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Original Research Article

Surgical Management of Unintentional Transvesical Caesarean Section: A study at a Tertiary Care Teaching Hospital (RIMS), Adilabad

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Abstract:

Background: Iatrogenic bladder injury is a very rare occurrence in obstetric and gynecologic surgeries. There is limited data available pertaining to the optimal duration for transurethral catheterization post-injury, suture methodologies involving suture selection, and the potential complications involved. The objective is to evaluate the frequency, factors contributing to risk, treatment approaches, as well as the immediate and extended consequences of inadvertent transvesical cesarean section (UTV-CS).

Methods: This case-control study was carried out in the Departments of General Surgery and Obstetrics and Gynecology, Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad. The prevalence was determined based on the total number of CS procedures conducted at the center during the study's timeframe from Jan 2019 to May 2023. The diagnoses of UTV-CS were verified through a manual examination of all charts and surgical procedure descriptions. Instances of bladder wall injury without UTV-CS were not considered.

Results: A total of 26,236 deliveries took place between Jan 2019 to May 2023, with 11,785 cesarean sections (CSs) performed, accounting for 44.92% of the total deliveries. Instances of bladder injury without a ureterovesical-transection cesarean section (UTV-CS) were excluded from the analysis. Four CSs presented complications in the form of extensive bladder injuries, leading to unintentional fetal extraction through the bladder. The overall incidence of UTV-CS was found to be 0.0339%, which translates to 1 in every 2,947 CS procedures.

Conclusion: The incidence of bladder injury during cesarean sections is low, it should always be considered as a potential complication. This study represents the first attempt to evaluate the incidence of UTV-CS, which might indicate a reluctance among obstetricians to report severe bladder injuries associated with cesarean sections. The risk factors identified for UTV-CS appear to be in line with factors generally associated with bladder injuries. However, due to the limited number of UTV-CS cases, a comprehensive evaluation of related risk factors in comparison to milder bladder injuries could not be carried out, and the conclusions are constrained by the scarcity of cases.

Keywords: Bladder injury, Caesarean section, Transvesical cesarean section, Obstetrics complications

Introduction

Iatrogenic injuries to the bladder are a recognized and rare complication of gynecological and obstetric surgeries, stemming from the close anatomical relationship between the female internal genitalia and urinary tract organs. Injuries to the urinary tract and bladder can manifest during surgical procedures involving the abdominal and/or pelvic cavities, encompassing gynecological, general, and urological surgeries. Hysterectomy and cesarean section (CS) stand as the foremost and second most prevalent causes, respectively. This is due to the substantial frequency of these procedures. [1, 2] While bladder injury during CS is relatively uncommon, it does occur and has reported incidences ranging from 0.016% to 0.94%. [3, 4] Various factors have been identified as risks for bladder injury during CS, including the presence of adhesions, repeated CS procedures, urgent CS, and attempts at vaginal birth after previous CS. [3-5] Notably, prior CS and the presence of peritoneal adhesions stand out as the principal risk factors for bladder injury, each independently associated with a 5.0- and 10.0-fold heightened risk, respectively, even after accounting for other influencing factors. [4] Furthermore, bladder injuries can manifest at different stages of the CS procedure: during the peritoneal cavity's initial opening, the creation of the bladder flap, the hysterotomy or its extensions, and in rare cases, during uterine suturing. [5, 6]

The frequency of bladder injuries varies depending on the specific surgical procedures and approaches utilized. A comprehensive review conducted by

Wong et al. in 2018 revealed a bladder injury incidence of 0.24% during Gynecologic laparoscopy for non-malignant reasons. [7] Separate investigations have cited an occurrence rate of 0.44% during cesarean sections and 1.54% during hysterectomies for benign conditions. [8, 9] Various factors, including previous abdominal or pelvic surgeries, adhesions, endometriosis, and urinary tract irregularities, contribute to an elevated likelihood of unintended bladder injury during surgery. [6, 7, 10] The consequences of injuries to the lower urinary tract, including the bladder, are associated with heightened morbidity. These complications encompass the formation of fistulas, infections, and even renal failure. Moreover, there exists a substantial probability of subsequent surgical intervention (approximately 60%) following damage to the urogenital system. Such injuries impact hospitalization durations and overall quality of life. [1, 11] This study aims to assess the incidence of complications stemming from the repair of iatrogenic bladder injuries, in addition to detailing suture techniques and identifying the most appropriate suture choices.

Material and Methods

This case-control study was carried out in the Departments of General Surgery and Obstetrics and Gynecology, Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad from the year Jan 2019 to May 2023. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in vernacular language.

The study's primary objective was to establish the prevalence of UTV-CS in pregnant women undergoing CS. This prevalence was determined based on the total number of CS procedures conducted at the center during the study's timeframe from Jan 2019 to June 2023. The diagnoses of UTV-CS were verified through a manual examination of all charts and surgical procedure descriptions. Instances of bladder wall injury without UTV-CS were not considered. Information concerning maternal history, demographic characteristics, obstetric parameters, cesarean section (CS) specifics, bladder injury details including location and extent, and the surgical technique employed were gathered. Patients who underwent minor procedures such as EUA (examination under anesthesia), D&C (dilation and curettage), and wound debridement were excluded from the study. Short-term outcomes encompassed the duration of catheterization, cystography outcomes (if conducted), instances of fever, and/or the requirement for a secondary operation before maternal discharge. Long-term outcomes pertained to the eventual bladder function.

Statistical analysis: The data was collected and uploaded on an MS Excel spreadsheet and analyzed by SPSS version 22 (Chicago, IL, USA). Quantitative variables were expressed on mean and standard deviations and qualitative variables were expressed in proportions and percentages. Fisher's exact test has been used to find the difference between two proportions.

Results

Throughout the study period conducted at our hospital, a total of 26,236 deliveries took place between Jan 2019 to May 2023, with 11,785 cesarean sections (CSs) performed, accounting for 44.92% of the total deliveries. Instances of bladder injury without a ureterovesical-transection cesarean section (UTV-CS) were excluded from the analysis. Four CSs presented complications in the form of extensive bladder injuries, leading to unintentional fetal extraction through the bladder. The overall incidence of UTV-CS was found to be 0.0339%, which translates to 1 in every 2,947 CS procedures. The limited number of cases prevented the execution of a statistical analysis of potential risk factors. Further details and both short-term and long-term outcomes of these cases can be found in Tables 1 through 3.

Table 1: Depicting the patient and pregnancy characteristics in the study

Case	Age	Gestational age in weeks	Gravity and parity	No of previous CS	Pregnancy	Admission	Surgical history	Medical History
1	30	38	G2P1	1	Uneventful	Obstructed labour	Nil	Nil
2	32	38	G3P2	2	Uneventful	With labor Pains	Nil	Nil
3	30	37	G3P2	2	Pre-eclampsia	Pre-eclamp-sia	Nil	Nil
4	31	37	G2P2	2	Uneventful	PROM	Nil	Nil

Table 2: Showing the characteristics of labor and cesarean section

Case	Labor	Elective / urgent	CS Indication	Peritoneal cavity	Bladder flap creation	Fetal weight/ outcome	Fetal presentation	Main risk factor
1	Spontaneous	urgent	Obstructed	Extensive adhesions between the bladder and uterus	Yes	3.0	Cephalic	None
2	Spontaneous	urgent		Bladder attached with uterus anterior wall covering and lower segment	Yes	2.9	Cephalic	Previous CS + second stage labor
3	Spontaneous	urgent	Severe Pre-eclampsia	Severe peritoneal adhesions up to the anterior wall of the uterus	No	3.1	Cephalic	Previous CS + second stage labor
4	No	urgent	PROM	Fixed adhesion between the bladder and uterus	Yes	2.8	Cephalic	Previous CS + second stage labor

Table 3: Attributes related to cesarean section, bladder injury, treatment approaches, as well as immediate and long-term consequences.

Case	CS step of the injury	Time of injury identification	Mode of injury identification	Bladder injury extension	Surgeon experience	Time of Foley removal	Timing of cystography	Short-term outcome	Long term outcome
1	Hysterectomy	After fetus extraction	Foley Balloon identification	10 cm	> 200	6 weeks P. O	6 weeks	Uneventful	Good bladder function
2	Hysterectomy	After fetus extraction	Foley Balloon identification	8 cm	> 100	6 weeks P. O	6 weeks	Uneventful	Good bladder function
3	Hysterectomy	After fetus extraction	Foley Balloon identification	10 cm	> 150	6 weeks P. O	6 weeks	Uneventful	Good bladder function
4	Hysterectomy	After fetus extraction	Foley Balloon identification	10 cm	> 450	6 weeks P. O	6 weeks	uneventful	Good bladder function

The surgical procedure and postoperative care employed in the four cases managed at our hospital involved the following steps:

1. Iatrogenic bladder injury was identified after fetal extraction but before uterine repair using visual inspection and identification of a Foley urinary catheter. To rule out injuries affecting the bladder trigone or the distal and intramural ureteral portions, we used intravenous dyes, such as indigo carmine or methylene blue, and/or retrograde ureteral catheterization with a Bracci catheter (6/8 Ch). Additionally, we conducted a urethral inspection following Foley catheter placement. If the injury involved the bladder trigone, ureters, and/or urethra, we recommended a multidisciplinary approach involving a urologist. [12]
2. The second step involved dissecting the posterior bladder wall and anterior wall of the lower uterine segment, extending caudally to the level of the bladder trigone and cervix. We separated the posterior bladder wall from the uterine wall as needed to expose the posterior cystotomy edge, ensuring tension-free repair (Fig. 1). This step also allows for exposure of the uterine incision, facilitating uterine repair using standard techniques (third step).

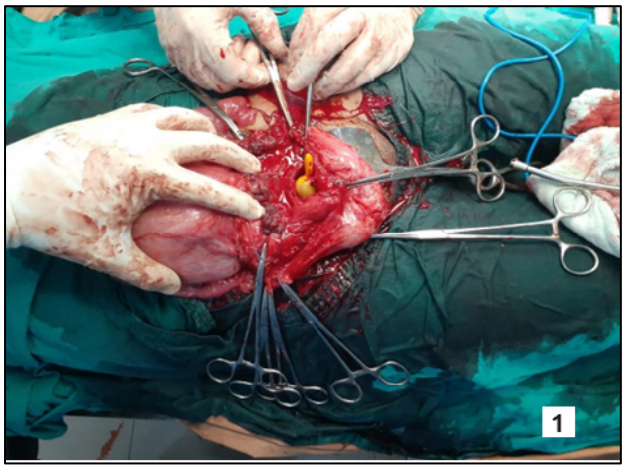

Figure 1: Showing Foley's catheter in the bladder and separation of bladder from the anterior wall of uterus.

The fourth step involves bladder repair. Both the anterior and posterior bladder walls were closed in two–three layers using 3-0 and 4-0 delayed-absorbable and absorbable sutures. The mucosal layer was closed with continuous sutures. The submucosal and muscular layers were sutured with either continuous or interrupted stitches, with inversion of the mucosal layer. The posterior wall was closed first, with submucosal and muscular layers sutured extravesically using a 2-0 delayed-absorbable suture (see Fig. 3), followed by suturing of the bladder mucosa intravesically using a 3-0 absorbable suture (see Fig. 2). Subsequently, the anterior wall was sutured, beginning with the mucosal layer and then the submucosal and muscular layers. After bladder repair, we confirmed bladder integrity by retrograde dye instillation through a Foley catheter. Continuous unobstructed bladder drainage was maintained for 10 - 15 days. To exclude urinary retention, we measured the residual urine volume after discontinuing Foley catheter drainage and performed cystography before catheter removal, considering this type of bladder injury with the involvement of both the anterior and posterior walls. These techniques aim to provide vascularized margins for bladder wounds, facilitating rapid and complication-free healing. [13]

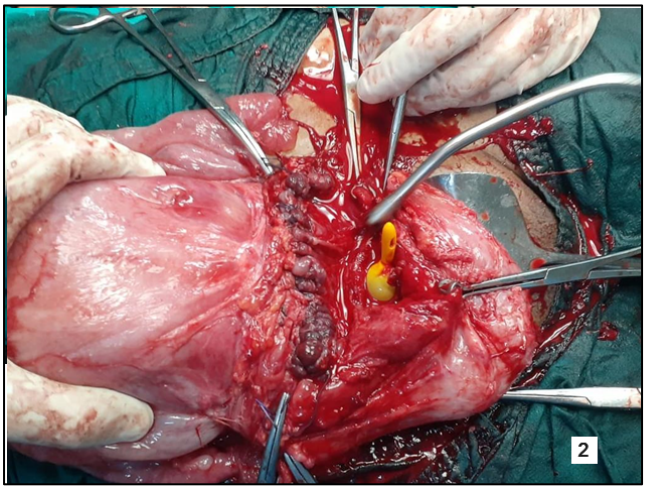

Figure 2: Showing the closure of uterine incision in 2 layers and closure of posterior wall of the bladder

In all cases, antibiotic prophylaxis was administered at the start of surgery following the routine management of cesarean sections. Antibiotic prophylaxis was repeated based on the duration of surgery and additional antibiotic prophylaxis was not administered, although it is recommended in cases of fever or urinary symptoms.

Discussion

The close anatomical proximity of the female genital and urinary systems increases the risk of potential urinary system injuries during surgical procedures. [6 of 1068] Injury to the urinary tract is a frequent complication in obstetric and gynecologic surgeries. [14] The occurrence of urinary tract injuries has been documented in medical literature as far back as 1030 AD in a work known as "Al-Kanoun." The global incidence of such injury ranges from 0.5% to 1.5% [15], with a Nigerian study reporting an incidence of 0.4%. [16] Montz et al. [17] documented bladder injuries occurring at a rate of 0.5% to 1%. In cases of prior cesarean sections, this dissection becomes challenging due to scarring, heightening the susceptibility to bladder injury. In such situations, the application of upward traction on the vesico-cervical fascia can render the dissection between the bladder and uterus safer. Bladder

injuries may become apparent through signs such as urine leakage from the vagina or surgical wound, the presence of blood in the urine (haematuria), and the detection of significant cystostomies (large openings in the bladder). Smaller tears can be identified by instilling a mixture of methylene blue and saline into the bladder. [18] It is indisputable that performing primary bladder repair during the operation yields outstanding outcomes.

The overall incidence of UTV-CS in this study was found to be 0.0339%, which translates to 1 in every 2,947 CS procedures. While the extent of bladder trauma varied, timely diagnosis and effective surgical repair ensured the restoration of normal urological function in all the cases described. The identified risk factors appear to align with factors associated with less severe bladder injuries. Various research studies have explored the occurrence and risk factors associated with bladder injuries during cesarean sections (CS). [6] However, in most of these studies, bladder injury was typically defined as any full-thickness defect of the bladder requiring surgical repair or had a less specific definition [3–7], and the classification according to AAST-OIS (American Association for the Surgery of Trauma Organ Injury Scale) for bladder injuries was seldom employed. [1, 19] In our retrospective study, we specifically investigated grade IV and V bladder injuries in accordance with AAST-OIS criteria. These injuries are exemplified by UTV-CS, characterized by the extraction of the fetus through a double full-thickness bladder wall cystotomy. Intentional TV-CS has been documented as necessary in instances of prior major genitourinary tract reconstruction, primarily due to the challenging exposure of the lower uterine segment resulting from the altered bladder position. [20] In contrast, TV-CS can also occur inadvertently and unintentionally, with only a limited number of such cases having been previously described. [20, 21] In our study, the incidence of UTV-CS within cesarean sections was found to be 0.0339%. Rahman et al. [5] reported two bladder injuries occurring during uterine incisions, which were discovered after fetal extraction, with an incidence of 0.025%. Furthermore, Phipps et al. and Gungorduk et al. reported five and twenty-four bladder injuries, respectively, occurring either during uterine incision or delivery, with incidences of 0.033% and 0.042%, respectively. [3, 4] Although not all of these cases could be classified as UTV-CS, and some cases could not be ruled out, the calculated incidences align with our study's findings.

Previous cesarean sections with a high attachment of the bladder to the uterus, multiple int4ra peritoneal adhesions, and poor availability of transport facilities in rural areas to tertiary hospitals leading to patients presenting with obstructed labor were the important causes in our study. [3–6] Furthermore, any condition making difficult to delineate the bladder from the lower uterine segment raises bladder injury risk, as well as peritoneal adhesion, CS during the second stage of labor, endometriosis, presence of large fibroids, previous irradiation, and congenital and acquired abnormalities of the urogenital system. [22] In all the cases of UTV-CS reported, risk factors related to bladder malposition and adhesion between the bladder and anterior uterine wall were present. Furthermore, any condition making it difficult to delineate the bladder from the lower uterine segment increases bladder injury risk, as well as peritoneal adhesion, CS during the second stage of labor, endometriosis, presence of large fibroids, previous irradiation, and congenital and acquired abnormalities of the urogenital system. [22] In all the cases of UTV-CS reported, risk factors related to bladder malposition and adhesion between the bladder and anterior uterine wall were present. Indications for identifying bladder injury include the presence of urine outside the bladder, the visual observation of a Foley catheter, the presence of hematuria in the Foley catheter bag, and the detection of visible wounds or mucous membrane lesions on the bladder. In cases of uncertainty, intravesical instillation of dye through the Foley catheter serves as a valuable selective intraoperative aid. [4, 5] Additionally, injuries to the bladder and ureters should be classified using the AAST-OIS grading system and managed based on the extent and type of injury, as outlined in the surgical technique for UTV-CS. [19] Cystography was conducted for all cases. Although the role of cystography in evaluating bladder function after bladder injury repair remains a topic of debate, we routinely perform and recommend it before catheter removal. [23]

In the cases reported, antibiotic prophylaxis at the beginning of surgery followed the standard practice for cesarean sections, which involved a combination of penicillin and beta-lactamases. This prophylaxis was repeated as necessary, depending on the duration of the surgery. Common alternative antibiotics include cephalosporins and clindamycin. Regarding the use of prophylactic antibiotic therapy during the 10-15 days of Foley catheter placement, there is insufficient evidence to support it as an effective strategy for reducing post-operative complications, especially when the bladder injury is promptly detected and repaired [19, 22] Generally, while urinary tract infection is the most frequent postoperative complication, in these cases, antibiotic therapy was administered only in response to the presence of fever or urinary symptoms.

Conclusion

The incidence of bladder injury during cesarean sections is low, it should always be considered as a potential complication. This study represents the first attempt to evaluate the incidence of UTV-CS, which might indicate a reluctance among obstetricians to report severe bladder injuries associated with cesarean sections. The risk factors

identified for UTV-CS appear to be in line with factors generally associated with bladder injuries. However, due to the limited number of UTV-CS cases, a comprehensive evaluation of related risk factors in comparison to milder bladder injuries could not be carried out, and the conclusions are constrained by the scarcity of cases. Nonetheless, it is crucial to emphasize the importance of conducting a thorough risk assessment for bladder injury both before and during surgery. Recognizing this complication promptly is of utmost significance. After delivery, the integrity of the bladder and lower uterine segment should be examined in all cases at risk. In smaller healthcare facilities where the surgical expertise or multidisciplinary approach may be lacking, patients with recognized risk factors may need to be referred to a specialized center for elective cesarean delivery. Even in cases of UTV-CS, appropriate procedures during surgery and in the postoperative period appear to prevent severe complications and facilitate the restoration of normal urological function.

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