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An Overview on Urinary bladder Injuries during Cesarean Section

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Abstract:

Cesarean section is the most common surgery performed in the United States with over 30% of deliveries occurring via this route. This number is likely to increase given decreasing rates of vaginal birth after cesarean section (VBAC) and primary cesarean delivery on maternal request, which carries the inherent risk for intraoperative complications. Urologic injury is the most common injury at the time of either obstetric or gynecologic surgery, with the bladder being the most frequent organ damaged. Risk factors for bladder injury during cesarean section include previous cesarean delivery, adhesions, emergent cesarean delivery, and cesarean section performed at the time of the second stage of labor. Fortunately, most bladder injuries are recognized at the time of surgery, which is important, as quick recognition and repair are associated with a significant reduction in patient mortality. Although cesarean delivery is a cornerstone of obstetrics, there is a paucity of data in the literature either supporting or refuting specific techniques that are performed today. There is evidence to support double-layer closure of the hysterotomy, the routine use of adhesive barriers, and performing a Pfannenstiel skin incision versus a vertical midline subumbilical incision to decrease the risk for bladder injury during cesarean section. There is also no evidence that supports the creation of a bladder flap, although routinely performed during cesarean section, as a method to reduce the risk of bladder injury.

Keywords: Urinary bladder Injuries, Cesarean Section, Adhesions.

Introduction:

The bladder is a subperitoneal, hollow muscular organ that acts as a reservoir for urine. The bladder is located in the lesser pelvis when empty and extends into the abdominal cavity when full. In children, the bladder is located in the abdomen and does not completely descend into the pelvis until puberty. The bladder is a distensible organ and is typically able to hold up to 500 milliliters of urine **(1).**

The bladder is flat when empty and globular when distended. The superior surface and upper 1 or 2 cm of the posterior aspect of the bladder are covered by peritoneum, which sweeps off the bladder into the vesicouterine pouch. The anterior bladder is extraperitoneal and adjacent to the retropubic space (space of Retzius). Between the bladder and pubic bones lie adipose tissue, pubovesical ligaments and muscle, and a prominent venous plexus. The bladder rests inferiorly on the anterior vagina and lower uterine segment, separated by an envelope of adventitia (endopelvic fascia) **(2).**

The epithelium lining the bladder lumen is loosely attached to the underlying musculature, except at the trigone, where it is firmly adherent. The bladder lining consists of transitional epithelium (urothelium)

supported by a layer of loose connective tissue, the lamina propria. The internal surface of the bladder has a rugose appearance formed by mucosal folds in the contracted state. In the distended state, a variably prominent mesh-like appearance is formed by mucosa-covered detrusor musculature **(2).**

The bladder wall musculature is often described as having three layers: inner longitudinal, middle circular, and outer longitudinal. However, this layering occurs only at the bladder neck; the remainder of the bladder musculature is composed of fibers that run in many directions, both within and between layers. This plexiform arrangement of detrusor muscle bundles is ideally suited to reduce all dimensions of the bladder lumen on contraction **(2).**

Embryology:

The bladder is mostly a mesodermal organ but does contain some endoderm as well. Between weeks 4 to 7 of fetal development, the cloaca divides into the urogenital sinus ventrally, and the anal canal dorsally. The urogenital sinus is continuous with the allantois anteriorly. The base of the allantois expands and develops into the bladder while its anterior portion gives rise to the urachus. The urachus later develops into a fibrous cord, the median umbilical ligament **(3).**

Through mechanisms not clearly explained, the mesonephric ducts and ureteric buds connect to the posterior bladder wall and form a part of the trigone. The mesonephric ducts also migrate ventrally and come together to give rise to the urethra **(3).**

Function:

As stated above, the function of the bladder is to store the urine and then aid in its expulsion at a time deemed advantageous by the organism. The long-held belief has been that upon delivery to the bladder, urine will be excreted essentially unchanged in composition. However, new research is challenging this traditional view, and now there is evidence that the bladder epithelium can modulate the amount of both water and solutes that are ultimately present upon urination **(4).**

Bladder capacity changes throughout one's life. In children, an approximation of bladder volume can be calculated with the formula: (years of age + 2) x 30 ML. By adulthood, the average volume that a functional bladder can comfortably hold is between 300 and 400 ML. As the volume of urine held by the bladder increases, so too does the pressure therein. Wall pressure of 5 to 15 mm Hg creates a sensation of bladder fullness while 30 mm Hg and beyond is painful. The sensation of increasing bladder fullness is conveyed to the spinal cord via the pudendal and hypogastric nerves on both A-delta and C nerve fibers. "The A-delta fibers respond to passive distension and active contraction and thus convey information about bladder filling. The C-fibers are insensitive to bladder filling under physiological conditions and respond primarily to noxious stimuli such as chemical irritation or cooling" **(4).**

Iatrogenic bladder injury:

Most of the bladder injuries during cesarean section are intraperitoneal injury and usually it occurs at the dome of the bladder, more than 6 cm—and often more than 10 cm—away from the trigone **(5)**. Iatrogenic bladder injury can be classified as follows **(6):**

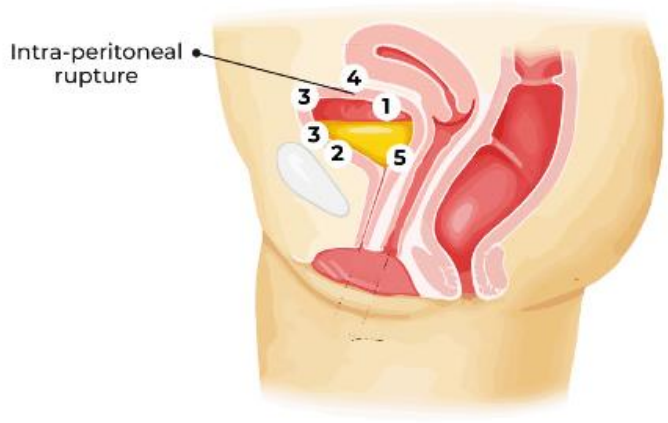
Grade 1: contusion, intramural hematoma or partial thickness laceration.

Grade 2: extraperitoneal bladder wall laceration <2 cm.

Grade 3: extraperitoneal >2 cm or intraperitoneal <2 cm laceration.

Grade 4: intraperitoneal bladder wall laceration >2 cm.

Grade 5: intra- or extraperitoneal bladder wall laceration involving the trigone or bladder neck.



Grade 1	Contusion, intramural hematoma, or partial thickness laceration
Grade 2	Extraperitoneal bladder wall laceration < 2 cm
Grade 3	Extraperitoneal > 2 cm or intraperitoneal < 2 cm
Grade 4	Intraperitoneal bladder wall laceration > 2 cm
Grade 5	Intra- or extraperitoneal bladder wall laceration involving the trigone or bladder neck

Figure 1: Basic bladder anatomy *(7)*

The involvement of the posterior area of bladder may raise the suspicion of trigonal and ureteral involvement. Grade 5 injury warrants calling the urologist or urogynecologist **(6).**

Diagnosis of bladder injury:

While operating on the patients, it would be prudent to look for any injuries during and at the end of the operation. Usually, urine dribbles out in the operative field. If there is no leaking of urine but there is a doubt about injury, then the color of urine should be observed. Hematuria might occur in 95% cases **(8).** Foley's bulb may become visible in the operative field. If there is a doubt of injury, it can be confirmed by instillation of dye (methylene blue/trypan blue etc.) or sterile milk through transurethral catheter into the urinary bladder and observing the colored leak. If necessary, cystoscopy, ureteric catheterization, or indigo carmine intravenous administration should be done. IV indigo carmine 10–15 minutes prior to cystoscopy reveals efflux of dye-stained urine from the ureters. In the absence of cystoscope, hysteroscope can be used **(9).**

Management:

Once diagnosed, bladder injuries are managed depending on their location (intraperitoneal or extraperitoneal). The majority of intraperitoneal injuries require immediate operative repair to prevent the development of sepsis. The occasional small intraperitoneal injury without resultant sepsis or ileus may be managed with conservative, nonoperative treatment. The standard repair is a two-layer closure including the mucosa with absorbable suture material. On the other hand, extraperitoneal injuries are often treated conservatively by decompression of the bladder with a Foley catheter and observation. However, if other associated injuries require operative repair, it is reasonable to repair an extraperitoneal bladder injury at the same time **(10)**.

Prevention of bladder injury:

Best practices for injury prevention include using sharp, rather than blunt, dissection, backfilling the bladder, and cephalad traction on a uterine manipulator. Sharp dissection rather than blunt tearing of tissues

avoids distortion of anatomic planes. Ensuring that the bladder is drained can reduce injury during a cesarean delivery. Retrograde filling of the bladder with either normal saline or sterile milk during laparoscopic or vaginal hysterectomy can more clearly delineate the borders of the bladder. The dissection of the vesicouterine peritoneum and cephalad traction on a uterine manipulator help mobilize the bladder away from the uterine arteries, allowing ligation to be accomplished safely. Lastly, electrosurgical energy should be cautiously used around the bladder because thermal spread can lead to delayed injury **(7).**

Postoperative period:

The closed suction drain usually dries within 48–72 hours by which time it can be removed. Indwelling transurethral and SPC catheters are kept for at least 10 to 14 days. In dual catheter insertion, the SPC catheter is clamped on day 10 and is removed on day 12. The transurethral catheter is removed on day 14 **(11)**.

Barbieri (5) in his editorial has stated that the catheter should be kept for a minimum of 7 days. Urine should be tested for culture and sensitivity every third day when the patient is on prolonged catheterization.

caesarean section & urinary bladder injury:

The urinary bladder injury is a rare but important complication of caesarean section (C-section). The decreasing trend of vaginal birth after C-section has led to an increased number of women with multiple C-sections **(12).** Bladder injury has been reported to occur in 0.08% - 0.94% of cesarean sections **(13).** After caesarean delivery, adhesions may develop between bladder and uterus (24.4–73%) which cause difficulty in identification and dissection of the bladder flap during the next operative delivery **(14, 15).**

Pfannenstiel's techniques (JoelCohen and Misgav-Ladach) seem to be safer for opening the peritoneum than "blunt" methods (Joel-Cohen and Misgav-Ladach) especially during repeated cesarean section. A first CS tends to damage the dome of the bladder (76.2%), whereas a repeated cesarean section tends to damage the body of the bladder and the trigone **(16).** Most of the bladder is injured in between 28.6% and 46.6% of cases when the peritoneum is opened, and in one large study, 41.4% occurred after the first CS and 58.6% after the second **(17).**

Bladder injury has serious physical, social and psychological implications **(18).** The injury leads to prolonged operative time, urinary tract infection (UTI), micturition problems and prolonged catheterization **(15).** A long complicated hospital stay creates an intense feeling of helplessness and anxiety **(18).** Moreover, unrecognized bladder perforation is a leading cause of morbidity due to the development of urinary ascites, peritonitis, and fistula formation **(19).**

Urinary bladder adhesions are the main risk factor for urinary bladder injury. The incidence of urinary bladder adhesions increases with each subsequent cesarean section **(20)**. The routine practice of preoperative insertion of urinary catheter improves visualization in the operative field but fails to prevent bladder injury in dense adhesions. One of the expected values of use of Foley’s catheter is to deflate the bladder, which may prevent bladder injury at time of entry and allow retraction of the bladder after its separation by its dissection from the lower uterine segment. However, in many studies’ literature had found that cesarean section without bladder deflation is safe **(21, 22).**

During the surgery, the bladder will fill spontaneously without an indwelling Foley's catheter. It may be perceived as safe to fill the bladder intentionally rather than spontaneously based on extrapolation. Clinical trials are being conducted to test this extrapolation. In cases of tough adhesions between the bladder and lower uterine segment, urinary bladder injuries can result. In such circumstances, separating the bladder may cause injury to the bladder. Filling the bladder can help in defining the bladder's contour and determining the best dissection plane **(20).**

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