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Review Article

Uterine Rotation and Associated Complications in Pregnancy

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Abstract

Background: Uterine rotation is a normal physiological adaptation during pregnancy, typically influenced by hormonal effects and displacement caused by a distended sigmoid colon. While mild dextrorotation is frequently observed, pronounced rotation or malalignment may pose considerable challenges in obstetric care. Contributing factors such as uterine fibroids, congenital structural anomalies, and pelvic adhesions can intensify the degree of rotation. This can hinder the progression of labor, lead to abnormal fetal positions, and complicate cesarean deliveries. In more severe scenarios, the uterus may become incarcerated or undergo torsion, necessitating specialized intervention. These positional changes may affect the formation of the lower uterine segment, elevate the risk of unintentional uterine incisions, and make fetal extraction more difficult. Preventing such complications relies on early diagnosis using prenatal imaging, careful intraoperative evaluation of uterine orientation, and meticulous surgical planning. Proper identification of anatomical structures, such as the round and broad ligaments, and realignment of the uterus before performing an incision are key to achieving safer outcomes. Enhanced clinical vigilance and comprehensive preoperative preparation are essential to minimizing maternal and fetal risks and improving the overall safety of delivery. **Conclusion:** Comprehensive preoperative evaluation, timely prenatal imaging, and accurate intraoperative correction of uterine malrotation are vital in minimizing surgical complications and enhancing both maternal and fetal outcomes.

Keywords: Uterine rotation, pregnancy complications, cesarean section, uterine incarceration, obstructed labor, fibroids, surgical precision

List of Abbreviations: CS – Cesarean Section; MRI – Magnetic Resonance Imaging; CT – Computed Tomography; IVP – Intravenous Pyelography; IUGR – Intrauterine Growth Restriction; FIGO – International Federation of Gynecology and Obstetrics; OB-GYN – Obstetrics and Gynecology; U/S – Ultrasound; LUS – Lower Uterine Segment; NICU – Neonatal Intensive Care Unit; PROM – Premature Rupture of Membranes

Introduction

Uterine torsion, defined as a rotation exceeding 45 degrees along the uterus's longitudinal axis, represents a rare and often unexpected obstetric complication. When it occurs during labor, it can obstruct cervical dilation despite effective contractions or result in fetal compromise due to impaired uteroplacental circulation. Additionally, torsion may lead to inadvertent incisions on the posterior or lateral uterine surface during cesarean delivery. In cases where torsion is diagnosed at term, the first-line approach is manual detorsion, typically followed by cesarean section. If realignment is not achievable, a controlled posterior uterine incision (posterior hysterotomy) may be performed to allow safe fetal delivery. Because the risk of uterine rupture in future pregnancies after a posterior incision is uncertain, elective repeat cesarean sections are usually recommended. Some clinicians advocate for round ligament plication postpartum to minimize recurrence, although this preventive measure is not universally accepted.

Prompt diagnosis plays a vital role in effective management. Repositioning techniques for an incarcerated or malrotated uterus range from conservative manual maneuvers to more invasive surgical correction. In the early second trimester, non-invasive strategies such as uterine disimpaction following bladder decompression and under appropriate anesthesia are generally effective. In select cases, a pessary may be used to stabilize the corrected position and reduce the likelihood of recurrence. However, beyond 20 weeks of gestation, repositioning becomes increasingly challenging and is often associated with elevated maternal and fetal risk [1].

This review explores the various causes of uterine malrotation and the key considerations for performing cesarean sections in pregnancies complicated by uterine malposition.

Uterus Retroversion

The uterus undergoes natural variations in size, shape, and position throughout pregnancy, as these features are not static. Periodic myometrial contractions and evolving uterine configurations are typical and expected during gestation. Some temporary changes, such as early gestational asymmetry (e.g., Piskacek's sign) or immediate postpartum alterations, are regarded as physiological variants.

However, in uncommon scenarios, deviations in uterine morphology or positioning may lead to significant obstetric complications. These complications can arise at different stages—prior to labor (such as incarceration due to retroversion, uterine prolapse, torsion, herniation, or sacculation), during labor (e.g., pathological retraction rings), or after delivery (e.g., acute or chronic uterine inversion). Among these, retroverted uterus with incarceration is the most commonly encountered malposition during pregnancy. (Fig.1) [2].

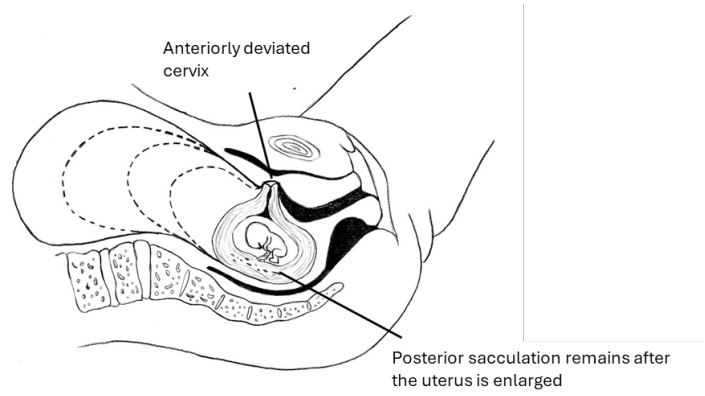

Figure:-1 Uterine retroversion with incarceration [2]

In nonpregnant women, the uterus may take on different positions, with uterine retroversion now recognized as a common anatomical variation that generally does not produce symptoms. Surgical intervention to correct chronic uterine retroversion, when not associated with underlying conditions such as endometriosis or other inflammatory diseases, has fallen out of favor. This change in practice stems from the absence of robust scientific or clinical evidence demonstrating that repositioning surgery effectively relieves symptoms like chronic pain or menstrual irregularities, or serves as an effective isolated treatment for infertility [3].

About 20% of healthy women have a retroverted uterus, which may be a normal anatomical variation or develop over time. However, fixed retroversion is not always harmless, as it can indicate an underlying gynecologic condition. Changes in the uterine shape caused by Müllerian anomalies, strategically located leiomyomas, or prior inflammatory processes such as endometriosis or salpingitis with pelvic adhesions can cause the uterus to become immobile in a retroverted or retroflexed position. Additionally, some observational studies have indicated a potential link between uterine retroversion and uterine prolapse [5].

Other Malrotations of Uterus

Adhesions that fix the uterus in place increase the risk of rare pregnancy complications such as uterine torsion, incarceration, or sacculation. Even without restrictive adhesions, a retroflexed uterus can become trapped behind the sacral promontory due to a particular combination of malposition and laxity in supporting tissues. When uterine retroversion with incarceration occurs during pregnancy, it often causes acute symptoms and serious complications, with early misdiagnosis being common. In rare instances, chronic uterine retroversion and incarceration can lead to uterine sacculation—an aneurysm-like dilation of the upper uterine wall—allowing the uterus to expand while causing significant anatomical distortion. These cases may present near term with acute maternal or fetal distress, frequently necessitating urgent surgical intervention.

Caesarean section (CS) is a common surgical procedure, generally straightforward, but this routine nature can sometimes cause surgeons to underestimate potential complexities. This chapter highlights essential anatomical and surgical principles for all CS procedures, with special attention to three challenging situations: an exaggerated or malrotated uterus, transverse fetal lie, and delivery during the second stage of labor. Many difficulties can be prevented through thorough preoperative planning, and when challenges arise, early recognition and mental rehearsal of strategies are key to improving outcomes.

During pregnancy, the expanding sigmoid colon, influenced by the relaxing effects of progesterone on smooth muscle, can cause dextrorotation of the uterus, which may become pronounced. In extreme cases, the uterus can rotate as much as 180 degrees.

This extreme rotation hinders the development of a normal lower uterine segment, since the rotational axis keeps the isthmic and cervical pedicle narrow, thereby restricting proper formation of the lower segment. (Figure 1)

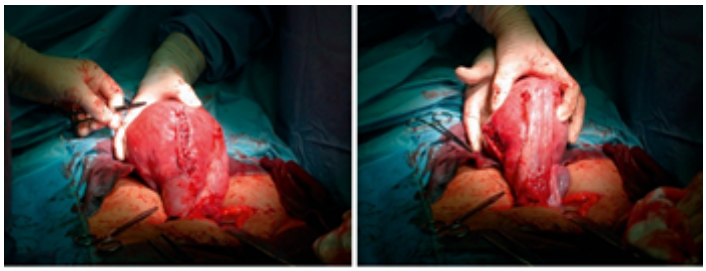

Figure 2:- 180-degree rotated uterus during delivery [6]

Fibroids Causing Uterine Retroversion

Fibroids can have a considerable impact on uterine position as pregnancy progresses. It is important to review early pregnancy ultrasounds to accurately locate fibroids before uterine rotation advances due to both gestational growth and fibroid enlargement. Later ultrasounds may give a false impression, showing a fibroid shifted laterally even if it originally developed on the anterior isthmic wall. During surgery, once the uterine rotation is corrected, the fibroid may block access and complicate the procedure. Therefore, thorough preoperative planning—including choosing the most suitable incision—is crucial to prevent unexpected difficulties during surgery [6].

There is still some debate about how fibroids change during pregnancy. The commonly accepted view is that fibroids grow in early pregnancy, mainly during the first trimester, and then their size plateaus. However, in certain instances, fibroids may keep enlarging throughout the pregnancy. Large fibroids—especially those situated in the cervix or lower uterine segment—can lead to labor complications, such as obstructed labor or labor dystocia) [7].

Clinical Presentation of Malrotations

Uterine retroversion in early pregnancy is fairly common and usually harmless, occurring in about 15% of pregnancies. Typically, the uterus shifts upward into the abdominal cavity by 14 to 16 weeks of gestation. However, if the retroverted position persists past mid-pregnancy, the uterus may become trapped in the sacral hollow, causing the cervix to be pushed upward against or above the pubic bone. This condition, known as uterine incarceration, occurs in approximately 1 in 3,000 pregnancies during the second trimester.

Symptoms of uterine incarceration are often vague and may include pelvic discomfort, lower abdominal or back pain, and a feeling of pelvic fullness or pressure. Urinary problems such as painful urination (dysuria), frequent urges to urinate, difficulty emptying the bladder, or paradoxical urinary incontinence can also be present. Gastrointestinal complaints, including rectal pressure, constant urge to defecate (tenesmus), and constipation, are frequently reported as well [8].

Clinically, an incarcerated uterus can be suspected when the fundal height is lower than expected, a mass is palpable in the cul-de-sac, and the cervix is positioned unusually far forward, making it difficult to access during a pelvic examination. Although the precise reasons for persistent uterine retroversion are not fully understood, contributing factors may include pelvic adhesions, endometriosis, uterine fibroids, a deep sacral concavity, and congenital uterine anomalies such as uterus didelphys [1].

Diagnosis and Preoperative Considerations for Pregnancies Complicated by Uterine Malrotation.

The diagnosis of a retroverted incarcerated gravid uterus for the first time at term or near term is exceedingly rare. Research indicates that onset of this condition during the third trimester is uncommon. Singh et al. reported that only 28 such cases had been documented in English-language medical literature between 1859 and 2006 [9].

Gravid uterine incarceration is associated with complications such as miscarriage and preterm labor. To help reduce risks, some specialists recommend closer prenatal monitoring, including frequent ultrasound assessments, especially if the condition continues beyond 20 weeks of pregnancy [1].

Restricted uterine volume and reduced blood flow may contribute to intrauterine growth restriction, later in gestation. When a pregnant patient presents with a cervix that is positioned very far forward or is inaccessible, along with a sense of fullness in the posterior cul-de-sac during a pelvic exam, uterine incarceration should be suspected. MRI is a valuable diagnostic tool in these situations, particularly when ultrasound findings are inconclusive or misleading. Detecting the condition before delivery via MRI enables improved surgical planning, helping to identify the best locations for abdominal and uterine incisions and thereby reducing the risk of injury to the genitourinary structures [10].

Clear communication with both the patient and medical team is crucial, especially in the event that an emergency Caesarean section is needed and performed by a different obstetrician. Although Caesarean delivery is often required in such cases, it must be approached with care due to the altered pelvic anatomy and increased risk of injury to the bladder, cervix, and vagina. Some authorities recommend a supraumbilical midline incision, followed by a careful attempt to correct the retroversion or incarceration. If repositioning the uterus is not possible, the uterine incision should be made at the point where the anterior wall folds back on itself [9].

Attempting to reposition an incarcerated retroverted gravid uterus at term is often technically challenging and may pose serious risks to the fetus. Van der Tuuk et al. recently described a case in which a transvaginal Caesarean section was performed at term in the setting of uterine incarceration, with the infant delivered through the posterior wall of the uterine fundus. Despite the success of this approach, the authors advised against its use in future cases.

Unfortunately, the risk of recurrence in subsequent pregnancies remains high, particularly in women with Müllerian anomalies. For this reason, early referral to an obstetrician in the first trimester is recommended for thorough pelvic examination and ultrasound evaluation to detect any signs of recurrent incarceration. If clinical suspicion remains, MRI can be a useful adjunct to confirm the diagnosis. Considering the potential complications associated with a persistently incarcerated retroverted uterus, early gestational repositioning should be considered—even in the absence of symptoms [11].

Changes in Labor

During labor, the myometrial fibers of the upper uterine segment contract and shorten, working to push the fetus downward while simultaneously drawing and stretching the lower segment. As labor progresses, this leads to a thickening and shortening of the upper segment and a progressive thinning and expansion of the lower segment. Normally, this coordinated activity results in fetal descent and eventual delivery. However, in advanced labor—particularly during Caesarean section performed at full cervical dilation, the lower uterine segment may become markedly distended, sometimes reaching up toward the umbilicus. This distension is especially pronounced in cases of obstructed labor, where a pathological constriction ring may form. (Figures 3, 4)

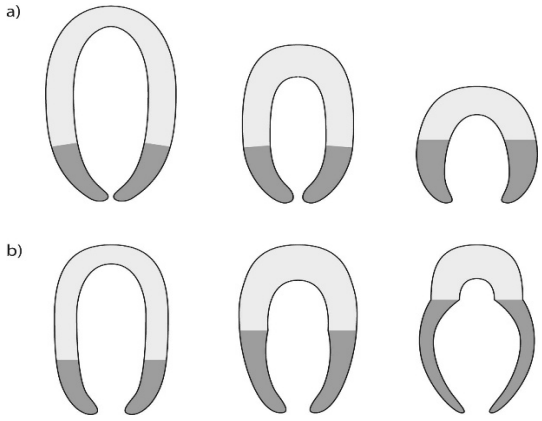

Figure 3:-Progressive Changes in the Uterine Segments During Labor

(a) Normal Labor: Retraction of the upper uterine segment combined with fetal descent facilitates cervical dilation and successful delivery.

(b) Obstructed Labor: Failure of fetal descent results in pronounced stretching and ballooning of the lower uterine segment.

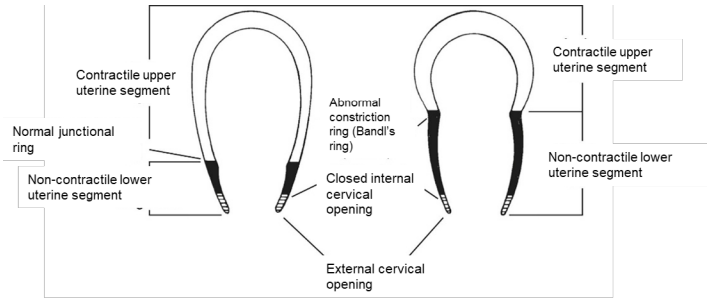

Figure 4:- Formation of Bandl's Ring During Obstructed Labor

Depicts the pathological retraction ring (Bandl's ring) that forms between the thickened upper uterine segment and the overstretched lower segment during prolonged or obstructed labor.

Surgical Precision in Caesarean Section

Verifying and Correcting Uterine Rotation During Caesarean Delivery

A careful and standardized surgical approach should be the norm during Caesarean sections. Prior to making the uterine incision, it is essential to assess the alignment of the broad and round ligaments to detect and address any uterine rotation. Overlooking this step may result in an uneven incision, increasing the likelihood of extension into the uterine angles and other intraoperative complications.

Recognizing Anatomical Landmarks at the Lower–Upper Uterine Segment Junction

The point where the loose peritoneum adheres to the upper edge of the lower uterine segment serves as an important anatomical reference. Identifying this landmark is crucial for evaluating whether the lower segment offers sufficient access for safe delivery, especially in cases of early gestation or transverse fetal lie. It also guides precise placement of the uterine incision, helping to avoid making it too low, which can be particularly problematic when the lower segment is overly stretched in advanced or obstructed labor [6].

Surgical Considerations for Cesarean Delivery in Cases of Uterine Rotation

Cesarean delivery in pregnancies complicated by uterine rotation poses distinct technical challenges that require vigilant intraoperative evaluation and surgical flexibility. A Pfannenstiel incision remains the preferred approach for abdominal entry. Upon entering the peritoneal cavity, the uterus may appear deviated laterally, with the opposite uterine horn seeming unoccupied. To rule out abnormal uterine malrotation or congenital anomalies, both round ligaments should be palpated before proceeding further.

After reflecting the bladder peritoneum, a transverse uterine incision should be cautiously made where the lower segment is presumed to be. In cases of significant rotation, however, the uterine wall may appear unusually thick, and the fetal head may not be immediately accessible. If a blind pouch is encountered instead of the amniotic sac, careful reevaluation is necessary to avoid making an incision into a non-communicating horn or an incorrect plane. In rare instances, multiple incisions—second or even third—may be required before the true uterine cavity is identified, emphasizing the need for continuous intraoperative assessment to minimize uterine trauma.

Rotation may also distort fetal positioning, leading to confusion between cephalic and breech presentation. Therefore, the fetal lie should be reassessed intraoperatively. In some complex cases, a longitudinal vaginal septum may be present, partitioning the vaginal canal and complicating access. Additionally, retroverted uterine incarceration may displace the vaginal vault superiorly, adding to the surgical difficulty. If the vaginal septum is transected during the procedure, careful reapproximation and suturing are necessary to restore anatomical integrity.

Following delivery, the uterine incision should be meticulously closed in layers to promote healing and prevent future complications. Postoperative imaging, such as CT intravenous pyelography, can be useful in confirming ureteral integrity and identifying any unintended injury. Given the anatomical complexities in such cases, patients should be closely monitored, and subsequent deliveries should be managed with heightened awareness. Understanding the surgical implications of uterine rotation and applying tailored intraoperative strategies can significantly enhance maternal and neonatal outcomes while reducing procedural risks [11].

Conclusion

Uterine malrotation and incarceration, though uncommon, pose significant challenges during pregnancy and delivery. Early recognition through imaging and careful intraoperative assessment are essential to minimize complications. Tailored surgical approaches and thorough preoperative planning can improve maternal and fetal outcomes in these complex cases. Continued vigilance is necessary in subsequent pregnancies to prevent recurrence and ensure safe delivery.

Declaration of Conflicting Interests

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