

Surgical technique to avoid bladder flap formation during cesarean section

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SUMMARY: Surgical technique to avoid bladder flap formation during cesarean section.

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Cesarean section (CS) is now the most common major surgical procedure performed on women worldwide. A CS can be performed by either suturing or not suturing of the visceral peritoneum. Creation of the bladder flap is an integral step of the standard cesarean section. The bladder flap is made by superficially incising and dissecting the peritoneal lining to separate the urinary bladder from the lower uterine segment. It's still debated whether the formation of bladder flap is advantageous or not. If the uterine incision is made slightly above the vesico-uterine peritoneal fold, the loose connective tissue between the uterus and the urinary bladder allows spontaneous descent of the bladder. Evidence on the role of the bladder flap in cesarean section is very limited. At present, it remains to be established whether there is any advantage in dissecting the bladder from the lower uterine segment during cesarean section.

RIASSUNTO: Tecnica chirurgica del taglio cesareo senza scollamento della plica vescicale.

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Il taglio cesareo è la pratica chirurgica intraperitoneale più diffusa nel mondo. La tecnica chirurgica del taglio cesareo presenta diverse problematiche, una di queste è la sutura o no del peritoneo viscerale. Lo scollamento e la formazione della plica vescicale costituiscono un tempo standard del taglio cesareo. La formazione della plica vescicale si ottiene con l'incisione del peritoneo viscerale e lo scollamento in basso della plica vescico-uterina. Attualmente non è ancora chiaro quali siano i vantaggi e gli svantaggi della incisione della plica vescico-uterina nel taglio cesareo. La formazione della plica vescico-uterina è possibile per lo scollamento e lo scivolamento dal connettivo sottoperitoneale. Le evidenze sul ruolo della plica vescico-uterina nel taglio cesareo sono attualmente limitate e resta da chiarire quali siano i reali vantaggi dello scollare sistematicamente la plica vescico-uterina.

KEY WORDS: Cesarean section - Bladder flap - Laparoscopy - Complications.
Taglio cesareo - Plica vescicale - Laparoscopia - Complicazioni.

Introduction

Cesarean section (CS) is now the most common major surgical procedure performed on women worldwide. In

the United States almost 25% of deliveries are by cesarean section and the rate continues to rise. Rates vary considerably between countries and health services (1-3) Global estimates indicate a caesarean section rate of 15% worldwide, ranging from 3.5% in Africa to 29.2% in Latin America and the Caribbean (4). Studies from the United States of America (5), the United Kingdom (6) and China (7) report rates between 20% and 25%. With the increasing numbers of cesarean sections, there is the need to employ evidence based techniques to optimize outcomes and minimize complications. A CS can be performed by either suturing or not suturing of the visceral peritoneum. Usually, the vesico-uterine space (VUS) can be easily dissected and sutured during surgical management of bladder flap (BF) in primary CS, because

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it is composed by submucosal tissue, with few vessels. In contrast, in the repeat CS, the post-CS adhesions and the submesothelial fibrosis modify the VUS, so the surgical management of BF is more difficult and can be complicated. This surgical decision evokes specific anatomical changes of the puerperal VUS, and result in different complications and complication rate based on this surgical decision [8]. In the CS performed without visceral peritoneum (VP) suturing, the VUS communicates with the large peritoneal cavity; thus, any spillage of fluid generated at the incision site during a CS the fluid will accumulate within the large peritoneal cavity, before the spontaneous restoring of the peritoneum in early puerperium (9).

In contrast, when VP is sutured, any retroperitoneal fluid generated in the BF does not drain into the peritoneum and may result in a bladder flap hematoma (BFH) or abscess, and if extensive, possibly, to post-CS broad-ligament edema, hematomas or abscesses (10).

However, it's still debated whether the formation of bladder flap is advantageous or not. If the uterine incision is made slightly above the vesicouterine peritoneal fold, the loose connective tissue between the uterus and the urinary bladder allows spontaneous descent of the bladder. During this process, no vascular injury occurs (11).

What is the bladder flap?

Creation of the bladder flap is an integral step of the standard cesarean section. The bladder flap is made by superficially incising and dissecting the peritoneal lining to separate the urinary bladder from the lower uterine segment. The vesico-uterine space (VUS) is the most frequent sub-peritoneal or extra-peritoneal area surgically encountered in obstetric and gynecologic surgery (12). The VUS is an anatomical virtual space between the anterior uterine wall, posterior bladder wall and laterally, the vesico-uterine ligaments and the lateral ligaments of the bladder, and continuing with broad ligament space and sub-peritoneal pelvic space; the VUS is reported in International Anatomic Nomenclature as number A 10 102 504, also called 'excavatio vesico-uterina' (13). Generally, the VUS can be easily dissected and sutured during surgical management of bladder flap (BF) in primary CS, because it is composed by submucosal areolar connective tissue, with few vessels. In contrast, in the repeat CS, the post-CS adhesions and the submesothelial fibrosis modify the VUS, so the surgical management of BF is more difficult and can be complicated (14). The VP closing frequently evokes, in early puerperium, small fluid collections in the upper part of the VUS, as evaluated by Faustin et al. (15), who reported that if these collections, the fluid-filled collections contained scatte-

red low-level internal echoes, are more than 3.5 cm of diameter, they are significantly symptomatic and more likely connected to the postoperative morbidity.

Because the US pockets generally contains edema (in prevalence), blood, clots, fibrin and tissue reaction, during the post-CS restoring period, they could interfere with the healing process, probably with a negative effect in the extra peritoneal VUS, particularly in the mesothelial and sub mesothelial recovery (14).

Probably, women who underwent serosal repair are much more likely to be diagnosed with US pockets, with more frequent complications in puerperium, and the dates of this study show that it is better to unsuturing the VP during CS, after the second stage of labor, either to prevent the closed pocket bladder formations, or to avoid the fluid collections in the VUS, favoring the healing of this extra peritoneal space. Indeed, some surgeons do not open the VUS in CS after prolonged second stage of labor, to avoid the BF formation (16-18).

The bladder flap: why?

Started in the pre-antibiotic era, the rationale for the bladder flap was to enable the surgeon gain access to the lower uterine segment while minimizing injury to the bladder (19). Its subsequent closure was supposed to protect the peritoneal cavity from intrauterine infection. Since then, closure of the bladder flap has been demonstrated to be unnecessary and has been abandoned. The bladder flap however, continues to be performed without evidence of benefit. In emergent cesarean sections where rapid delivery is the goal, the bladder flap is commonly omitted. While some older case reports suggested inadequate bladder flap reflection as a risk factor for bladder injury, it has not been corroborated (20). On the contrary, several studies have identified difficulty encountered while developing the bladder flap as a risk factor for bladder injury at cesarean section (21,22). Although uncommon, creation of the bladder flap may also be associated with complications such as bladder flap hematoma and dysuria, sometimes requiring re-operation to drain the collection or release the bladder flap (22-26). It has also been suggested that disruption of the autonomic innervations by creation of the bladder flap results in an increased incidence of urinary retention. In the long term, creation of the bladder flap may result in thick adhesions in the lower uterine segment that may lead to difficult subsequent cesarean delivery and bladder perforation (27).

Another rationale for the creation and subsequent closure of the bladder flap was to protect the peritoneal cavity from intrauterine infection. With the use of antibiotics, closure of the bladder flap has been demonstrated to be unnecessary and associated with increased morbidity

including febrile morbidity, adhesions and upward dislocation of the urinary bladder (28,29). This evidence determined the abandonment of closure of the bladder flap at cesarean section. Nonetheless, its creation has remained part of standard practice. Evidence on the role of the bladder flap in cesarean section is very limited. Recent studies challenge the common practice of creating a bladder flap in cesarean section.

What are the potential complications of bladder flap?

A possible complication after visceral peritoneal suturing during the traditional cesarean section method is the formation of a bladder-flap haematoma (BFH) since, when bleeding occurs during hysterotomy, a haematoma could develop between the bladder and the lower uterine segment, the vesico-uterine space. Bladder-flap haematoma (BFH) is a puerperal complication after cesarean section; it consists of a blood collection between the bladder and the lower uterine segment, in the vesico-uterine space, and it results from bleeding at the uterine suture.

Generally, BFH does not occur during cesarean sections performed by either the Misgaw Ladach method or the Stark technique, which are performed without peritoneal closure; since the vesico-uterine space communicates with the large peritoneal cavity any pathological fluid collections which may occur in this space as a result of uterine suture bleeding decant from the vesico-uterine space into the large peritoneal cavity, causing a haemoperitoneum (30).

In the classical cesarean section performed by Munro-Kerr method, a BFH may arise between the hysterotomy site and the lower uterine space when the haemostasis is inadequate during the hysterorrhaphy; this can be detected by ultrasound (US) as a solid area or a complex mass with clean walls and reinforcement of the distal echoes, indicating the blood collection in a potential "pocket" located between the bladder and the lower uterine space (25).

Microscopically, the BFH contains: fibrin, clots, esudate, tissue reaction or oedema, serous fluids or partial wound separation (23) and, sometimes, bacteria climbed from vagina; in this pocket, these elements could evoke a pseudo-inflammatory phenomenon that could lead to abscess (31,32).

These evidences result that this pocket could fill with blood and wound secretions from the uterine incisions and serve as nutrient media for bacteria, with a possible post-CS fever development.

Statistical evaluation confirmed the serosal repair during CS with significantly higher rate of BFHs, need for post-operative analgesia, post-operative febrile morbi-

dity and prolonged hospitalisation; moreover, the authors showed that the US evaluation in post-CS instrumental management can be a safe, cheapest and repeatable non-invasive method to study the uterine incision site, the BF and the BFH, and the literature on is rich of reports. The post-CS fluid collections in the VUS and in the incision site zone were distinguished in three echo-patterns: normally, Beker et al. (23) described an oval symmetric region of distinct echogenicity between the uterus and posterior bladder wall in uterine incision site.

Also Koutsougeras et al. (33,23) reported in their study an asymptomatic hypoechoic area, symmetric or asymmetric, with indistinct limits almost rounded, present in or adjacent to the uterine incision and distinct from the normal incision site, with a diameter of 2–3.5 cm, probably connected to a small hematomas or serous collection with not clinical significance, called asymptomatic BFH.

The BFH frequency is unknown because the post-caesarean section BFH diagnosis is confused and it is generally performed by instrumental examinations (25); arguing that post-caesarean section BFH detection can be made by ultrasound, CT and MRI, research has shown that MRI may be superior to CT in evaluating complications at the uterine incision site, because of its multiplanar capability and greater degree of soft tissue contrast (34). In the current obstetric surgical experience, the closure of the visceral peritoneum during cesarean section is associated with a major risk of post-caesarean section BFH, with febrile and infective morbidity.

It has also been suggested that disruption of the autonomic innervations by creation of the bladder flap results in an increased incidence of urinary retention. In the long term, creation of the bladder flap may result in thick adhesions in the lower uterine segment that may lead to difficult subsequent cesarean delivery and bladder perforation (27).

What does the literature tell us?

Data on the role of the bladder flap in cesarean section is very limited. Pelosi and Ortega (35) introduced elimination of the bladder dissection in CS, but these authors did not investigate this single modification (25) Wood et al. (36) compared Pelosi technique with Yale's traditional methods; they confirmed the utility of Pelosi-type CS, but they also did not investigate single modification of omission of bladder flap. Hohlag-schwandtner et al. (16) concluded that CS without the formation of a bladder flap provides a number of significant short-term benefits. But they did not evaluate long-term effects such as adhesions and fertility. Chigbu et al. (37) conclude that omission of the bladder flap

formation at CS is associated with good short- and long-term outcomes. Because the omission of the bladder flap causes less trauma and vascular injury, subsequently fewer additional hemostatic sutures are required (38). Omission of the bladder flap prevents the incision from being made too low, which prevents rupture of cervix when it is fully dilated. Bladder injuries are rare complications of cesarean but when they occur are usually caused by surgical difficulty encountered while developing the bladder flap (39). The lower rate of postoperative microhematuria in both studies (16,37) also reflects a reduced manipulation and trauma of the urinary bladder.

By an examination of the literature, Stark (40) affirms that the closing of VP possibly leads to a pocket formation on the VUS, with a subsequent hematoma formation, while Nagele et al. (41) report a higher rate of febrile morbidity and cystitis in the closed parietal peritoneum, probably due to the formation of sub-peritoneal pockets resulting from the suture; these pockets could fill with blood and wound secretions from the uterine incision and serve as nutrient media for bacteria.

Woo et al. (42) investigated the pelvis after CS and vaginal delivery by MRI and found that a BF adjacent to the low transverse uterine suture is formed by suture of the loose reflection of the peritoneum (serosa) that covers the uterus; Maldjan et al. (43) evaluated these collections by MRI in uterine incision sites, demonstrating findings consistent with asymptomatic and sub-acute hematoma, as a usual finding in post-CS women by closed visceral peritoneum.

Conversely, the VP suturing in CS leads to a closed pocket VP, site of allocation of fluid collections, in literature called BFH (44,23,25).

Data suggest to avoid the VP suturing during CS because the VUS, a virtual cavity, if it is open it rests a virtual space, if closed it becomes a pocket of edema, blood, clots, fibrin and tissue reaction, which leads to an asymptomatic or symptomatic BF, that interferes with healing process.

Only one study evaluated omission of the bladder flap as the only modification (11). This single randomized trial compared omission of the bladder flap in 53 patients to the standard technique of cesarean section in 49 patients. Results showed significant short term benefits of omitting the bladder flap including a reduction in operating time, blood loss, postoperative pain and microhematuria.

The value of this European study is limited by the exclusion of repeat cesarean sections, lack of medium and long-term outcome measures such as adhesions as well as homogeneity of the study population. It has also been argued that the time saved from omitting the bladder flap (an average of 5 minutes) is not clinically significant (45). On the other hand, 5 minutes saved for each of the 1

million cesarean sections performed annually in the United States will result in 1 million minutes (16667 hours, 694 days) of operating room time saved. Of note, this study was not designed to evaluate the effect of omitting the bladder flap on major bladder injuries (46). As the authors rightly argued, the low incidence of major bladder injuries at cesarean section (0.14-0.31%) means that a very large samples size (>40,000) would be required to demonstrate a difference (20,47). Such a study may never be done. The study was also limited to primary cesarean sections. The absence of data on omission of the bladder flap at repeat cesarean sections is particularly noteworthy. It is in these cases that adhesions in the lower uterine segment make creation of the bladder flap difficult and time consuming, with the potential for complications.

The unique other report on the effects of omitting the bladder flap at cesarean section is a West African case series of 142 patients (37). These data are of little value, given the absence of a comparison group and the unique study setting.

Malvasi et al (14) published a study on 474 women, who underwent a primary CS using the Misgav-Ladach technique, during 2004–2008. Their goal was to compare cesarean section (CS) using open or closed visceral peritoneum of the bladder flap (BF) in relation to fluid collection in vesico-uterine space (VUS) by ultrasound (US) and clinical outcome. Their results suggested that VP suturing of women requiring CS for dystocia is associated to increased rate of blood collection in the VUS, which could possibly explain the higher rate of puerperal complications in these patients. These data clearly indicate that suturing the VP of the BF in women undergoing CS for dystocia is contraindicated. These data could be probably extrapolated to all cesarean deliveries. Moreover visceral peritoneum (VP) closure resulted in significant increase blood collections in the VUS ($p < 0.0001$) and in a significantly higher morbidity in all the following parameters: rate of BFHs, postoperative fever, need for post-operative analgesia, require antibiotic administration and prolonged hospitalization ($p < 0.01$).

For surgeons convinced of the benefits of VP closure during CS, they also proposed an alternative method for VP closure during CS, named by them, “Mass Closure Method” (MCM) (48). This method is based on the direct incision, no bladder flap formation and not suturing a part of the VP, substantially to reduce the VUS surface, consequently decrease bleeding, and prevent a pouch formation.

On the basis of the author’s experiences, the MCM could represent for obstetrics a safe alternative to the surgical approach during CS, as it cut down operative time, surgical bleeding, BHF formation for the non-bladder flap formation, thus reducing the VUS surface.

What is the “mass closure method”?

Mass closure method (MCM), introduced in 2009 by Malvasi et al., might be an appropriate technique to perform the CS. In Malvasi's study all CSs are performed using the modified Joel Cohen incision in the Stark CS, with the Munro Kerr way of hysterotomy. The LUS stretches from the foetal head, and it is particularly in first dystocic CS, in advanced first stage, or in second stage repeat CS.

The surgical technique is as follows: the incision must be made 2 cm over the vesicouterine plica (VUP), directly on the VP and, simultaneously, on the myometrium, to enter in the uterine cavity for foetal extraction. This transversal hysterotomy can be performed on this site being the LUS thin and hypovascularized. Subsequently, the foetus is extracted and the placenta is removed; surgeons suture the hysterotomy with the uterus inside the abdomen.

The hysterography is performed according to the MCM, preferably utilizing Vycril n81, with curved needle n840. The anterior uterine wall of the LUS, at site of hysterotomy, is sutured by a monolayer simple suture including the incised myometrium together with decidua and VP. No case of BFH was recorded, but only hyperchogenic areas in the vesicouterine space (VUS), to be ascribed to the intra-operatives stitches. In literature, in fact, there is evidence of the BFHs occurring in women with bladder flap formation and VP suturing.

The direct incision, no bladder flap formation and not suturing a part of the VP, substantially reduce the VUS surface, consequently decrease bleeding, and prevent a pouch formation. All the above may lead to a blood-filled BFH, with wound secretions at the hysterotomy site, nutrient media for bacteria that could turn into an on-site infection.

The peritoneum suturing by MCM, during author's CS, is similar to the corneal transplant, because ophthalmologist suture corneal epithelium with the same method; this can be explained by basic biology: corneal epithelium is a non keratinized pluristratified epithelium, whereas peritoneum is a non-keratinized mono-stratified epithelium (48). On the basis of the author's experiences, to avoid CS complications (49), the MCM could represent for obstetrics a safe alternative to the surgical approach during CS, as it cut down operative time, surgical bleeding, BHF formation for the non-bladder flap formation, thus reducing the VUS surface.

Conclusion

At present, it remains to be established if there is any advantage in dissecting the bladder from the lower uterine segment during cesarean section. The paucity of evidence for this commonly utilized technique in cesarean section calls for a well designed randomized trial to provide evidence for clinic practice. With the increasing numbers of cesarean deliveries, eliminating unnecessary and potentially harmful steps will reduce morbidity, improve outcomes and save costs. We hypothesize that omission of the bladder flap in both primary and repeat cesarean sections would be associated with shorter operating time without a significant increase in intraoperative and postoperative complications. A new randomized controlled trial registered as “NCT00918996”, called “The Bladder Flap at Cesarean Section: A Randomized Controlled Trial” is currently recruiting participants and estimated study completion date will be available in June 2011. The goal of this study is to employ a well designed randomized controlled clinical trial to evaluate the effects of avoiding the bladder flap creation at cesarean section.

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