UDK: 616-089:618.3

UROLOGICAL SURGICAL AND ANESTHETIC CHALLENGES IN PREGNANCY

ANESTHESIA FOR NON-OBSTETRIC SURGERY DURING PREGNANCY

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Non-obstetric surgery during pregnancy is a rare occurrence, with an incidence ranging from 0.2% to 2%. Maternal physiological, hormonal and anatomical changes affect cardiovascular, respiratory, hematological, gastrointestinal, endocrine and urinary systems, posing increased risks. Complications, such as premature birth, are prevalent, making diagnosis and treatment complex. The American College of Surgeons' National Surgical Quality Improvement Program reports an overall postoperative complication rate of 5.8%. This includes reoperation within 30 days (3.6%), infections (2%), respiratory complications (2%), wound site complications (1.4%), thromboembolism (0.5%), bleeding (0.2%) and a mortality rate of 0.25%. A literature review from 2017 to 2022, using PUBMED and VHL, highlights key insights on anesthesia and surgery during pregnancy. Neuraxial techniques in the first trimester, general anesthesia in the second trimester for abdominal surgeries, and surgical procedures in the third trimester pose specific risks, including low birth weight and premature delivery. The findings stress the importance of precise planning, management, and intraoperative fetal monitoring to optimize outcomes for both mother and baby.

Non-obstetric surgery during pregnancy may be indicated for various conditions, including acute intra-abdominal infections, acute appendicitis, cholecystitis, ovarian cysts and trauma. Additionally, urological issues, such as symptomatic urolithiasis, iatrogenic injuries of the urethra and bladder, as well as rare conditions like placenta percreta with bladder invasion, pheochromocytoma and bladder tumors, may necessitate surgical intervention.In managing anesthesia during pregnancy, understanding physiological changes and altered pharmacokinetics is crucial. Preoperatively, emphasis on hemodynamic stability, oxygenation, thromboprophylaxis and airway management is vital. Careful .selection of anesthesiology techniques, patient positioning and consideration of hematological changes is necessary. Intraoperative fetal monitoring is essential, with operation time linked to gestational age. Recognizing inherent risks, both anesthetic and surgical, throughout pregnancy highlights the critical nature of essential and emergency operations. Notably, surgical procedures in the second trimester show better fetal outcomes, emphasizing the importance of strategic decision-making in maternal and fetal care during operations.

The American Heart Association and American College of Cardiology recommend utilizing echocardiography for evaluating congenital heart disease, impaired valve function and non-physiological murmurs. In pulmonary assessments, altered respiratory dynamics, like decreased functional residual capacity (FRC), increased minute volume (MV) and tidal volume (TV) may lead to respiratory alkalosis, favoring rapid induction with inhalation anesthetics. Vigilance is

crucial for complications such as tachypnea, pulmonary embolism, physiologic anemia affecting oxygen delivery, airway edema and assessing difficult airway and aspiration risks. Failed endotracheal intubation, with a 10 times higher incidence than the general population, requires adherence to The American Society of Anesthesiologists' guidelines for managing difficult airways in obstetrics. Factors like Mallampati class 3, fiberoptic intubation and strong recommendations to prevent atelectasis are integral components in ensuring safety for both the pregnant patient and the developing fetus during non-obstetric surgery. Thromboprophylaxis is crucial during non-obstetric surgery in obstetric patients due to a 6-10 times higher risk of deep vein thrombosis. Low molecular weight heparin (LMWH) is preferred for its lower bleeding and thrombocytopenia risk. Gastroesophageal reflux prevention involves prokinetics, antacid drugs and the anti-Trendelenburg position.

Considerations for timing and type of surgery are essential, especially to prevent fetal hypoxia in the third trimester. Laparoscopic procedures, commonly performed in the first trimester (42%), adhere to safety recommendations in general surgical literature. However, caution is warranted when considering the inclusion of endourological surgery due to potential gaps in existing research. In non-obstetric surgery for pregnant patients, the recommended positioning is a 30° left lateral decubitus. Intraoperative fetal monitoring, recommended after 22 weeks of gestation, involves continuous monitoring with a focus on uterine contractions. In non-obstetric urological surgical patients, physiological changes during pregnancy are noteworthy. The right-sided hydronephrosis, occurring in 50% to 90% of the cases, is prominent in the second and third trimesters. This is attributed to hypertrophy of Waldeyer's sheath, progesterone effects, communication between the right ovarian vein and the ureter and the protective arrangement of the left ureter with the sigmoid colon, along with a dextrorotated uterus. These changes lead to an increased capacity of the collecting system (200-300ml) causing urinary stasis.

Pregnancy also induces an elevation in glomerular filtration rate, heightened excretion of sodium, calcium and uric acid, increased levels of 1.25 dihydroxy vitamin D, bladder displacement, hypervascularization of pelvic organsand a tendency towards coagulopathy. Symptomatic urolithiasis in pregnancy, the most common non-obstetric indication for urological surgery (1:200 - 1:1500), presents diagnostic and treatment challenges and numerous complications.Diagnostic modalities such as renal and bladder ultrasound (RBUS) and computed tomography without contrast (NC-CT) are employed, while interventions like ureteral stents and percutaneous nephrostomy may be necessary. Guidelines from prominent urological associations (EAU, AUA, ACR) recommend an early multidisciplinary approach, thromboprophylaxis and a meticulous management plan. The initial evaluation includes pain and nausea therapy along with fetal monitoring, utilizing RBUS, RI and transvaginal ultrasonography. Interventions depend on clinical urgency, focusing on reducing radiation exposure. Therapeutic measures include pain relief, hydration, expulsive therapy, and the use of selective alpha 1 blockers, such as tamsulosin. For urgent decompression in cases of septic obstructive urolithiasis during pregnancy, the preferred method is a ureteral stent, that is deemed safe for both the mother and fetus. Percutaneous nephrostomy (PCN) is the intervention of choice in situations involving previous urinary tract reconstruction, septic shock, large stones, or prone positioning for percutaneous nephrolithotomy (PCNL), where accessing the airway and fetal monitoring may pose challenges. Changing ureteral stents every four weeks is standard until the final treatment. Ureteroscopy with laser lithotripsy stands as the first-line treatment, offering an advanced surgical technique with a single-session approach, avoiding undue anesthesia exposure. Notably, neuraxial anesthesia is

preferred, supported by a retrospective study spanning 16 years, which found no significant increase in reduced birth weight during general anesthesia (Devroe S., Bleeser T et al., ObstetAnesth Ang., 2019, 39:74-81).

Pheochromocytoma in pregnancy has anincidence of 0.007%(in 30,246 pregnancies during 20 years). Despite autopsy studies indicating a potentially higher occurrence, more than 50% result in maternal and fetal mortality. Improved outcomes are observed with advanced anesthetic and surgical approaches. Primary management focuses on early diagnosis, preventing hypertensive crises and ensuring timely delivery with definitive surgical intervention.Early diagnosis of pheochromocytoma in pregnancy is vital to significantly reducemortality. Despite its complexity due to association with pregnancy symptoms, various tools like ultrasound, CT, MRI and laboratory analyses measuring metanephrine levels in blood and urine, contribute to timely identification. Hypertensive crises can occur due to mechanical factors like tumor compression and non-mechanical factors, such as gestational hormones. Surgical procedures pose particular risks including moving a patient to an operating chair, induction under general anesthesia, endotracheal intubation, changes in intra-abdominal pressure, pneumoperitoneum and surgical manipulations. These situations can lead to uteroplacental insufficiency, fetal hypoxia and fetal death. In managing pheochromocytoma during pregnancy, cesarean delivery is preferred, and vaginal delivery is considered only for previously treated cases. Adrenergic blockade is administered for fetal maturity and spinal anesthesia is chosen during childbirth to reduce adrenal stimulation. Swift surgical intervention, especially before the 24th week of gestation, is recommended. Laparoscopic adrenalectomy, after prior pharmacological treatment, is preferred, but caution is needed due to potential fetal acidosis and hemodynamic changes with CO_2 pneumoperitoneum. General anesthesia during surgery involves IV lidocaine, opioids, a short-acting vasodilator, desflurane and remifentanil.

Placenta percreta with bladder invasion represents the most severe form of placenta accreta, where the placenta penetrates the uterine wall and attaches to another structures. The incidence, often associated with a history of previous cesarean sections, remains unclear. It carries a high maternal mortality rate of 9.5%. Diagnostics involves ultrasound, dopplerography and MRI. Serious complications occur in 72% of cases, including cystectomy, hysterectomy, vesicovaginal fistula and massive bleeding. The latter involves extrauterine blood vessels, non-blood vessel formation, complete penetration of chorionic villi into the myometrium and adjacent organs and potential complications during surgical separation or application of endovascular procedures such as occlusion or embolization. Pre-operative planning involves assessing blood loss, monitoring vital parameters (CVP, IAP), ensuring hemodynamic stability, maintaining body temperature, and implementing a massive transfusion protocol. Correcting coagulopathy and electrolyte imbalances, along with preoperative optimization of iron and hemoglobin are essential components for comprehensive patient’s preparation. Anesthesia techniques for obstetric patients include general and regional anesthesia. General anesthesia ensures ventilation control, hemodynamic stability and facilitates longer operative treatment with muscle relaxation for careful surgical dissection. Postoperative epidural analgesia is commonly employed in this context. On the other hand, regional anesthesia offers benefits such as postoperative analgesia, lower risk of aspiration and blood loss, and reduced exposure of the fetus to anesthetics. However, it may pose challenges related to hemodynamic instability. The choice between these techniques depends on various factorsand careful consideration is given to optimize patient’s safety and comfort during obstetric procedures.

Bladder tumors during pregnancy are exceptionally rare, with an incidence of 0.0013%. The first reported case dates to 1927, and fewer than 50 cases have been documented in the literature. Transitional cell carcinoma (TCC) is the most common type, accounting for 70% of the cases, presenting symptoms like hematuria, nocturia, frequent urination, cystitis and pain. Diagnosis challenges often lead to delayed or incorrect identification. Various diagnostic tools including ultrasound, MRI and flexible cystoscopy are employed. The role of pregnancy in either protecting against or increasing the risk of tumor occurrence and spread, remains a topic of consideration in these infrequent cases. The treatment considers the trimester and malignancy stage. Early Transurethral Resection of Bladder Tumor (TURBT) is crucial, safely performed in all trimesters with lowest risk in the second and third. Using spinal anesthesia and a bipolar technique ensures safety. Delivery method (vaginal or cesarean) varies. Intravesical therapy is delayed until after delivery for maternal-fetal well-being.

In conclusion, advanced surgical techniques can be safely applied to obstetric patients undergoing non-obstetric surgery, with a complication rate comparable to non-obstetric patients. The choice of anesthetic techniques and standard doses demonstrates minimal impact on fetal development, ensuring control of hemodynamics, oxygenation, and maintenance of utero-placental perfusion and uterine relaxation. The multidisciplinary approach, coupled with close communication within the team comprising a gynecologist, anesthesiologist, surgeon and internist, is deemed essential for ensuring safety and achieving successful treatment outcomes.

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