Acute complications after Cesarean Delivery: how to avoid misdiagnosis

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Learning objectives

In this exhibit we discuss the role of MDCT in the evaluation of specific Cesarean Delivery (CD) complications, focusing on the difference between normal and abnormal post-operative findings in order to help radiologist to avoid misdiagnosis.
Background

Because of the increasing occurrence of CD, the imaging of these patients has become more frequent.

Cesarean section is the most commonly performed major abdominal operation in women [1] and it is considered a safe procedure, even if it presents a variety of acute complications that the radiologist should well recognise.

The most performed is the low transverse cesarean delivery via a Pfannenstiel or Joel-Cohen skin incision, which has the lowest risk for major acute complications in subsequent pregnancies compared to the vertical incision at the body of the uterus. [1, 2].

Unfortunately, MDCT appearance of the uncomplicated CD scar is really variable and imaging interpretation is tough since there is an important overlap between normal and post-operative pathological acute findings.

Radiologists should get familiar with the anatomy, normal and abnormal post-operative findings for not missing pathological conditions or sending the patients to the surgeon in absence of an acute CD complication.
Findings and procedure details

MDCT is the imaging modality of choice during the immediate post-procedure period in case of suspected acute complications, in the proper clinical setting. MDCT is usually preferred to Magnetic Resonance Imaging (MRI) since it is cost effective and quick, even if it exposes the patient to a significant radiation dose. Unfortunately, there are only few evidences in literature about its role in detecting CD complications.

At our institution, we routinely perform a three-phase (unenhanced, arterial and venous phase) MDCT examination from the diaphragm to the inferior pubic ramus, with the possibility of a delayed phase (3-5 minutes) in case of confusing images.

Immediately after CD, normal MDCT interpretation is often very difficult since normal MDCT findings can mimic possible acute complications. In this setting, patient's clinical history is extremely important for a proper image interpretation.

In the first postpartum week normal cesarean scar appears at MDCT images such as an oval or triangular area of decreased attenuation in the myometrium of the anterior lower uterine segment (Fig.1-2A-B) [1], probably due to edema with areas of compromised blood supply [3]. It can mimic a myometrial discontinuity and, in absence of suggestive symptoms or other MDCT findings, it's not considered as uterine rupture or dehiscence [1].

The uterine cavity should be empty even if endometrial clot and debris can be seen as hyperattenuating material at MDCT. These findings can be normal in the immediate post procedure period but can also be suggestive for endometritis [1], and have to be related to anamnestic and clinical signs.

Other normal findings in the immediate post-CD period include [1]:

- a small amount of intracavitary gas (normal up to 3 weeks post-partum). However, a large volume of intrauterine gas, especially during post-operative days, may be suspicious for infection

- a small amount of air in the subcutaneous incision, associated with haziness and stranding or small areas of fluid due to the surgical procedure

- a small amount of fluid in the uterine cavity which appears as a central area of hypodense content

- small peritoneal pelvic fluid collections, in the absence of abnormal bleeding

- increased vascularity over the entire thickness of the myometrium (Fig. 3), with focal areas of increased vascularity corresponding to site of prior placental insertion [4].
- the uterus is enlarged to twice its normal pre-pregnancy dimensions and then gradually returns to its normal size within 6-8 weeks (Fig. 4) [5].

The most common acute CD complications include hemorrhage (bladder flap hematoma, subfascial hematoma or rectus sheath hematoma), infections (endometritis, wound infection, infected hematoma, and abscess formation), uterine dehiscence, uterine rupture, ovarian and pelvic septic thrombophlebitis and retained products of conception (RPOC).

**Bladder Flap Hematoma**

In case of CD performed with a low uterine transverse incision, the peritoneum is cut between the myometrium and bladder and reflected inferiorly [1]. If bleeding occurs at this site, a hematoma known as a bladder flap hematoma forms between the urinary bladder and the lower uterine segment and it’s seen at MDCT imaging as a fluid-attenuation collection (slightly hyperattenuating) in the extraperitoneal space between the posterior bladder wall and the anterior wall of the lower uterine segment (Fig. 5) [1, 5].

Bladder flap hematomas are usually not pathological if less than 4 cm in size (Fig. 6 A-B) [1]; a bladder flap hematoma exceeding 5 cm, instead, should alert for uterine dehiscence [6].

Bleeding from the low uterine transverse incision is usually confined by the overlying peritoneum but can spread to the broad ligaments, retroperitoneum and peritoneum [1]. Superimposed infection of bladder flap hematomas will appear as gas-containing fluid collection with or without multiple internal septa with rim-enhancing (Fig. 7) [1].

**Subfascial Hematoma**

Subfascial hematoma results from injury of the inferior epigastric vessels or their branches between the transversalis and umbilicovesical fasciae and it consists in a blood collection within the prevesical space, posterior to the rectus muscles and transversalis fascia but anterior to the peritoneum continuous with the space of Retzius [1,7].

On contrast-enhanced MDCT images, it appears as an hyperattenuating collection (70-90 UH) situated behind the rectus muscle or in the rectus sheath which could determine ipsilateral muscle enlargement, extend in the prevesical space and cause hemoperitoneum (Fig. 8 A-B) [1,5].

When active bleeding is present, contrast material extravasation can be seen [1] and selective arterial embolization can be considered if there is no response to conservative management [5,8].
For a proper treatment plan, it is important to distinguish a subfascial hematoma from a bladder flap hematoma: the surgical evacuation of a subfascial hematomas, in fact, does not require the incision of the peritoneum, which is fundamental in the surgical evacuation of a bladder flap hematoma.

It's also important to distinguish a subfascial hematoma from a superficial wound hematoma since the first one correlates with a potential major blood loss [1,7].

For this purpose, the radiologist should remember that the rectus muscle could be considered a useful landmark since the superficial wound hematoma is usually located before and the subfascial hematoma is usually located behind it [1].

When an extensive infection or an abscess is present at the incision site in the subcutaneous tissue, MDCT images show organizing areas of subcutaneous gas and fluid collection (Fig. 9) [1,9].

**Uterine dehiscence**

Uterine dehiscence consists in an incomplete rupture of the uterine wall, usually involving the endometrium and myometrium but with an intact overlying serosal layer [1].

Unfortunately, on MDCT images there is an important overlap with the normal cesarean scar appearance and the clinical diagnosis correlates poorly with MDCT findings [1].

MDCT imaging features include a full-thickness transmural gap at the site of incision with loss of clear margination of the myometrium (Fig. 10 A-B) [3]; associated signs can be free fluid, bladder flap hematoma, pleural effusion, bowel distension and intrahepatic abscess [1].

As said before, a bladder flap hematoma greater than 5 cm and larger pelvic hematomas are suspicious for dehiscence in the proper clinical setting [1], but a full-thickness myometrial wall defect in absence of particular clinical or further MDCT signs, (pelvic collection, hematoma…) is not suggetive for dehiscence [3].

MR imaging can depict this pathological condition better than MDCT and distinguish it from uterine rupture, which is very important for a proper therapeutical planning, since dehiscence can be treated conservatively with antibiotics whereas rupture usually requires surgical intervention [1].

MRI allows the identification of the serosal layer which is intact in the uterine dehiscence and not in the uterine rupture [6] because of its multiplanar capability and greater soft-tissue contrast.

**Uterine Rupture**
Uterine rupture is the most severe complication of CD and it's associated with high morbidity and mortality rates [1,5].

In the uterine rupture all the layers of the uterine wall are separated, including the serosal layer, with a direct communication between the uterine and peritoneal cavity [1].

The typical clinical presentation includes severe abdominal pain which can be associated to vaginal bleeding (from spotting to massive hemorrhage) [10]. Moreover, intraperitoneal hemorrhage is often severe and can cause hypovolemic shock [10].

On MDCT images, uterine rupture appears as an hypoattenuating defect within the enhancing myometrium which represents a focal disruption of uterine wall with hypoattenuating fluid with or without air bubbles in the disrupted site that often extends into the endometrial cavity and extrauterine region (Fig. 11A-B). A hematoma in the broad ligament and hemoperitoneum can coexist. [1,8,10].

Moreover, a larger amount of blood or an infection in the myometrium that extends into an infected bladder flap hematoma or parametrial abscess, especially if in direct communication with the endometrium, is really suggestive for uterine rupture [1].

**Ovarian and Pelvic Vein Thrombosis and Thrombophlebitis**

Ovarian and pelvic vein thrombosis and thrombophlebitis occurs in one out of every 600 cesarean deliveries [1], from 2 to 10 day after partum. It is usually unilateral and more frequent in the right ovarian vein [1,10].

The symptoms are non-specific (fever and acute pelvic and flank pain) [4] and it can be complicated by thrombophlebitis, especially in postpartum infections like endometritis.

Common MDCT findings of thrombosis include enlarged ovarian or other pelvic veins with low-density thrombus in the center of the lumen, surrounded by an enhancing vessel wall [1], with adjacent inflammatory stranding in case of thrombophlebitis.

**Uterine Subinvolution: Endometritis and Retained Products Of Conception (RPOC)**

Retained products of conception (RPOC), blood clots or intra-uterine infection or inflammation can affect the physiologic involution of the uterus to its normal size determining uterine subinvolution [5].

The two main causes of uterine subinvolution are infections (endometritis) and RPOC [5].

The symptoms of postpartum endometritis range from fever, abdominal pain to diffuse peritonitis and extreme uterine tenderness since endometritis may progress to myometritis, pelvic abscess and septic thrombophlebitis [11].
MDCT is performed to assess uterine involvement and extra-uterine complication when there is no response to antibiotic therapy [9]. Patient's clinical history is extremely important for a proper image interpretation since there is an important overlap between normal and pathological findings.

MDCT appearance of endometritis include the presence of fluid or air within the endometrial cavity, as well as endometrial enhancement on post-contrast images (Fig. 12 A-B) [10]. Pelvic abscess can be seen as a thick-walled, rim-enhancing, fluid-filled collection with adjacent inflammatory stranding [10]. An air-fluid level and internal septations may be present [10].

RPOC is the most common cause of secondary or late postpartum hemorrhage [8] and it manifests with pelvic pain and vaginal bleeding.

Ultrasounds is the first-line imaging modality; MRI is performed when ultrasound findings are inconclusive and patient care depends on further imaging [8].

MDCT is the imaging modality of choice, instead, in the setting of acute postpartum hemorrhage for the individuation of the source of bleeding.

On MDCT images RPOC appears as an enhancing soft-tissue mass within the endometrial cavity but these imaging findings may overlap with those found in endometritis (Fig. 13) [9].

Accurate diagnosis is determinant for a proper treatment planning, which generally consists on either medical treatment (uterotonics) or surgical treatment (dilatation and curettage of retained material) [4].
Fig. 1: Normal postoperative appearance of a cesarean delivery incision (7 days after CD). Axial oblique reformatted contrast-enhanced MTDC scan through the pelvis shows an oval area of low attenuation (arrow) at the site of the surgical incision in the anterior lower uterine segment. The axial oblique scan is oriented on the axis of the CD incision in the sagittal plane.

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Fig. 2: Normal postoperative appearance of a cesarean delivery incision (6 days after CD). Sagittal (Fig. 2A) and axial oblique (Fig. 2B) reformatted contrast-enhanced MDCT images demonstrate an oval area of low attenuation (arrows) at the site of the surgical incision in the anterior lower uterine segment. The axial oblique scan is oriented on the axis of the CD incision in the sagittal plane.

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Fig. 3: Normal post-partum uterus (1 day after CD). Axial contrast enhanced MTDC scan obtained during the arterial phase through the pelvis demonstrates an enlarged uterus with fluid in the endometrial cavity. Intramural arterial uterine branches (arrow) appear as a dot-like or tubular enhancing structure in the myometrium.

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Fig. 4: Normal postoperative appearance of a cesarean delivery incision (37 days after CD). Sagittal reformatted contrast-enhanced MDCT image demonstrates a normal low-attenuating incision in the anterior lower uterine segment (arrow) associated with post-cesarean delivery uterine involution.
**Fig. 5:** Bladder flap hematoma (7 days after CD). Axial contrast enhanced MTDC image demonstrates an hyperattenuating collection in the extraperitoneal space between the posterior bladder wall and the anterior wall of the lower uterine segment (arrow), adjacent to the surgical myometrial incision (arrowhead)

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Fig. 6: The presence of a small uncomplicated bladder flap hematoma between the anterior lower uterine segment and the posterior bladder wall is better shown in the sagittal (Fig. 6A) and coronal (Fig. 6B) reformatted plane (arrows).

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Fig. 7: Superimposed infection of a bladder flap hematoma (6 days after CD). Axial contrast-enhanced MDCT image demonstrates a high-attenuation gas-containing fluid collection, with internal gas and peripheral rim-enhancing, located posterior to the bladder wall and anterior to the lower uterine segment (arrows).

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**Fig. 8:** Acute subfascial hematoma (7 days after CD). Axial (Fig. 8A) and sagittal (Fig. 8B) reformatted contrast-enhanced MDCT images demonstrate a big hyperattenuating collection (arrows) situated in the rectus sheath which extends posterior to the rectus muscles and in the prevescical space (arrowheads). Note the associated bilateral muscles enlargement.

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Fig. 9: Superimposed infection of a subfascial hematoma (5 days after CD). Axial contrast-enhanced image shows an organizing area of subfascial fluid collection with gas situated in the rectus sheat with bilateral muscles enlargement (arrows).

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Fig. 10: Uterine dehiscence (10 days after CD). Fig. 10A. Axial oblique contrast-enhanced CT image demonstrates an hyperattenuating fluid collection with small amount of gas located anterior to the lower uterine incision site that communicates with the endometrial cavity (arrow). The axial oblique scan is oriented on the axis of the CD incision in the sagittal plane. Fig. 10B. Sagittal reconstructed image better demonstrates a full-thickness transmural gap at the site of incision with loss of clear margination of the myometrium with a small gas-fluid collection in continuity with the endometrial cavity (arrow). Images and clinical symptoms (iperpiressia and abdomino-pelvic pain) were highly suggestive for uterine dehiscence. This finding was confirmed surgically.

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Fig. 11: Uterine rupture. Fig. 11A. Axial contrast-enhanced MDCT image demonstrates a focal disruption of the uterine wall at the site of CS incision that communicates with a big fluid pelvic collection containing air bubbles. Fig. 11B. Sagittal reconstructed contrast-enhanced CT image better demonstrates the communication between the big anterior pelvic gas-containing fluid collection and the endometrial cavity. Images and clinical symptoms (iperpiressia and abdomino-pelvic pain) were highly suggestive for uterine rupture. This finding was confirmed surgically.

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Fig. 12: Cervical blood clot and endometritis. Axial (Fig. 12A) and Sagittal (Fig. 12B) reconstructed contrast-enhanced MDCT image show a big blood clot (*) in the cervical canal associated with a fluid component (arrowheads) and air bubbles (arrows) within the distal endometrial cavity. Images and clinical symptoms (anemia and fever) were highly suggestive for endometritis.

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Fig. 13: RPOC. Axial contrast-enhanced MDCT image shows a small area of iper-enhancement in the anterior myometrial-endometrial junction and endometrium (arrow), suspected for RCOP. A small amount of fluid collection is also presente within the endometrial cavity (*).

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Conclusion

Uncomplicated CD scar can assume different aspects on MDCT images and, unfortunately, a significant overlap between normal and abnormal postoperative findings makes image interpretation more difficult and can cause misdiagnosis.

In this setting, radiologists should get familiar with MDCT imaging after CD in order to give the gynecologist precious information for a proper treatment plan and should remember that myometrial defects and small hematomas in unusual location can be considered normal in absence of clinical signs or further MDCT imaging findings.

On the other hand, major hematomas, uterine dehiscence and rupture should alert the radiologist since, in the appropriate clinical setting, are suggestive for major complications.
References


