

## SPONTANEOUS UTERINE RUPTURE DURING PREGNANCY

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## SAŽETAK

Ruptura materice je životno ugrožavajuća komplikacija trudnoće i povezana je sa visokom učestalošću maternalnog i neonatalnog morbiditeta i mortaliteta. Cilj ovog rada je da prikaže faktore rizika, kliničku sliku, dijagnostičke i terapijske mogućnosti za zbrinjavanje rupture materice. U radu su prikazani podaci iz radova selektovanih pretraživanjem PubMed baze podataka korišćenjem kombinacije ključnih reči: "uterine rupture", "pregnancy", "delivery", "risk factors", "diagnosis", "treatment".

U razvijenim zemljama ruptura materice je najčešće komplikacija prethodnog carskog reza, a ređe drugih operacija na materici. U zemljama u razvoju se javlja češće i obično je posledica opstrukcije porođaja ili neadekvatne upotrebe medikamentata za indukciju i/ili stimulaciju porođaja. Tipična klinička slika rupture materice podrazumeva pojavu abdominalnog bola i znakova hemoragičnog šoka kod trudnice uz poremećaj rada srca fetusa. Nespecifični simptomi i znaci rupture materice predstavljaju otežavajući faktor za pravovremeno postavljanje dijagnoze. Tretman rupture materice zavisi od obima rupture, starosne dobi, pariteta i opšteg stanja pacijentkinje. Primarni cilj hirurškog zahvata je zaustavljanje krvarenja i hemodinamska stabilizacija pacijentkinje, a podrazumeva histerektomiju ili ušivanje materice.

Kao posledica sve veće učestalosti porođaja carskim rezom, koji u novije vreme predstavlja najveći faktor rizika za nastanak rupture materice u trudnoći i porođaju, ruptura materice i dalje predstavlja veoma značajnu komplikaciju trudnoće. Na rupturu materice treba misliti kod trudnica sa prisutnim faktorima rizika, naročito u slučaju pojave nespecifičnog bola u abdomenu i patoloških promena u kardiokografskom zapisu. U ovakvim situacijama, postavljanje pravovremene dijagnoze i hitno lečenje mogu značajno doprineti povoljnom, kako maternalnom, tako i neonatalnom ishodu.

**Ključne reči:** ruptura materice; faktor rizika; dijagnoza; tretman

## ABSTRACT

Uterine rupture is a life-threatening complication of pregnancy which is associated with high incidence rates of maternal and neonatal morbidity and mortality. The aim of this paper is to present the risk factors, clinical picture, and diagnostic and therapeutic options for the management of uterine rupture. The paper presents the data from the papers selected by searching the PubMed database using the combination of the following keywords: *uterine rupture, pregnancy, delivery, risk factors, diagnosis, treatment*.

In developed countries, uterine rupture is most often a complication of a previous caesarean section, and less frequently of other uterine procedures. It occurs more frequently in developing countries, and it is usually the consequence of obstructed labor or inadequate use of labor-inducing medication. A typical clinical picture of uterine rupture includes abdominal pain and hemorrhagic shock in the mother and abnormal fetal heart rate. Non-specific symptoms and signs of uterine rupture make timely diagnosis difficult. The treatment of uterine rupture depends on the extent of the rupture, age, parity, and the patient's general condition. The primary goal is to stop hemorrhage and make the patient hemodynamically stable, which is done by hysterectomy or suturing of the uterus.

Due to the increasing caesarean section rate and the fact that nowadays it is the most common risk factor for uterine rupture during pregnancy and childbirth, uterine rupture is still an important complication of pregnancy. Uterine rupture should be considered in pregnant women with risk factors, especially in case of non-specific abdominal pain and cardiotocographic changes. In such situations, timely diagnosis and immediate treatment can significantly contribute to a favorable maternal and neonatal outcome.

**Key words:** uterine rupture; risk factor; diagnosis; treatment

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## UVOD

Ruptura materice predstavlja životno ugrožavajuću akušersku komplikaciju i povezana je sa visokom učestalošću maternalnog i neonatalnog morbiditeta i mortaliteta [1]. U razvijenim zemljama je retka i najčešće predstavlja komplikaciju prethodnog carskog reza, ređe drugih operacija na materici, kao što su miomektomija i metroplastika [2,3,4,5]. U zemljama u razvoju se javlja češće i obično je posledica opstrukcije porođaja ili neadekvatne upotrebe medikamenata za indukciju i/ili stimulaciju porođaja [1,2,6].

Ruptura gravidne materice može nastati tokom trudnoće, na početku porođaja, ili tokom prolongiranog porođaja, najčešće u terminskoj trudnoći ili u trećem trimestru trudnoće. Veoma retko, do rupture materice može doći početkom trudnoće ili u ranom drugom trimestru [7,8].

Cilj ovog narativnog revijalnog rada je da prikaže faktore rizika, kliničku sliku, dijagnostičke i terapijske mogućnosti za zbrinjavanje rupture materice.

## MATERIJAL I METODE

U radu su prikazani podaci iz radova selektovanih pretraživanjem PubMed baze podataka korišćenjem kombinacije sledećih ključnih reči: *uterine rupture, pregnancy, delivery, risk factors, diagnosis, treatment*. Podaci prikupljeni iz radova odabranih uz pomoć konsenzusa koji su postigle autorke upotrebljeni su i predstavljeni u ovom radu.

## KLASIFIKACIJA

U odnosu na anatomske slojeve zida materice, ruptura može biti kompletna ili inkompletna [6]. U slučaju inkompletne rupture materice perimetrijum ostaje intaktan, dok kod kompletne rupture materice dolazi do pucanja kompletne debljine materičnog zida, uključujući i perimetrijum. Ovo dovodi do nastanka direktne veze između peritonealnog prostora i šupljine materice, sa ili bez protruzije ili ekspulzije fetusa i/ili placente u peritonealnu duplju [8].

Inkompletna ruptura materice je najčešće uzrokovana dehiscencijom ožiljka od prethodnog carskog reza i/ili neke druge operacije na materici i često je asimptomatska, te se dijagnoza postavlja tokom carskog reza, ili prilikom manuelne eksploracije materice nakon vaginalnog porođaja kod pacijentkinje koja je prethodno imala operaciju materice [7,9].

Prema tome da li nastaje kod pacijentkinje čija materica u trenutku nastanka rupture ima hirurški ožiljak, ruptura materice može biti primarna ili sekundarna [10]. Primarna ruptura materice predstavlja rupturu materice bez ožiljka, dok sekundarna ruptura materice

## INTRODUCTION

Uterine rupture is a life-threatening complication of pregnancy which is associated with a high incidence of maternal and neonatal morbidity and mortality [1]. In developed countries it occurs rarely and is most commonly a complication of a previous caesarean section, or less frequently of other uterine procedures, such as myomectomy and metroplasty [2,3,4,5]. In developing countries, it occurs more often and is commonly the consequence of obstructed labor or inadequate use of labor-inducing medication [1,2,6].

Rupture of the pregnant uterus may occur during pregnancy, during the onset of labor, or during prolonged labor, most commonly in full term pregnancy or in the third trimester. Extremely rarely, uterine rupture may occur during the first trimester or early second trimester [7,8].

The aim of this narrative review is to present the risk factors, clinical picture, and diagnostic and therapeutic options for the management of uterine rupture.

## MATERIAL AND METHODS

The paper presents the data from the articles selected by searching the PubMed database using the combination of the following keywords: *uterine rupture, pregnancy, delivery, risk factors, diagnosis, treatment*. The data collected from the articles, which had been previously selected by means of consensus reached by the authors, are used and presented in this paper.

## CLASIFICATION

In relation to the layers of the uterine wall, uterine rupture can be complete or incomplete [6]. In case of incomplete uterine rupture, perimetrium remains intact, whereas complete rupture involves all three layers of the uterine wall, including the perimetrium. This results in a direct connection between the peritoneal cavity and the uterine cavity, with or without protrusion or expulsion of the fetus and/or placenta into the peritoneal cavity [8].

Incomplete uterine rupture is most frequently caused by uterine scar dehiscence from a previous caesarean section and/or another uterine procedure and it is frequently asymptomatic, so the diagnosis is made during the cesarean section or during manual exploration of the uterus after vaginal delivery in a patient who has previously undergone a uterine procedure [7,9].

Uterine rupture can be primary or secondary depending on whether it occurs in a patient whose uterus has a surgical scar at the time of the rupture [10]. Primary uterine rupture is uterine rupture without a scar, whereas secondary uterine rupture is the rupture

predstavlja rupturu materice na kojoj postoji ožiljak od neke prethodne operacije i/ili intervencije, kao i rupturu materice kao posledicu traume ili anomalije materice [4,5,10].

## EPIDEMIOLOGIJA

Ruptura materice predstavlja veoma retku akušersku komplikaciju. Učestalost kompletne rupture materice u porođaju, prema podacima iz literature iznosi 0,4 do 0,6/10000 na intaktnoj materici i 21,1 do 22,0/10000 na ožiljno izmenjenoj materici [8]. U razvijenim zemljama, prosečna incidenca rupture materice je 0,09% [11].

U istraživanju Al-Zirkija i saradnika [10] na uzorku od 1441712 porođaja u Norveškoj između 1967. godine i 2008. godine, dokumentovano je 359 ruptura materice, sa incidencom od 2,5/10000 porođaja [12]. Incidenca rupture materice u ovoj studiji bila je značajno veća kod žena koje su prethodno imale rez na materici, sa trendom porasta od 14,2/10000 u periodu između 1978. godine i 1988. godine na 66,8/10000 u periodu između 2000. godine i 2008. godine. Ovakav porast incidence objašnjava se značajnijim uticajem faktora rizika za nastanak rupture materice u drugom ispitivanom periodu, kao što su: starost trudnica veća od 35 godina, prisustvo prethodnog reza na materici, te indukcija porođaja korišćenjem prostaglandina i sintocinona.

U studiji koju je sproveo Čeng [13] na Novom Zelandu tokom 11 godina (od 2008. godine do 2018. godine) u tercijarnoj ustanovi na uzorku od 38182 porođaja, registrovane su 32 kompletne rupture materice (8,4/10000). Od toga, u 29 slučajeva ruptura je nastala tokom porođaja, a u tri slučaja pre započinjanja porođaja. Ni kod jedne pacijentkinje nije došlo do smrtnog ishoda, a kod tri je bilo neophodno uraditi histerektomiju.

U internacionalnoj multicentričnoj studiji Vendenburga i saradnika [14], utvrđeno je da se porast incidence kompletne rupture materice može, između ostalog, objasniti povećanjem učestalosti pokušaja vaginalnog porođaja nakon prethodnog carskog reza (engl. *Trial of Labour After Caesarean Section-TOLAC*). Istraživanje je obuhvatilo devet zemalja (Austriju, Belgiju, Dansku, Finsku, Francusku, Nemačku, Holandiju, Švedsku i Ujedinjeno Kraljevstvo Velike Britanije i Severne Irske) u periodu između 2004. godine i 2014. godine.

Motomura i saradnici [15] istraživali su incidencu rupture materice kod trudnica koje su imale ožiljak od prethodnog carskog reza u 29 zemalja sveta u Africi, Aziji, Latinskoj Americi i na Bliskom istoku. U uzorku od ukupno 37366 trudnica, utvrdili su incidencu rupture materice od 0,3% u kategoriji najrazvijenijih zemalja. U visoko razvijenim zemljama, incidenca je bila 0,2%, u srednje razvijenim zemljama 0,4%, a u nerazvijenim zemljama 1,0%.

of the uterus which has a scar from a previous surgery, or uterine rupture resulting from trauma or an anomaly of the uterus [4,5,10].

## EPIDEMIOLOGY

Uterine rupture is a very rare obstetric complication. According to literature, the incidence of complete uterine rupture during labor is 0.4 to 0.6/10000 in an intact uterus and 21.1 to 22.0/10000 in a scarred uterus [8]. In developed countries, the average incidence of uterine rupture is 0.09% [11].

On a sample of 1441712 labors in Norway between 1967 and 2008, Al-Zirqi et al. [10] documented 359 uterine ruptures with the incidence of 2.5/10000 labors [12]. The incidence of uterine rupture in this study was significantly higher in women who had previously had a uterine incision, with an upward trend from 14.2/10000 in the period between 1978 and 1988 to 66.8/10000 in the period between 2000 and 2008. This increase in incidence is explained by a more significant influence of risk factors for the occurrence of uterine rupture in the second examined period, such as: maternal age above 35 years, a prior uterine scar, and prostaglandins and Syntocinon for inducing labor.

In a study conducted by Chang [13] in a tertiary institution in New Zealand during the period of 11 years (from 2008 to 2018), on a sample of 38182 births there were 32 complete uterine ruptures (8.4/10000). In 29 out of 32 cases, the rupture occurred during labor whereas in three cases it occurred before the onset of labor. There was no fatal outcome and it was necessary to perform hysterectomy in three patients.

In an international multicenter study by Vandenberghe et al. [14], it was determined that the increase in the incidence of complete uterine rupture may be explained, among other things, by an increase in the incidence of attempts of vaginal delivery after a previous caesarian section (*Trial of Labor After Caesarean Section –TOLAC*). The study included nine countries (Austria, Belgium, Denmark, Finland, France, Germany, the Netherlands, Sweden and the United Kingdom of Great Britain and Northern Ireland) in the period between 2004 and 2014.

Motomura et al. [15] examined the incidence of uterine rupture in patients who had a scar from a previous caesarian section in 29 countries in Africa, Asia, South America and in the Middle East. On a sample of 37366 pregnant women, they determined the incidence of uterine rupture was 0.3% in the category of most developed countries. In highly developed countries, the incidence was 0.2%, in moderately developed countries it was 0.4%, and in underdeveloped countries it was 1.0%.

## FAKTORI RIZIKA

Prema podacima iz literature, postoje brojni faktori koji mogu doprineti nastanku ruptуре materice u trudnoći i prilikom porođaja [13,14,16]. Kao najznačajniji među njima navodi se postojanje ožiljka na materici, najčešće od carskog reza, ali i od drugih hirurških intervencija (miomektomija, sutura zida materice nakon perforacije i/ili kiretaže, metroplastika), pri čemu postojanje ožiljka od prethodnog carskog reza predstavlja najznačajniji faktor rizika u razvijenim zemljama [2,13,14,16,17]. Trudnoće nakon miomektomije takođe su komplikovane povećanim rizikom od nastanka ruptуре materice, a učestalost ovakvih trudnoća je u porastu [18].

U ostale faktore rizika za nastanak ruptуре materice ubrajaju se nekritična indukcija porođaja, godine starosti pacijentkinje ( $\geq 40$  godina), multiparitet, gestaciona starost veća od 40 nedelja, fetalna makrozomija, kratak interval između dve trudnoće, produženo drugo porođajno doba, anomalije placente, gestacione trofoblastne bolesti, primena Kristelerovog zahvata, kao i prisustvo mioma i postojanje urođenih anomalija materice [3,11]. Veoma značajan faktor rizika za nastanak ruptуре materice je i stanje nakon trudnoće komplikovane rupturom materice u prethodnoj trudnoći ili prilikom porođaja [3,19].

Prema Tinelliju i saradnicima [5], podaci o faktorima rizika za spontanu rupturu materice u drugom i ranom trećem trimestru trudnoće su veoma ograničeni. Kod žena koje nisu prethodno imale carski rez, ruptura materice se javlja retko, pri čemu se u faktore rizika za nastanak ruptуре ubrajaju multiparitet, anomalije placente, kao i anomalije materice.

Prema Al-Zirkiju i saradnicima [16], najvažniji faktor rizika za kompletnu rupturu materice na porođaju je kombinovana indukcija porođaja prostaglandinima i sintocinonom, kako kod trudnica koje su prethodno imale carski rez, tako i kod onih sa intaktnom matericom. Od ostalih faktora rizika, izdvojeni su karlični porođaj, stimulacija porođaja sintocinonom, antepartalna smrt ploda, pobačaji u prvom trimestru završeni kiretažom materične šupljine, starost preko 35 godina, makrozomija, gestaciona starost  $\geq 41$  nedelje i amniotomija.

Sturzenegger i saradnici [11] su istraživali faktore rizika za nastanak ruptуре materice na uzorku od ukupno 22152 porodjaja. Rezultati multivarijantne regresione analize u ovoj studiji su pokazali da jedino postojanje ožiljka na materici od carskog reza predstavlja značajan faktor rizika za nastanak ruptуре materice.

Istraživanjem koje su sproveli Gambacorti-Paserini i saradnici [20] obuhvaćene su 23 studije i ukupno 2367 trudnoća nakon miomektomije. Analiza rezultata pokazala je učestalost ruptуре materice kod trudnica kod kojih je pokušao vaginalni porođaj nakon mio-

## RISK FACTORS

According to literature, there are numerous factors that can contribute to the occurrence of uterine rupture in pregnancy and during labor [13,14,16]. It is stated that the most significant among them is a uterine scar, usually from a previous caesarean section, but also from other surgeries (myomectomy, suture of the uterine wall after perforation and /or curettage, metroplasty), the scar from a previous caesarean section being the most important factor in developed countries [2,13,14,16,17]. Pregnancies after myomectomy are also complicated by an increased risk of uterine rupture and the frequency of such pregnancies is on the rise [18].

Other risk factors for uterine rupture are: uncritical induction of labor, maternal age ( $\geq 40$ ), multiparity, gestational age over 40 weeks, fetal macrosomia, a short interval between two pregnancies, prolonged second stage of labor, a placental abnormality, gestational trophoblastic disease, the application of Kristeller maneuver, as well as the presence of myomas and congenital uterine anomalies [3,11]. Another significant risk factor for uterine rupture is a previous pregnancy complicated by uterine rupture either during pregnancy or in labor [3,19].

According to Tinelli et al. [5], the data on risk factors for spontaneous uterine rupture in the second and early third trimester are very limited. Uterine rupture occurs rarely in women who have not previously had a cesarean section and the listed risk factors include multiparity, a placental abnormality, and uterine anomalies.

According to Al-Zirqi et al. [16], the most significant risk factor for complete uterine rupture in labor is combined induction by prostaglandins and Syntocinon, both in women who have previously had a cesarean section and in those whose uterus is intact. Among other risk factors, breech delivery, induction of labor by Syntocinon, antepartum fetal death, first trimester termination of pregnancy by curettage of the uterine cavity, maternal age over 35 years, macrosomia, gestational age  $\geq 41$  and amniotomy were singled out.

Sturzenegger et al. [11] examined risk factors for uterine rupture on a sample of 22152 births. The results of a multivariate analysis showed that only the existence of a scar on the uterus from a previous caesarean section represented a significant risk factor for uterine rupture.

The research conducted by Gambacorti-Paserini et al. [20] included 23 studies and 2367 pregnancies following myomectomy. The analysis of the results showed the incidence of uterine rupture of 0.47% in women in whom trial of vaginal labor was attempted following myomectomy. The significance of previ-

mektomije od 0,47%. Na značaj prethodne miomektomije kao faktora rizika za nastanak rupture materice ukazali su i Tinelli i saradnici [7]. Uz to, miomektomija, kao i prethodni carski rez, mogu direktno ili indirektno da uslove formiranje abnormalno invazivne placente, što dodatno utiče na povećanje rizika od nastanka ruptur materice [7,21].

Multicentrična studija Tinellija i saradnika [3] na uzorku od 270 pacijentkinja kod kojih je registrovana ruptura materice, pokazala je da je kod 224 (82,9%) pacijentkinje postojala operacija koja je prethodila rupturi materice. Ovo istraživanje je pokazalo da je najčešća operacija na materici koja je prethodila rupturi materice u trudnoći bio carski rez – kod 113 (65,69%) pacijentkinja.

Najčešći faktori rizika za nastanak ruptur materice se značajno razlikuju u nerazvijenim, u odnosu na razvijene zemlje [6,22]. Berhe i saradnici [6] navode da su najčešći uzroci ruptur materice u nerazvijenim zemljama opstrukcija porođaja usled fetopelvične disproporcije ili fetalne malprezentacije, nekritična i neadekvatna upotreba medikamenata za stimulaciju materičnih kontrakcija, Kristelerov zahvat, multiparitet, embriotomija, unutrašnji okret i nedostatak adekvatne medicinske pomoći pri porođaju. Slični faktori rizika se navode i u istraživanju sprovedenom u Nigeriji [23].

## KLINIČKA SLIKA RUPTURE MATERICE

Ruptura materice se može javiti pre porođaja, tokom porođaja, ili nakon porođaja [2]. Mesto ruptur može biti na zadnjem zidu materice, prednjem zidu materice, bočno, na fundusu materice ili na donjem segmentu materice (istmično-cervikalno) [7].

Ruptura ožiljno izmenjene materice najčešće nastaje u trećem trimestru trudnoće, mada se ruptura materice nakon histeroskopske miomektomije i nakon korporalnog carskog reza češće javlja pre započinjanja porođaja i u mlađoj gestaciji, u odnosu na onu koja nastaje nakon carskog reza u predelu donjeg materičnog segmenta [2,3].

Tipična klinička slika ruptur materice podrazumeva pojavu akutnog abdominalnog bola i znakova hemoragičnog šoka kod trudnice s anamnestičkim podatkom o prethodnoj operaciji na materici [2].

Najčešći simptom ruptur materice kod pacijentkinja koje su prethodno imale operaciju na materici predstavlja bol u abdomenu (naročito suprapubični bol u slučaju postojanja ožiljka od prethodnog carskog reza), koji prati intraabdominalno krvarenje [2]. Ostali simptomi ruptur uključuju hipotenziju, stanje šoka, hematuriju i bol u ramenu [17]. Ne postoje patognomonični simptomi ruptur materice, a u slučaju sporog raslojavanja ožiljka na materici simptomi mogu

ous myomectomy as a risk factor for the occurrence of uterine rupture was also pointed out by Tinelli et al. [7]. Apart from this, myomectomy, as well as a previous caesarean section, can directly or indirectly cause the formation of abnormally invasive placenta which additionally increases the risk of uterine rupture [7,21].

A multicenter study by Tinelli et al. [3] on a sample of 270 patients diagnosed with uterine rupture showed that 224 patients (82.9%) had had a surgery prior to uterine rupture. This research showed that the most common operation on the uterus that preceded uterine rupture in pregnancy was caesarian section – in 113 (65.69%) patients.

The most common risk factors for the occurrence of uterine rupture are significantly different in underdeveloped countries in comparison with developed countries [6,22]. Berhe et al. [6] state that the most common causes of uterine rupture in underdeveloped countries are: obstructed labor due to fetopelvic disproportion or fetal malpresentation, uncritical and inadequate use of medication to stimulate uterine contractions, Kristeller maneuver, multiparity, embryotomy, internal rotation and lack of adequate medical assistance during childbirth. Similar risk factors are listed in a research conducted in Nigeria [23].

## THE CLINICAL PICTURE OF UTERINE RUPTURE

Uterine rupture may occur before labor, during labor or upon labor [2]. A rupture may occur on the back wall of the uterus, on the front wall of the uterus, laterally, in the fundus or in the lower uterine segment (the isthmic-cervical segment) [7].

Rupture of the scarred uterus most commonly occurs in the third trimester, although uterine rupture after hysteroscopic myomectomy or a classical caesarian section more frequently occurs before the onset of labor and at a younger gestational age compared to uterine rupture which occurs after lower-segment transverse caesarian section [2,3].

A typical clinical picture of uterine rupture includes acute abdominal pain and signs of hemorrhagic shock in the pregnant woman with a history of previous uterine procedure [2].

The most common symptom of uterine rupture in patients who have previously had a uterine procedure is abdominal pain (especially suprapubic pain) [2]. Other symptoms of uterine rupture include hypotension, shock, hematuria and shoulder pain [17]. There are no pathognomonic symptoms of uterine rupture and in case of a slow dehiscence of the uterine scar symptoms may be completely absent until the occurrence of complete rupture when changes in the fetal heart

biti i potpuno odsutni, do nastanka kompletne ruptu-  
re, kada se često registruju promene u radu srca fetusa  
(varijabilne deceleracije, kasne deceleracije i bradikar-  
dija) [2,3,24].

Kliničkim pregledom se može, a ne mora, registrova-  
ti postojanje bolne osetljivosti abdomena na palpaciju.

Tokom porođaja, jedan od najčešćih simptoma  
predstavlja poremećaj rada srca fetusa, koji se obično  
manifestuje kao fetalna bradikardija na kardiograf-  
skom zapisu [2,9,13,17,24,25]. Prema Čengovom istra-  
živanju [13], pojava patološkog kardiografskog za-  
pisa se registruje kod 45% pacijentkinja sa intaktnom  
matericom i 78% pacijentkinja sa ožiljno izmenjenom  
matericom. Ostali simptomi intraportalne ruptu-  
re su prestanak materičnih kontrakcija, izmenjen  
oblik materice, hipotenzija majke, hematurija i bolna  
osetljivost na mestu prethodnog reza, pri čemu je naj-  
češća kombinacija simptoma poremećaj rada srca fetu-  
sa i bol u abdomenu majke [2,9,17].

Ruptura materice nastala nakon završetka porođaja  
manifestuje se bolom u abdomenu, pri čemu se može  
javiti i postpartalno krvarenje [2]. Ukoliko ruptura za-  
hvata i mokraćnu bešiku može se javiti i hematurija [2].

Ruptura intaktne materice je praćena kliničkim  
simptomima masivnog krvarenja i brzim razvojem šok-  
nog stanja kod majke, za razliku od ruptu-  
re ožiljno izmenjene materice, gde se dehiscencija ožiljka može  
razvijati postepeno, a obim krvarenja je obično manji  
[7]. Rupturu materice bez ožiljka obično prati snažan  
bol u abdomenu pacijentkinje, uz prisustvo fetalne  
bradikardije ili odsustvo otkucaja srca fetusa, a može  
je pratiti i prestanak kontrakcija materice, vaginalno  
krvarenje i vaskularni kolaps majke [7]. Tipična klinička  
slika ruptu-  
re intaktne materice podrazumeva pojavu  
akutnog abdominalnog bola, maternalnu tahikardiju i  
hipotenziju, pojavu vaginalnog krvarenja i stanje šoka,  
dok se delovi tela ploda palpiraju preko prednjeg tr-  
bušnog zida majke.

## DIJAGNOZA I DIFERENCIJALNA DIJAGNOZA

Budući da su simptomi ruptu-  
re materice nespecifični i  
mogu se javiti i u brojnim drugim stanjima, dijagnoza  
se teško postavlja i, neretko, sa zakašnjenjem [26]. Ro-  
tenštrajh i saradnici [27] su na uzorku od 174189 po-  
rođaja u periodu između 2005. godine i 2018. godine  
u Izraelu identifikovali 143 slučaja ruptu-  
re materice, od čega je u 20% slučajeva došlo do kašnjenja u po-  
stavljanju dijagnoze. Faktori koji su značajno doprineli  
kašnjenju u postavljanju dijagnoze u ovoj studiji bili su:  
odsustvo ožiljka na materici, primena epiduralne anal-  
gezije na porođaju i multiparitet.

Imajući u vidu da poremećaj rada srca fetusa tokom  
porođaja predstavlja jedan od značajnih simptoma koji

rate are often registered (variable decelerations, late  
decelerations, bradycardia) [2,3,24].

Abdominal examination may or may not register  
the presence of tenderness on palpation.

During labor, one of the most common symp-  
toms is a change in fetal heart rate which is usually  
manifested by fetal bradycardia in cardiotocography  
[2,9,13,17,24,25]. According to Chang's study [13], the  
occurrence of a pathological cardiotocographic find-  
ing is registered in 45% of patients with scarred uter-  
us. Other symptoms of intrapartum uterine rupture  
include cessation of uterine contractions, a change in  
the shape of the uterus, maternal hypotension, hema-  
turia, and tenderness at the site of the previous scar,  
the combination of fetal heart failure and maternal ab-  
dominal pain being the most common of all [2,9,17].

Uterine rupture that occurs after labor is mani-  
fested by abdominal pain which may be followed by  
postpartum hemorrhage [2]. If the rupture affects the  
urinary bladder as well, hematuria may also occur [2].

The rupture of intact uterus is followed by clinical  
symptoms of massive hemorrhage and a rapid devel-  
opment of shock in the mother in comparison with  
the rupture of scarred uterus where scar dehiscence  
may develop gradually and bleeding is usually less  
intense [7]. The rupture of intact uterus is usually fol-  
lowed by a strong abdominal pain in the mother and  
fetal bradycardia or the absence of fetal heartbeat,  
and it may be accompanied by cessation of uterine  
contractions, vaginal bleeding, and maternal collapse  
[7]. A typical clinical picture of the rupture of intact  
uterus includes the occurrence of acute abdominal  
pain, maternal tachycardia and hypotension, vaginal  
bleeding and the state of shock, and parts of the fetal  
body are palpated over the front abdominal wall of  
the mother.

## DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

Since the symptoms of uterine rupture are non-specific  
and can occur in many other conditions, establishing a  
diagnosis is difficult and often delayed [26]. On a sam-  
ple of 174189 births in Israel between 2005 and 2008,  
Rottenstreich et al. [27] identified 143 cases of uterine  
rupture of which in 20% of cases there was a delay in  
making a diagnosis. The following factors significantly  
contributed to establishing a diagnosis in this study:  
the absence of a uterine scar, the application of epidur-  
al analgesia during labor, and multiparity.

Bearing in mind that fetal heart failure during la-  
bor is one of the significant symptoms that indicate the  
possibility of uterine rupture, it should be considered  
an early warning sign in order to arrive at a diagnosis  
as soon as possible [7].

ukazuju na mogućnost nastanka rupture materice, trebalo bi ga smatrati ranim znakom upozorenja kako bi se što pre postavila dijagnoza [7].

Promene kontraktilnosti materice tokom porođaja takođe predstavljaju jedan od kliničkih znakova ruptur materice, i to: hipertonija i hipotonija, kao i povećanje i smanjenje broja materičnih kontrakcija [3].

Ruptura materice se na ultrazvuku obično ispoljava u vidu prazne materice i prisustva amnionskog sadržaja i/ili delova ploda van materice, pri čemu se uz to mogu videti i znaci krvarenja u materici i/ili u peritonealnoj duplji [7].

Imidžing metode kao što su kompjuterizovana tomografija (CT) i magnetna rezonanca, imaju ograničenu primenu u dijagnostici ruptur materice, budući da zahtevaju više vremena za izvođenje, a CT je povezan i sa primenom radioaktivnog zračenja [7,26].

Diferencijalno-dijagnostički, u slučajevima ruptur materice dolaze u obzir ektopična trudnoća, abrupcija posteljice, prednjačeca posteljica, inverzija materice, laceracije mekih porođajnih puteva, koagulopatija, atonija materice, kao i ruptura materičnih krvnih sudova [7,17]. Tri najčešća uzroka masivnog krvarenja u akušerstvu su abrupcija posteljice, prednjačeca posteljica i ruptura materice [28]. Druga, ređa stanja koja treba razmotriti u diferencijalnoj dijagnozi su subkapsularni hematomi jetre sa ili bez ruptur jetre, ruptura široke materične veze, ruptura slezine, torzija materice, kao i ruptura materičnih krvnih sudova [29].

## TRETMAN RUPTURE MATERICE

Pravovremeno postavljanje dijagnoze i adekvatna reanimacija su veoma značajni u tretmanu ruptur materice [7]. Najznačajniji faktori koji utiču na smanjenje maternalnog i fetalnog morbiditeta i mortaliteta su rano postavljanje dijagnoze, odgovarajuća nadoknada gubitka krvi, hitna hirurška intervencija i dostupnost savremene intenzivne neonatalne nege. Kada je u pitanju gubitak krvi, važno je imati u vidu da kod trudnica gubitak i do dva litra krvi može nastati bez uočljivih promena u hemodinamici, dok se opšte stanje pacijentkinje može značajno pogoršati ukoliko je gubitak krvi veći od dva i po litra [7].

Opisani su slučajevi u kojima je ultrazvučnim pregledom dijagnostikovani nastanak ruptur materice u drugom i trećem trimestru trudnoće koji je uspešno tretiran ušivanjem materice, a trudnoća nastavljena do postizanja fetalne zrelosti [7]. Ukoliko je nastala kompletna ruptura materice, povoljan maternalni i neonatalni ishod obezbeđuje hitan porođaj [25]. Prema podacima iz literature, ukoliko se hirurška intervencija učini u roku od 10 do 37 minuta od nastanka ruptur materice, rizici trajnog fetalnog morbiditeta mogu biti izbegnuti [3].

The following changes in uterine contractility during labor are also one of the clinical signs of uterine rupture: hypertonia and hypotonia, as well as an increase or a decrease in the number of uterine contractions [3].

On ultrasound, uterine rupture is usually manifested as an empty uterus and the presence of amniotic fluid and/or parts of the fetus outside the uterus, while signs of bleeding in the uterus and/or peritoneal cavity can also be seen [7].

Imaging methods such as computerized tomography (CT) and magnetic resonance imaging have limited use in the diagnosis of uterine rupture since they require more time, and CT is also associated with radiation [7,26].

When it comes to differential diagnosis, in cases of uterine rupture, the following may be taken into consideration: ectopic pregnancy, placental abruption, placenta previa, uterine inversion, soft birth canal lacerations, coagulopathy, uterine atony, and rupture of uterine blood vessels [7,17]. Three most common causes of massive hemorrhage in obstetrics are placental abruption, placenta previa, and uterine rupture [28]. Other, less frequent, conditions that should be taken into consideration in differential diagnosis are subcapsular hematoma of the liver with or without hepatic rupture, rupture of broad ligament, spleen rupture, uterine torsion, as well as rupture of uterine blood vessels [29].

## MANAGEMENT OF UTERINE RUPTURE

Timely diagnosis and adequate resuscitation are of great significance in the management of uterine rupture [7]. The most important factors that influence the reduction in maternal and fetal morbidity and mortality rates are timely diagnosis, adequate replacement of blood loss, urgent surgical intervention, and the availability of modern neonatal intensive care. When it comes to blood loss, it is important to keep in mind that in pregnant women the loss of up to two liters of blood can occur without any noticeable changes in hemodynamics, while the patient's general condition can significantly worsen if there is a loss of more than two and a half liters [7].

There are cases in literature in which the occurrence of uterine rupture was diagnosed by ultrasound examination in the second and third trimester and then successfully treated by suturing the uterus, so the pregnancy continued until fetal maturation [7]. In case of complete uterine rupture, a favorable maternal and neonatal outcome is ensured by immediate delivery [25]. According to literature, if surgical intervention is performed within 10 to 37 minutes upon the onset of uterine rupture, the risks of permanent fetal morbidity can be avoided [3].

Po ekstrakciji fetusa i placente iz trbušne šupljine pacijentkinje, prioritet je zaustavljanje krvarenja majke [2]. Ukoliko je ruptura nastala na zadnjem zidu materice, teško ju je dijagnostikovati, a moguće je i da nastane na mestu na kome pacijentkinja nije prethodno imala rez, što takođe utiče na izbor hirurškog pristupa [2].

Tretman rupture materice zavisi od razmera rupture, starosne dobi, pariteta i opšteg stanja pacijentkinje, kao i iskustva operatora, koji pre svega treba da proceni da li je moguće ušivanje rupture ili je neophodna histerektomija [2,7]. U skladu s tim, izbor hirurškog zahvata koji će biti primenjen svodi se na četiri mogućnosti: potpuna (totalna) histerektomija, supracervikalna (subtotalna) histerektomija, ušivanje rupture, ili ušivanje rupture kombinovano sa bilateralnom ligacijom jajovoda. Primarni cilj hirurške intervencije jeste zaustavljanje krvarenja, reanimacija pacijentkinje i što brže dovođenje pacijentkinje u hemodinamski stabilno stanje [7]. Najčešći razlozi za histerektomiju su ekstenzivna ruptura materice koja onemogućava adekvatnu hiruršku rekonstrukciju defekta nastalog na materici i obilno krvarenje [27]. Maternalne ishode kompletne rupture materice istraživali su Al-Zirki i saradnici [30] u Norveškoj na uzorku od 2209506 trudnica, kod kojih je identifikovano 247 potpunih ruptura materice. Citirani autori su ustanovili da je postpartalna histerektomija u ovom istraživanju značajno povezana sa rupturom intaktne materice, godinama starosti, multiparitetom i rupturom materice nakon vaginalnog porođaja. U nerazvijenim zemljama učestalost maternalnog i perinatalnog morbiditeta i mortaliteta je značajno viša [31].

Neonatalne ishode kompletne rupture materice ispitali su Al-Zirki i saradnici [32] na uzorku od 244 novorođenčeta. Citirani autori su zaključili da su rupture intaktne materice bile češće povezane sa fetalnom ili neonatalnom smrću. Kada je reč o vremenu koje je proteklo od trenutka kada se posumnjalo na rupturu materice do trenutka porođaja, medijana je iznosila 20 minuta, a najmanji broj smrtnih ishoda za fetus je bio u slučaju ukoliko je ovaj period bio kraći od 20 minuta.

## TRUDNOĆA NAKON RUPTURE MATERICE

Nedavno publikovani podaci multicentrične URIDA studije ukazuju na to da trudnoća nakon rupture materice može biti relativno bezbedna [3]. U uzorku od 174 porođaja nakon rupture materice, najveći broj trudnoća je završen carskim rezom, a kod jedne pacijentkinje urađena je postpartalna histerektomija.

## ZAKLJUČAK

Ruptura materice predstavlja retku i životno ugrožavajuću akušersku komplikaciju. Kao posledica sve veće učestalosti porođaja carskim rezom, koji u novije vre-

After extracting the fetus and the placenta from the patient's abdominal cavity, the priority is to stop maternal bleeding [2]. If the rupture occurs on the back wall of the uterus, it is difficult to diagnose it, and it is also possible that it occurs in an old incision site, which also affects the choice of surgical approach [2].

The treatment of uterine rupture depends on the size of rupture, age, parity, and the patient's general condition, as well as the experience of the surgeon who needs to assess whether suturing of the rupture is an option or if hysterectomy is necessary [2,7]. According to this, the choice of the surgical intervention comes down to four options: complete (total) hysterectomy, supracervical (subtotal) hysterectomy, suturing of the rupture, or suturing of the rupture combined with bilateral tubal ligation. The primary aim of the surgical intervention is to stop bleeding, resuscitate the patient, and make her hemodynamically stable as quickly as possible [7]. The most common reasons for hysterectomy are extensive uterine rupture which does not allow an adequate surgical reconstruction of the defect, and profuse bleeding [27]. Al-Zirki et al. [30] researched maternal outcomes of complete uterine rupture in Norway on a sample of 2209506 pregnant women and they registered 247 cases of complete uterine rupture. The cited authors found that postpartum hysterectomy in this research was significantly associated with the rupture of intact uterus, age, multiparity, and uterine rupture after vaginal delivery. In underdeveloped countries the incidence of maternal and perinatal morbidity and mortality is significantly higher [31].

Al-Zirki et al. [32] researched neonatal outcomes of complete uterine rupture on a sample of 244 newborns. The cited authors concluded that ruptures of intact uterus were more often associated with fetal or neonatal death. When it comes to the time that passed from the moment uterine rupture was suspected to the moment of delivery, the median was 20 minutes, and the number of fatal fetal outcomes was the lowest if this period was shorter than 20 minutes.

## PREGNANCY AFTER UTERINE RUPTURE

Recently published data from a multicenter URIDA study indicate that pregnancy after uterine rupture may be relatively safe [3]. In a sample of 174 deliveries after uterine rupture, the largest number of pregnancies ended by caesarean section, and one patient underwent postpartum hysterectomy.

## CONCLUSION

Uterine rupture is a rare and life-threatening obstetric complication. As a consequence of increasing frequency of caesarean births, which nowadays represents the



me predstavlja najčešći faktor rizika za nastanak rupture materice u trudnoći i na porođaju, ruptura materice i dalje predstavlja veoma značajnu komplikaciju trudnoće u savremenom akušerstvu. Poseban izazov u praksi predstavlja pravovremeno postavljanje dijagnoze, budući da su simptomi i znaci rupture materice nespecifični i često slični simptomima brojnih drugih komplikacija koje mogu nastati tokom trudnoće ili na porođaju. Zbog toga, na rupturu materice treba misliti kod svih trudnica sa prisutnim faktorima rizika, naročito u slučaju pojave nespecifičnog bola u abdomenu i patoloških promena u kardiokografskom zapisu. U ovakvim situacijama, postavljanje pravovremene dijagnoze i promptan tretman mogu doprineti povoljnom, kako maternalnom, tako i neonatalnom ishodu.

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