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IATROGENIC BLADDER INJURY IN A MIDLINE LAPAROTOMY- A RARE UNEXPECTED COMPLICATION IN A COVID POSITIVE PATIENT

Surgery

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ABSTRACT

Urinary bladder is the most frequently injured organ during pelvic surgery, most often in obstetric or gynaecological procedures. Bladder rupture can be classified as extraperitoneal or intraperitoneal. Approximately 60% of bladder injuries are extraperitoneal, 30% are intraperitoneal, and the remaining 10% are both extra and intraperitoneal. Most cases of extraperitoneal rupture are managed with non- operative management with bladder drainage via catheter followed by a cystogram to confirm healing of the injury. Intraperitoneal rupture requires surgical management through open or laparoscopic approach. Here we are presenting a case of an iatrogenic intraperitoneal bladder rupture secondary to an emergency laparotomy done in a COVID Positive patient. The signs of bladder rupture was seen on the postoperative day 3 and the patient underwent a relaparotomy for bladder repair.

KEYWORDS

Extraperitoneal, Intraperitoneal, bladder rupture, iatrogenic

INTRODUCTION

Urinary bladder rupture is a relatively rare condition which most commonly occurs due to abdominal and/or pelvic trauma but may be spontaneous or iatrogenic in association with surgical or endoscopic procedures. Anatomically, the bladder is well protected within the bony pelvis. Hence majority of bladder injuries occur in association with pelvic fractures, especially those involving the pubic rami. The most common symptoms in any form of bladder rupture is pelvic pain and gross hematuria.

Iatrogenic Injuries result from a variety of procedures, most commonly, cystoscopy, laparoscopy, and vaginal or open pelvic and abdominal operations. The probability of bladder injury varies according to the degree of bladder distention; therefore, a full bladder is more likely to become injured than an empty one.

The incidence of bladder injuries associated with blunt abdominal trauma is about 1.6%. Approximately 60% of bladder injuries are extraperitoneal, 30% are intraperitoneal, and the remaining 10% are both extra and intraperitoneal.

Here we are presenting a case of bladder injury which occurred during a midline laparotomy done in a covid positive patient with appendicular perforation presented 4 days after the onset of symptoms with signs of generalised peritonitis .The patient had an indwelling foleys catheter inserted preoperatively and draining urine. The patient was diagnosed with bladder trauma when urine started to ooze out from the laparotomy wound after catheter removal on post op day 3. The patient was taken up for re-laparotomy and bladder wall repair was done.

Case Report

A 24 year old male patient, a diagnosed case of covid 19 presented with abdominal pain of 4 days duration and diagnosed with peritonitis mostly due to a perforated appendix. The patient was taken up for Emergency Exploratory Laparotomy under General Anaesthesia with due consent and covid protocols in covid OT. Patient had a nasogastric tube and Foley's Catheter inserted preoperatively and it was draining clear urine. Patient had a midline laparotomy with incision extending from 3 cm above the umbilicus to 4cm above pubic symphysis. Appendicular perforation was confirmed and patient underwent appendicectomy with peritoneal lavage. Rest of the abdominal viscera were normal . Abdomen was closed with No.1 Loop Ethilon in one layer and skin with 2-0 Ethilon.

Patient was shifted to covid ward . Postop day 1 was uneventful except for a reddish tinge in the urine. Catheter was removed on postop day 2. Since patient did not pass urine for more than 12 hrs post catheter removal, he was recatheterised. Patient had also complained of pain around the suture line.Urine was reddish when catheter was reinserted. Clear fluid was coming out of the suture line as shown in *Fig1*. It was confirmed to be urine by Fluid Creatinine levels being 42.1mg/dl.

Fig1- Urine coming out through the suture line

Contrast enhanced CT Abdomen was done with intravesical injection of the radioopaque dye through the perurethral catheter. It showed extravasation of dye from the bladder in to the peritoneum and flowing out through the anterior abdomen wall into the stoma bag placed at the site of the wound dehiscence as shown in Fig2.

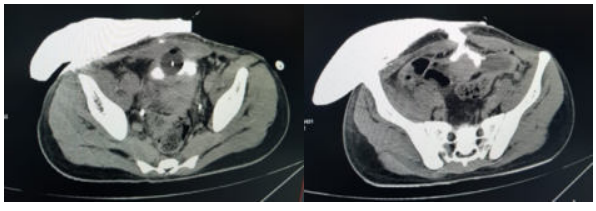

Fig2- CT image showing Foley's bulb inside bladder(red arrow) and extravasation of contrast through anterior abdomen wall into the urobag outside

Patient was taken up for relaparotomy and exploration through the same midline incision which was extended to pubic symphysis. A single 2x2cm vertical full thickness injury was found on the dome of the urinary bladder as shown in *Fig3*. No other injuries to the ureter and prostate found.

Fig3- Single 2x2 cm tear found on the dome of the urinary bladder.

The bladder tear was sutured in 2 layers with Vicryl sutures. A suprapubic cystostomy was done and brought out lateral to the skin incision on the right side. A perurethral indwelling catheter was also kept and intraperitoneal drain placed in pelvis. Abdomen was closed in layers. Postop period was uneventful.

Intraperitoneal drain was removed on postop day 3. Antibiotic and analgesic were given.patient had an uneventful recovery.

After 2 weeks repeat nasopharyngeal swab for COVID-19 was found NEGATIVE. The surgical wound was normal, the previous urine leak site showed minimal wound gaping and scanty discharge as shown in *Fig4.*

Fig4- Wound site showing minimal gaping and scanty discharge with SPC catheter lateral to the wound

Suprapubic Cystostomy was removed after 3 weeks with perurethral catheter being kept for 1 more week and was removed. Currently the patient is voiding clear urine freely with no symptoms of dysuria, hematuria or pyuria.

DISCUSSION

Bladder injuries can be classified etiologically as external, iatrogenic, or spontaneous[1]. Extraperitoneal rupture occurs in approximately 60-65% of cases, and IPR in 25%[2]. Over 80% of patients with bladder rupture also have pelvic fracture, bowel injury, or intraperitoneal solid organ injury[3]. The most superior aspect (dome) of the bladder is closely related to the peritoneum and anchored by the urachus to the anterior abdominal wall. During filling, the dome of the bladder expands superiorly and its muscle fibres are progressively stretched with urinary filling. If there is a sudden compression by a blunt force on a maximally filled bladder, an isolated intraperitoneal bladder rupture can occur. By contrast, extraperitoneal injury is usually associated with the posterior bladder wall and fibrous attachments, including the pubovesical ligament, puboprostatic fascia in men, superior fascia, and inferior fascia. Surrounding the bladder and bony fascial attachments, there is antero-inferior and lateral loose areolar connective tissue known as the potential "space of Retzius."[4] Laceration of the bladder by bony spicules or from compression during pelvic fracture can lead to a bladder rupture that directly communicates with the anterior arch of the pelvis.

The bladder is the most frequently injured organ during pelvic surgery, most often in obstetric or gynaecological procedures [5] (Level of evidence 3). Table 1 shows the incidence of bladder injuries associated with various procedures.

Table1- Incidence(per 1000 procedures) for various procedures associated with bladder injury

Surgery	Frequency/1000 procedures
Vaginal Delivery	0.1
Caesarean Section	1.8
Open Gynecological Surgery	1.5
Vaginal Hysterectomy	9
Radical Cancer Surgery in pelvis	14
Diagnostic Laparoscopy	0.1
Lap Sterilisation	0.2
Lap Hysterectomy	10
Lap Assisted Vaginal Hysterectomy	28
TUR for bladder tumour	25
TUR of Prostate	0.1
Laparoscopic Bladder neck suspension	19
Tension free Vaginal taping for urinary incontinence	0.4
Laparoscopic Hernia surgery	1.6

Its incidence increases gradually according to the complexity and local/regional conditions of each procedure. As per the American Association for the Surgery of Trauma Bladder Organ Injury Scale[6], the injury is graded into 5 grades as given in *Table2.*

Table2- American Association for the Surgery of Trauma Bladder Organ Injury Scale.

Grade	Injury	Description
I	Hematoma	Contusion, intramural hematoma
	Laceration	Partial thickness
II	Laceration	Extraperitoneal bladder wall laceration <2 cm
III	Laceration	Extraperitoneal ≥ 2 cm or intraperitoneal <2 cm bladder wall laceration
IV	Laceration	Intraperitoneal bladder wall laceration ≥ 2 cm
V	Laceration	Laceration extending into bladder neck or ureteral orifice (trigone)

Risk factors for bladder injury include any pelvic process resulting in anatomic distortion and reduced exposure (eg, adhesions or scarring from previous surgery or radiation, inflammation, malignant infiltration, pregnancy, or hemorrhage) and mechanical factors, such as the presence of a vaginal pessary or simple failure to empty the bladder preoperatively. Table 3 summarised the various risk factors[7] for the bladder rupture with various procedures.

Table 3 – Risk factors for the bladder rupture associated with various procedures

Procedure	Risk factors
Caesarean delivery	Previous caesarean delivery Previous pelvic surgery Presence of labour Station of presenting foetal part + 1 Foetal weight >4 kg
Hysterectomy	Malignancy Endometriosis Prior pelvic surgery Pelvic organ prolapse surgery
General Surgery	Malignancy Diverticulitis Inflammatory bowel disease
Mid-urethral sling operation	Retropubic route Previous caesarean delivery Previous colposuspension BMI <30 kg/m2 Rectocele
Transurethral Resection of Prostate/Bladder(TURP/TURB)	Tumour size Elderly patients Pretreated bladder (previous TURB, intravesical instillation, radiotherapy) Tumour location at the dome or in Diverticulum

However in our patient, preoperative emptying of bladder was done by perurethral catheterisation.

Laparoscopy in its steep learning curve and rapid growth, may result in inadvertent bladder injury in otherwise uncomplicated patients. In a literature review conducted by Ostrzenski and Ostrzenska[8] it was found that the incidence of laparoscopic bladder injuries ranges from 0.02% to 0.3%, the majority occurring during either laparoscopic hysterectomy or diagnostic laparoscopy (40% and 24%, respectively). The use of laparoscopy as a diagnostic and therapeutic tool is used

increasingly in the emergency setting with many of these procedures being performed by surgical trainees. Complications arising from primary and secondary port insertion in the presence of previous surgery are well recognised and documented[9].

Timing of injury recognition is probably the single most significant factor in achieving satisfactory outcomes and limiting delayed complications and patient anxiety. From a literature review, it is difficult to ascertain the exact number of bladder injuries recognized intraoperatively, with a wide range reported (from 53% to100%)[10].

During the operation, the diagnosis of bladder injury is suggested by the presence of gas filling up the Foley bag or visibly bloody urine in the Foley bag. Other signs of injury are urinary/fluid drainage from a secondary trocar site incision, or fluid pooling in the abdomen/pelvis[11]. If a bladder injury is suspected, the bladder should be filled with methylene blue-colored saline. The forcing out of fluid/dye in the peritoneal cavity indicates a bladder injury inside the abdominal membrane.

For delayed injuries, conventional plain film or CT cystography, with retrograde bladder filling with dilute contrast material should be performed to classify the injury and plan appropriate treatment. The cystographic finding of extraperitoneal bladder perforation is contrast extravasation into the pelvis. In cases of intraperitoneal perforation, extravasated contrast material outlines bowel loops and accumulates in the paracolic gutters or infradiaphragmatic space. A combined perforation cystography shows both extra and intraperitoneal extravasation. In our case, extravasation of contrast material to the peritoneal cavity was seen. The contrast was also seen extravasating through the anterior abdominal wall and filling the stoma bag placed outside.

Most cases of extraperitoneal rupture are managed with non- operative management with bladder drainage via catheter followed by a cystogram to confirm healing of the injury. In a study by Johnsen et al., cystogram revealed continued extravasation in at least 18% of patients with EP injuries managed with catheters, suggesting confirmatory cystography may still be of some utility[12]. The majority of ruptures heal by three weeks; if the injury has not healed by four weeks, AUA guidelines recommend surgical repairs[13]. The guidelines also recommend surgery for EP bladder injuries when there is persistent hematuria, associated pelvic organ injury, the presence of foreign bodies or projecting bones in the bladder, ongoing urinary leak, and penetrating trauma.

Intraperitoneal Ruptures(IPR) usually require surgical interventions. Conservative management have been given trials. In the 1970s, studies conducted by Mulkey and Witherington[14], Richardson and Leadbetter[15] and Robards et al[16] , about the nonoperative management for IPR, concluded surgical repair might not be the only choice. These were the earliest trials of nonoperative management in IPR. In 2002, study by Pansadoro et al[17] reported the successful management of two cases of IPR following transurethral resection of bladder tumour using intraperitoneal and transurethral Foley catheters in situ. In 2008, study by Basiri and Radfar[18] claimed that they had conservatively treated for the first time a case of spontaneous intraperitoneal rupture of the urinary bladder due to prostate cancer.

The indications for surgical repair are improper bladder drainage, deterioration of the general condition in the first few hours, prolonged urinary drainage through the peritoneal drain, lack of clinical or laboratory improvement, and concomitant injuries that need laparotomy. The choice of surgical approach usually depends on the initial operation: with an open abdominal or pelvic procedure, bladder repair is transabdominal; with a vaginal procedure, repair can be transvaginal if adequate bladder closure can be achieved. Bladder wall repair is usually done in 2 layers with an absorbable suture material preferably Vicryl. The integrity of the suture line can be tested with injecting methylene blue contrast through a per-urethral catheter and checking for leaks. At the termination of a bladder repair, a transurethral Foley catheter should be used alone or in combination with a suprapubic Malecot tube/Foley's Catheter. There are no current guidelines on the optimal time for catheter placement after bladder repair, but 7-14 days has been reported and is commonly used[19]. AUA guidelines do not recommend usage of suprapubic catheters following bladder repairs, as urethral catheters are sufficient in the majority of cases[20]. In fact, drainage with per-urethral catheters have been associated with shorter hospital stays and lower morbidity compared to combined drainage with suprapubic and urethral catheters[21].

In our case, the intraperitoneal bladder injury could have occurred while performing the skin incision during the first laparotomy or due to excessive retraction of the lower skin with metal retractors. But it was identified early within 2 days and was repaired. Post bladder repair, a combined perurethral and suprapubic catheter drainage was done and subsequently removed after 4 weeks with full recovery.

CONCLUSION

Bladder rupture was considered a life threatening injury with 44% mortality in the year 1942[22]. However with advancements in technology it is not a dreaded injury today if it is treated promptly with the standard protocol. Proper assessment of the patient clinically and radiologically and appropriate initial resuscitation is important for successful outcome in these cases.

Although iatrogenic bladder injuries are common with laparoscopic and other gynecological procedures, we should always anticipate such injuries during midline laparotomies(done for general surgical procedures) even when the patient is catheterised prior to incision. The policy of adopting good surgical techniques, giving tissue respect, meticulous dissection, and appropriate use of instruments will reduce the incidence of iatrogenic bladder injuries. A low threshold for a relaparotomy should be kept in our management plan if an iatrogenic rupture of bladder is suspected.

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