao u lipnju 1971. godine. Zaposlio se u osječkoj bolnici 1973. godine. Želio je i dobio kirurgiju, kao i njegovi susjedi iz kvarta i škole. Jedan za drugim došli su na Odjel za kirurgiju nadaleko poznat po željeznoj disciplini i hijerarhiji. Imao je od koga učiti. Specijalistički ispit položio je 1979. godine te cijeli radni vijek proveo na Odjelu za traumatologiju u Osijeku.

Domovinski rat zatekao ga je u Osijeku – u naponu kirurške snage, u pedesetim godinama života. Godine 1991. i 1992. provodi na liniji fronte u osječkoj bolnici. Budući da su kirurgija i rat kao sestra i brat, odlično se snalazi u novim okolnostima, kao i cijela njegova generacija. Smirivanjem rata u Osijeku, s najboljim sinovima našeg grada odlazi braniti svoj narod u Bosnu, pa sa Specijalnom policijom na Velebit i u Dubrovnik. Prestankom rata, vraća se svojoj kirurgiji. U rujnu 2001. postaje pročelnik Odjela za traumatologiju Klinike za kirurgiju, sve do mirovine 2010. godine.

Umro je tijekom prijepodneva u srijedu 14. siječnja, naglo i neočekivano. Lijepo za njega koji odlazi, a teško za nas koji ostajemo i koji smo ga voljeli.

Imao je puno nadimaka: Saša, Coco, Cobra, Nagi, Nađika, Crveni Oblak i Poglavica – kako su ga zvali današnji klinci na Klinici za kirurgiju. Malo je velikih kirurga koji su umjeli prenijeti svoje znanje na mlađe liječnike. Vodio nam je drhtave ruke, dok ne bismo skupili dovoljno utakmica i veselio se svakom našem napretku. Odgojio je generacije današnjih općih kirurga i traumatologa, te svih trenutno aktivnih ortopeda u KBC-u Osijek. Imao je najviše asistencija od svih iz svoje generacije, nama mlađima.

Nagyju je kirurgija bila način života, a ne posao; zanat, a ne nauka. Bio je tvrd, temperamentan, odlučan. Govorili su da ima kratki fitilj. Ne, on fitilja uopće nije imao. Pucao je lako. Hladio se brzo, zbog svog velikog i dobrog srca. Nikome nije zlo pamtio. Prema svim pacijentima bio je jednak – pošten i iskren. Kretao se pravocrtno, bez kompromisa i često je to skupo plaćao. Kada bi odlučio podvući crtu, crta je bila podvučena. Pušio je po dvije kutije cigareta dnevno. Prije dvadeset godina odlučio je prestati pušiti. Više nikada nije zapalio. Cijelu knjigu mogli bismo napisati o anegdotama iz njegova života. Život je živio punom snagom.

Nije volio pozdravljanja i rastanke. Tako je i otišao.

Dok smo mi živi, živjet će i sjećanje na njega.

Sahranjen je na Aninom groblju u Osijeku nedaleko od svoje rodne kuće, u svom kvartu, u svom voljenom gradu koji je njemu dao sve i kojem je on sve dao.

Počivao u miru.

Nagy, volimo te.

Dr. Krešimir Čandrlić

KBC Osijek

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Slike i tablice

Preferirani format za slike je EPS za vektorske grafike izvedene iz programa za crtanje, dok se TIFF format preferira za nijansirane ilustracije. EPS datoteke trebaju sadržavati i TIFF preglednicu slike. Naziv datoteke (jedna datoteka – jedna slika) treba sadržavati broj slike. Naslov slike treba biti uključen u tekst, ne u datoteku slike.

Rezolucija skenirane slike: skenirani linijski crteži trebaju biti digitalizirani s minimalnom rezolucijom od 800 dpi, relativno u odnosu na konačnu veličinu slike. Za digitalno nijansiranje 300 dpi je obično dovoljno.

Ilustracije u boji: spremite ilustracije u boji kao CMYK u TIFF formatu.

Vektorske grafike: svi oblici slova korišteni u vektorskim grafikama moraju biti uklopljeni. Najmanja debljina linije mora biti 0,2 mm (0,567 pt) u odnosu na konačnu veličinu.

Broj i konačna veličina slika i tablica mora biti svedena na najmanju mjeru dostatnu za objašnjenje teksta. Ne iznositi iste podatke i u grafovima i u tablicama. Ne koristiti „pite" za prikaz podataka. Ne integrirati slike i tablice u tekst. Numerirati slike i tablice slijedom u zasebnoj seriji. Uz broj, svaka slika treba imati legendu, a svaka tablica mora imati naslov. Sve slike i tablice treba navesti u tekstu. Planirati slike kako bi stale u stupac širine 81 mm. Najveća količina dostupnog prostora na jednoj stranici je 169 x 240 mm. Proporcionalno odredite visinu, širinu, veličinu tipa i simbola te mjernu liniju na slici. U konačnoj veličini slike, veličine velikih slova ili simbola ne smiju biti manje od 1,5 mm, a mjerna linija ne smije biti kraća od 0,25 mm. Grupirajte legendu za slike na posebnom listu. Naslov tablice i bilo kakve bilješke (fusnote) navedite izravno iznad, odnosno ispod tablice.

Cjeloviti članak i pregledni članak

Cjeloviti članci i pregledni članci trebaju biti napisani što konciznije kako se ne bi narušila čista i jasna prezentacija teme. I oblik i sadržaj rada trebaju biti pažljivo pregledani kako bi se isključila bilo kakva potreba za ispravcima.

Kratka obavijest

Kratke obavijesti (objave) treba pripremiti kako je gore navedeno osim sljedećeg: prosječna duljina Kratke obavijesti ne bi trebala biti duža od 1500 riječi i trebala bi sadržavati najviše dvije slike ili tablice. Sažetak ne bi trebao sadržavati više od 80 riječi.

Prikaz slučaja

Prikaz slučaja treba biti edukativan i/ili naglasiti potrebu za promjenom u kliničkoj praksi. Treba prikazati originalan opis ranije neprikazanog slučaja, predstaviti novi prikaz poznate bolesti ili ponuditi novu perspektivu slučaja koji predstavlja dijagnostički ili terapeutski izazov. Prikaz slučaja treba uključivati jasan pregled sličnih slučajeva i naglasiti razliku između opisanog i prethodnih slučajeva. Prikazi slučajeva trebaju uključivati kliničke slike. Autori od pacijenata trebaju tražiti pisani pristanak za objavljivanje informacija.

Pismo uredniku

Pisma uredniku su dobrodošla, trebaju se sastojati od najviše 750 riječi, te mogu uključivati tablicu ili slike i reference.

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Article by DOI: Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. J Mol Med (in press). DOI: 10.1007/s103530000086.

Online document: Doe J (1999) Title of subordinate document. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG. http://www.rsc.org/dose/title of subordinate document. Cited 15 Jan 1999.

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