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REVIEW ARTICLES
PREGLEDNI ČLANCI

PREOPERATIVE CONSIDERATIONS AND MOST COMMON NON-OBSTETRIC SURGICAL CONDITIONS IN PREGNANCY

PREOPERATIVNA RAZMATRANJA I NAJČEŠĆA NEAKUŠERSKA HIRURŠKA STANJA U TRUDNOĆI

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Abstract

Introduction. During pregnancy, approximately 1-2% of patients undergo non-obstetric surgical interventions. Pregnant women are considered at increased risk in the perioperative period, due to anatomical and physiological changes that occur during gravidity. **Anatomical and physiological changes.** Changes in the respiratory tract are especially pronounced towards the end of pregnancy. These changes include swelling of the oropharyngeal tissues and reduced caliber of the glottis, which can lead to difficulty during ventilation and intubation. **Perioperative anesthesiological considerations.** Carefully titrating anesthetics is essential, as drug requirements are usually reduced during pregnancy. **Medications and toxicity.** Drugs administered during pregnancy may have a harmful effect on the fetus depending on dosage, method of administration and time of exposure. Despite years of animal experiments and observational studies in humans, no anesthetic has been shown to be clearly dangerous to the human fetus. **Fetal monitoring.** Accurate interpretation of fetal heart rate patterns and understanding of the effects of anesthetics enable effective monitoring of fetal well-being and informed decision-making regarding intraoperative care for the safety of both mother and fetus. **Non-obstetric surgical conditions.** Appendicitis and cholecystitis are the two most common surgical conditions that require treatment during pregnancy. Other more common conditions are chronic inflammatory bowel diseases and pancreatitis. Traumatic injuries of pregnant patients are a special topic. **Conclusion.** Comprehensive preoperative preparation should performed before every surgical intervention. Pregnant women should never be denied an emergency indicated surgical procedure, regardless of the current trimester of pregnancy.

Key words: Pregnancy; Periperative Care; Abdominal Surgical Procedures; Appendicitis; Cholecystitis; Risk Factors; Fetal Monitoring; Pregnancy Complications; Airway Management; Anesthetics

Sažetak

Uvod. Oko 1-2% trudnica tokom perioda trudnoće podvrgne se neopstetričkoj hirurgiji. Trudnice se smatraju grupom sa većim perioperativnim rizikom zbog fizioloških i anatomskih promena koje se razvijaju u trudnoći. **Anatomske i fiziološke specifičnosti graviditeta.** Promene disajnog puta su posebno izražene pred kraj trudnoće. Ove promene uključuju otok orofaringealnih tkiva i smanjen kalibar glotisnog otvora, što može dovesti do poteškoća tokom ventilacije i intubacije. **Perioperativna anesteziološka razmatranja.** Neophodno je pažljivo titrirati anestetike, jer su potrebe za lekovima tokom trudnoće obično smanjene. **Medikamenti i toksičnost.** Lekovi dati tokom trudnoće mogu imati štetan efekat na fetus u zavisnosti od doze, načina primene i vremena izloženosti. Uprkos godinama eksperimenata na životinjama i opservacionih studija na ljudima, nijedan anestetik nije pokazan kao jasno toksičan za ljudski fetus. **Fetalni monitoring.** Tačno tumačenje obrazaca fetalne srčane frekvencije i razumevanje uticaja anestetika omogućavaju efikasno praćenje dobrobiti fetusa i donošenje informisanih odluka o intraoperativnom zbrinjavanju radi bezbednosti i majke i fetusa. **Neopstetrička hirurška stanja.** Apendicitis i holecistitis jesu dva najčešća hirurška abdominalna, neginekološka oboljenja koja zahtevaju lečenje u trudnoći. Ostala učestalija stanja jesu hronične inflamatorne bolesti creva i pankreatitis. Poseban entitet jesu traumatske povrede gravidnih bolesnica. **Zaključak.** Neophodno je sprovesti sveobuhvatnu preoperativnu pripremu trudnice pred planirani operativni zahvat. Trudnici se nikada ne sme uskratiti hitan indikovani operativni zahvat, bez obzira na aktuelni trimestar trudnoće.

Ključne reči: trudnoća; perioperativna nega; abdominalne hirurške procedure; apendicitis; holecistitis; faktori rizika; fetalni monitoring; komplikacije u trudnoći; zbrinjavanje disajnog puta; anestezija

Introduction

About 1-2% of pregnant women undergo non-obstetric surgery during pregnancy [1]. Diagnosing and managing non-obstetric abdominal pathologies during pregnancy represents a clinical challenge for both obstetricians and anesthesiologists. During anesthetic and perioperative surgical care of pregnant

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Abbreviations

FDA – The Food and Drug Administration
DNA – deoxyribonucleic acid
NSAID – non-steroidal anti-inflammatory drugs
MRI – magnetic resonance imaging

patients, strict patient selection and careful timing are key factors when deciding to perform non-obstetric surgical procedures [2]. Pregnant women are considered a group with higher perioperative risk due to physiological and anatomical changes that develop during pregnancy. These changes, driven by hormonal factors and mechanical effects of the enlarged uterus, have important implications for both surgeons and anesthesiologists [3]. Nevertheless, an urgently indicated operation must never be withheld from a pregnant patient, regardless of the current trimester [4]. Appendicitis, cholecystitis, ovarian torsion, maternal malignancies, and traumatic injuries are the most common indications for surgical intervention during pregnancy [5]. The most frequent non-obstetric procedures performed in pregnancy are appendectomy (44%) and cholecystectomy (22.3%) [3].

Anatomical and physiological specificities of pregnancy

The primary physiological changes that occur during pregnancy are influenced by pregnancy hormones. These changes are crucial to ensure adequate oxygen and nutrient delivery to the fetus [6].

Pregnant women exhibit changes in pain perception and pain threshold, reduced anesthetic requirements, and physiologically increased activity of the sympathetic nervous system. The minimum alveolar concentration for volatile anesthetics decreases by 28% at 8-12 weeks of gestation, reaches 40% of the non-pregnant value as pregnancy progresses, and returns to baseline by day three postpartum [7].

Airway changes may appear halfway through the second trimester and are particularly pronounced near the end of pregnancy. These changes include edema of oropharyngeal tissues and reduced glottic aperture, which may lead to difficulty with ventilation and intubation [2]. Due to cranial displacement of the diaphragm by the gravid uterus, the transverse diameter of the chest increases and functional residual capacity decreases by 20%. Minute ventilation increases by 50%. The combination of increased minute ventilation and reduced functional residual capacity explains the rapid uptake of volatile anesthetics [8]. Increased maternal resting metabolism and the increased metabolic demands of the fetoplacental unit raise oxygen consumption by 60% [9]. Reduced functional residual capacity along with increased oxygen demand underlies rapid oxygen desaturation that can occur in pregnant women in the event of apnea or airway obstruction.

During pregnancy, cardiac output increases by 50%, with a consequent rise in heart rate (by 10-20/min) and stroke volume (30–40%). Accordingly, induction of anesthesia with intravenous agents is faster [8]. This increase begins early in pregnancy. As cardiac output rises, systemic vascular resistance and pulmonary vascular resistance decrease simultaneously[10].

Regarding intraoperative positioning, after 18–20 weeks of gestation, pregnant patients should be positioned with a 15° left lateral tilt during surgery. This reduces aortocaval compression and mitigates the risk of supine hypotensive syndrome, which can occur due to pressure on both venae cavae when the patient lies flat on her back [11]. Because fetal perfusion is determined by maternal blood pressure, avoiding maternal hypotension is essential. In addition to preventing hypotension, maintaining maternal blood oxygenation is crucial in avoiding fetal hypoxemia during general anesthesia [8]. During surgical procedures in pregnant women, precautionary measures are aimed at preventing four key risks: hypotension, hypoxemia, hypovolemia, and hypothermia [12].

Aspiration of gastric contents is rare, with an incidence of 2:10,000, but recognizing risk factors (obesity and a known difficult airway) and adequate preparation (preoperative fasting and gastric decompression in selected cases) are imperative for preventing aspiration [13]. The gravid uterus increases intragastric pressure and reduces the protective effect of the diaphragm on the lower esophageal sphincter. Gastroesophageal reflux and regurgitation are more common in pregnant women than in the general population [8].

Because pregnancy leads to a procoagulant state, perioperative venous thrombosis prophylaxis should be considered [14]. For abdominopelvic procedures lasting more than 45 minutes, the risk of thromboembolic complications is moderate. Unfractionated and low-molecular-weight heparin are considered safe in pregnancy [15].

In Rh-negative mothers who are expected to deliver an Rh-positive child, there is an increased risk of hemolytic anemia. Preventively, in such cases, the mother should receive anti-D immunoglobulin [16].

Perioperative anesthetic considerations for non-obstetric surgery in pregnancy

The risks of surgery during pregnancy are determined by numerous factors, including physiological changes, potential adverse effects of anesthetic agents, gestational age, the type, duration, and location of the

surgical pathology, the anesthetic technique, and the patient's overall condition. Each pregnant patient should be assessed by an anesthesiologist to evaluate general status, potential comorbidities, fetal viability, and gestational age. An individualized plan should be developed to ensure maternal and fetal safety, control teratogenic risk, avoid intrauterine fetal asphyxia, and prevent preterm labor [17]. Despite careful management, patients exposed to surgery and anesthesia during pregnancy may still develop serious complications, including pneumonia, sepsis, venous thromboembolism, and even death, as well as fetal loss, preterm delivery, and low birth-weight neonates [7].

Pregnant patients requiring surgery should undergo preoperative preparation in a manner similar to non-pregnant patients. This comprehensive approach ensures the safety and well-being of both mother and fetus [11]. Mallampati scores III and IV have been described in 12% of women in the first trimester. This proportion rises to 20% in the second trimester, which is considered the preferred time for non-urgent procedures. This emphasizes the importance of careful airway assessment and preparation [18]. The incidence of failed intubation in obstetrics is 1:390-443 and is higher than in non-obstetric patients [13]. In addition to the expected risk of difficult intubation, the anesthesiologist should also pay special attention to extubation and subsequent postoperative care. Failed intubation in obstetrics affects both mother and fetus [8]. According to one study, a higher number of neonatal intensive care unit admissions was reported among newborns whose mothers had difficult intubation [19]. A routine "head-up" position during induction of general anesthesia is recommended, as it facilitates airway manipulation and laryngoscopy, particularly in pregnant women with enlarged breasts. To prevent desaturation during induction, the following are recommended: preoxygenation with a tightly fitted face mask for at least three minutes and achieving end-tidal oxygen of 90%; mask ventilation prior to intubation (with a maximum inspiratory pressure of 20 cmH_2O); and passive oxygenation during apnea via nasal cannula at 5-15 L/min [8]. An increasing number of studies suggest that videolaryngoscopy should be the first-line method for securing the airway [20]. Cricoid pressure should not be applied if it impairs airway management and intubation on the first laryngoscopy attempt. If the first intubation attempt fails, mask ventilation and oxygenation should be resumed. The next (second) attempt should be performed by the most experienced available anesthesiologist, using a different laryngoscope if available. If cricoid pressure was used during the first attempt, the second attempt should be without cricoid compression. It is recommended to limit the maximum number of intubation attempts to two. A third attempt, in special circumstances, should be performed by the most senior anesthesiologist. If failed intubation is declared, the priority is to ensure oxygenation via a face mask or second-generation supraglottic airway devices [8].

After failed intubation and the decision to proceed with the surgical intervention, anesthesia should be maintained as safely as possible, ensuring adequate ventilation and appropriate anesthetic depth. Controlled ventilation, non-depolarizing neuromuscular blockers, second-generation supraglottic airway devices, and inhalational anesthetics are preferred. A gastric tube should be passed through the laryngeal mask to decompress the stomach. If the surgical procedure is abandoned due to failed intubation, the plan for further safe management should be formulated by the team. Regional anesthesia techniques and awake tracheal intubation should be considered. Awake tracheal intubation may be performed using a flexible bronchoscope, rigid direct or indirect laryngoscopy, or tracheostomy. Regardless of the final airway technique and type of anesthesia, the occurrence of difficult and/or failed intubation should be documented in the patient's medical records, particularly because the patient may require general anesthesia later in life [8].

The incidence of non-obstetric surgery during pregnancy is 0.48%, with most procedures performed in the second trimester (44%) and under general anesthesia (81%) [21]. Regional anesthesia offers several advantages in pregnant patients. It usually involves lower drug exposure, a lower risk of teratogenicity, especially in the first trimester, and reduces interference with fetal monitoring later in pregnancy. Regional techniques often provide better postoperative analgesia, facilitate early mobilization, and reduce the risk of thromboembolism [11]. General anesthesia was long considered the anesthesia of choice for vaginal delivery and cesarean section in obstetrics [8]. Although mortality associated with general anesthesia in obstetrics declined by 60% in the period 1991-2002 compared with 1979-1990, literature still reports maternal deaths associated with difficult intubation [22,23]. When surgery is performed under general anesthesia, a higher frequency of low birth-weight neonates has been observed, and the rate of preterm delivery is higher for procedures performed in the third trimester compared with the other trimesters [21].

Anesthetic agents should be carefully titrated because drug requirements during pregnancy are generally reduced for both volatile and intravenous anesthetics. This ensures that maternal physiological changes are properly managed and that anesthesia remains effective without unnecessary risk to the mother or fetus [24]. Pregnant women are also more sensitive to neu-

romuscular blockers. Although the dose of succinylcholine is usually not reduced, neuromuscular blockade may be mildly prolonged due to decreased pseudocholinesterase activity. These findings highlight the importance of careful titration and monitoring of anesthetic agents for optimal anesthetic management in pregnant patients undergoing surgery [10]. Ketamine has been shown to induce uterine contractions in early pregnancy similarly to ergometrine, but this effect is not present in late pregnancy. Therefore, ketamine's excellent analgesic properties can be safely utilized in late pregnancy. Volatile anesthetics such as halothane, sevoflurane, desflurane, and isoflurane have been shown to inhibit uterine contractility, potentially contributing to uterine relaxation and reducing the frequency of preterm labor [5].

When appropriate, analgesic modalities such as continuous peripheral or neuraxial blocks though IV infusions are optimal for postoperative pain control. Adequate postoperative analgesia is essential, as studies have shown that pain can increase the risk of preterm labor. By effectively controlling postoperative pain, clinicians can reduce this risk and improve outcomes for both mother and fetus [11]. After surgery, early mobilization is recommended to reduce the risk of deep vein thrombosis [25].

Medications and Toxicity

In the first 15 days of pregnancy, the "all-or-nothing" phenomenon occurs: either fetal loss occurs, or the fetus remains unaffected. During organogenesis (from day 15 to day 56), structural anomalies develop, whereas after this period functional abnormalities may occur, depending on the specifics of the case [17]. Teratogenesis may manifest as structural anomalies (e.g., growth restriction or congenital malformation) or as functional, behavioral, or cognitive delays [7]. The Food and Drug Administration (FDA) introduced fetal risk categories for medications, from Category A (safest) to Category X (known danger) [26]. Drugs administered during pregnancy may harm the fetus depending on dosage, route of administration, and timing of exposure. Despite years of animal experiments and observational human studies, no anesthetic has been shown to be clearly toxic to the human fetus [1]. Anesthetic agents such as induction agents, inhalational and intravenous agents, muscle relaxants, local anesthetics, benzodiazepines, and opioids, when used under normal clinical conditions, have been shown to be safe and nonteratogenic [17]. Nitrous oxide inhibits methionine synthase activity and may affect deoxyribonucleic acid (DNA) synthesis in the developing fetus, and can be teratogenic during the peak of organogenesis in rodents. Regarding antibiotics, cephalosporins, penicillins, and macrolides can be used safely. Amoxicillin-clavulanate should be avoided due to an increased risk of necrotizing enterocolitis. Although considered relatively safe, the main adverse effects of aminoglycosides are ototoxicity and nephrotoxicity in both the mother and fetus [27]. Anticholinesterases may increase uterine tone during pregnancy, so slow administration is recommended [17]. Sugammadex may encapsulate progesterone and reduce progesterone levels in pharmacologic simulation studies [7].

Benzodiazepine use is associated with anorectal anomalies and additional congenital defects. Opioids readily cross the fetoplacental barrier, and in-utero exposure may lead to fetal-neonatal respiratory distress syndrome, a higher incidence of neonatal hospitalizations, and the development of behavioral developmental disorders. Guidelines recommend that opioids and paracetamol (acetaminophen) may be used to treat mild to moderate pain during pregnancy. Preference is given to paracetamol, especially as it is considered safe in pregnancy and has no known teratogenic effects. However, non-steroidal anti-inflammatory drugs (NSAIDs) should be avoided due to potential fetal risks [10]. NSAIDs should be avoided, especially in advanced gestation, because of the risk of oligohydramnios, premature closure of the ductus arteriosus, and necrotizing enterocolitis. Additionally, they can inhibit uterine contractions, making them unsuitable for pain treatment in pregnancy, particularly in later stages [11]. A prospective Norwegian cohort study on NSAID exposure during pregnancy and the risk of selected congenital malformations showed that NSAID exposure during the first 12 weeks of gestation does not appear to be associated with an increased risk of selected congenital malformations [28].

Antenatal corticosteroid administration should be considered in mothers with a viable fetus (23-24 gestational weeks) up to 33 weeks plus six days of gestation if there is an increased risk of preterm birth within the next 1-7 days. Perinatal morbidity is significantly lower in children born before 34 gestational weeks if antenatal corticosteroids were administered. When deciding on corticosteroid use, their adverse effects should be considered, such as the risk of neonatal hypoglycemia and a potential impact on neurological development [29].

Fetal monitoring

The decision to use fetal monitoring during surgery in pregnant patients should be individualized, taking into account gestational age, maternal status, the type and duration of surgery, and fetal well-being.

Accurate interpretation of fetal heart rate patterns and knowledge of anesthetic effects enable effective assessment of fetal well-being and informed intraoperative management decisions to ensure maternal and fetal safety [1]. If the fetus is considered pre-viable, it may be sufficient to confirm the fetal heart rate by Doppler before and after the procedure. For viable fetuses, simultaneous electronic monitoring of fetal heart rate and uterine contractions should be performed before and after the procedure to assess fetal well-being and the absence of contractions. Continuous intraoperative fetal heart rate monitoring is advised only when interrupting the non-gynecologic surgical procedure is possible if the need for emergency delivery arises, and when an obstetrician capable of performing an emergency cesarean section is present in the operating room in case of pathological fetal heart rate tracings [30]. Fetal heart rate monitoring is feasible from approximately 18-22 weeks of gestation. However, from around 25 weeks, heart rate variability becomes easier to recognize, providing important information about fetal well-being [11]. In addition, regardless of gestational age, fetal heart rate monitoring should be documented before and after the surgical procedure. It is also important to emphasize that general anesthetics cross the placenta and may cause absent fetal heart rate variability, highlighting the importance of careful monitoring and timely intervention to ensure maternal and fetal safety during surgery [4]. It should also be kept in mind that certain anesthetics can cause changes in fetal heart rate monitoring tracings, such as opioids, beta-blockers, atropine, and magnesium sulfate. Careful consideration of these factors is necessary for maternal and fetal safety during surgical procedures [10].

Non-obstetric surgical conditions

Intra-abdominal pathological processes pose a particular challenge in pregnant patients, most notably in respect to balancing risk factors and potential benefits of surgery [12]. Appendicitis and cholecystitis are the two most common abdominal, non-gynecologic surgical diseases requiring treatment during pregnancy. Other more frequent conditions include chronic inflammatory bowel disease and pancreatitis. Traumatic injuries in pregnant patients represent a separate topic.

Initial diagnosis is often difficult due to the non-specific nature of symptoms such as abdominal pain, bloating, and nausea [31]. Additionally, the gravid uterus displaces intra-abdominal organs, which can complicate clinical examination. Traditionally, the beginning of the second trimester is considered the most suitable period for performing surgery for several reasons: the risk of preterm birth is thought to be lowest, and the gravid uterus is believed not to significantly impair surgical visualization of abdominal structures [32]. Regarding radiologic diagnostics, ultrasound and magnetic resonance imaging (without gadolinium) are first-line modalities because they avoid radiation exposure to the mother and fetus. If imaging that produces ionizing radiation is necessary, consultation with a radiologist is advised to ensure adequate diagnostics using minimal radiation doses [33].

Appendicitis occurs in 0.05-0.15% of pregnancies [34] and most commonly presents in the second trimester [35]. Diagnosis is not always straightforward. Patients most often report pain in the right lower quadrant, although pain may be present in any abdominal region [36]. The gravid uterus can often displace the appendix. In laboratory testing, appendicitis is most commonly associated with hyperbilirubinemia, leukocytosis, an elevated neutrophil-to-lymphocyte ratio, and an elevated platelet-to-lymphocyte ratio [37]. The initial imaging modality is ultrasound; however, reported sensitivity in pregnant women ranges from 28-100% and specificity from 33-92%, with declining sensitivity in later trimesters [32]. Computed tomography and magnetic resonance imaging demonstrate sensitivity and specificity of nearly 100% [38]. Appendicitis during pregnancy is associated with preterm birth, intra-amniotic infection, and intrauterine fetal demise. Current recommendations indicate that in acute appendicitis, surgical appendectomy is the treatment of choice compared with conservative management. In addition, appendectomy is associated with a lower need for cesarean delivery, fewer re-hospitalizations of pregnant/postpartum patients, and a lower incidence of maternal sepsis [39]. Regarding surgical technique, laparoscopic appendectomy is recommended over open appendectomy when the uterine fundus is below the level of the umbilicus. In later stages of pregnancy, the enlarged uterus may affect port placement as well as the available infra-abdominal space required for safe laparoscopy [12].

Cholecystitis occurs somewhat less frequently, in 0.01-0.06% of cases. Spontaneous perforation occurs in approximately 2-10% of patients with acute cholecystitis and often presents with nonspecific symptoms, which complicates timely diagnosis [40]. Symptoms and signs in pregnant patients are similar to those in the general population. For example, intermittent postprandial pain in the right upper quadrant and/or epigastrium suggests biliary colic. In laboratory testing, elevated total and direct bilirubin levels as well as gamma-glutamyl transferase suggest biliary obstruction [41]. Ultrasound is the imaging modality of choice, with nearly 100% sensitivity for gallstones and 95% sensitiv-

ity for cholecystitis [42]. In unclear cases, abdominal magnetic resonance imaging (MRI) should be performed [32]. Laparoscopic cholecystectomy is recommended over conservative treatment of biliary disease during pregnancy; therefore, in acute cholecystitis, laparoscopic cholecystectomy is the treatment of choice. However, in biliary colic during the third trimester, both conservative and operative management should be considered. Reported benefits of laparoscopic cholecystectomy include lower incidence of cesarean delivery, delivery during hospitalization, neonatal death, neonatal intensive care admission, pregnancy loss, and maternal re-hospitalization. Reported risk factors associated with laparoscopic cholecystectomy include sepsis, preeclampsia, and postoperative bile leakage from the operative field [12]. According to some studies, preterm birth and eclampsia are more frequent in patients operated in the last trimester compared with those operated in the first three postpartum months [43]. In pregnant patients with symptomatic choledocholithiasis, endoscopic retrograde cholangiopancreatography is recommended over conventional surgical exploration of the bile ducts [12].

In patients with inflammatory bowel disease, emergency surgical conditions may occur due to bowel perforation or persistent bowel obstruction. Indications for emergency surgery are the same in pregnant and non-pregnant patients. Open surgery is the approach of choice [12]. The use of mesalamine, sulfasalazine, steroids, thiopurines, and biologics is relatively safe in pregnancy, with the need for additional consideration depending on trimester, the patient's overall status, and incomplete data in the available literature. Inflammatory bowel disease is associated with prematurity, low birth weight, congenital anomalies, and a higher incidence of cesarean delivery [44].

Pancreatitis occurs in pregnant women at a similar incidence as in the general population [33]. Pancreatitis develops in 0-29% of cases in the first trimester, 4.8-63.6% in the second, and 27.3-95.2% in the third trimester [45,46]. The most common causes during pregnancy are biliary calculi and hypertriglyceridemia. Maternal complications of pancreatitis include multi-organ dysfunction, acute respiratory failure, venous thromboembolism, disseminated intravascular coagulation, preeclampsia, postpartum hemorrhage, and death (0-5.1%) [46]. Typical symptoms include severe epigastric pain radiating to the back, nausea, and vomiting. Elevation of amylase and lipase to three times the upper reference limit, along with appropriate clinical symptoms and imaging findings, is sufficient to establish the diagnosis of pancreatitis [47]. Initial treatment includes fluid resuscitation, correction of electrolyte imbalance, multimodal analgesia, and antiemetic therapy. Although parenteral nutrition is often initiated, early enteral nutrition should be emphasized [45]. More invasive treatment modalities include endoscopic retrograde cholangiopancreatography and surgical cholecystectomy [32].

Traumatic injuries during pregnancy are the leading cause of non-obstetric maternal mortality, with nearly 20% of maternal deaths occurring as a direct consequence of injury. Non-fatal injuries most commonly occur as a result of traffic accidents or domestic/partner violence [48]. Management of pregnant trauma patients requires consideration of anatomical and physiological changes, potential exposure to ionizing radiation or teratogenic medications, the need to assess fetal viability, and other pregnancy-specific issues discussed above. During initial management, it is advised that every woman of reproductive age be considered pregnant until proven otherwise, since nearly 3% of women hospitalized after traumatic injuries are pregnant, and among them 11% are incidental pregnancies. When securing the airway, the previously described pregnancy-specific airway considerations should be taken into account. In addition, due to delayed gastric emptying, a pregnant patient should be considered to have a "full stomach" up to 24 hours after the last meal. For vascular access in all severely injured patients, placement of two peripheral IV lines (14–16G) is recommended to enable rapid crystalloid resuscitation, correction of hypovolemia, and administration of blood and blood products as indicated. Vasopressors can significantly reduce placental perfusion; therefore, their use should be delayed if there is a positive response to fluid administration and hypotension can be corrected with volume resuscitation. Ultimately, treatment of the injured mother should take priority over any intervention aimed at fetal benefit [49].

Conclusion

Although the second trimester is considered the safest time for surgical procedures, pregnant women should never be denied an emergency indicated surgical procedure, regardless of the current trimester of pregnancy. Appendicitis and cholecystitis are the two most common abdominal, non-gynecologic surgical conditions requiring treatment during pregnancy. Comprehensive preoperative preparation should be performed before every surgical intervention, with special emphasis on preoperative airway assessment and adequate preparation for difficult intubation. When it comes to the use of anesthetics, most drugs used in general anesthesia are considered safe, both for the pregnant patient and the fetus.

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