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Bladder injury – A team challenge

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Abstract: Bladder trauma is caused by a direct blow to the distended bladder, severe injury fracturing the pelvis, iatrogenic, or penetrating wounds. Early detection and diagnosis are key to successful management of cases, but omission or late reveal of bladder damage increase mortality and create long-term problems. A bladder injury may not always present with immediate obvious signs and symptoms, especially in a multi-trauma patient, who is also more difficult to investigate. Moreover, during the COVID-19 pandemic, delayed patients' access to tertiary, multidisciplinary hospitals, increases the risk for delayed diagnosis and also increases the need for more specialists from different surgical and non-surgical areas to raise their awareness of less common manifestations of bladder trauma. We present a review of literature and cases of less common bladder damage from the perspective of a multi-disciplinary team in the University Emergency Hospital in Bucharest.

Keywords: bladder injury, pelvic fracture, urinary fistula

BACKGROUND

Bladder injuries

Based on etiology, bladder rupture and injury can be blunt, penetrating, iatrogenic, or spontaneous. Anatomically, bladder injury can be extraperitoneal (40-60%), intraperitoneal (15-30%) or mixed (10-25%) [1].

Most of these injuries are caused by road traffic accidents, work-related accidents, falls, crashes, violent crimes, military conflicts, and iatrogenic maneuvers, such as obstetric, gynecologic, and urologic procedures [1, 2]. Common signs and symptoms of blunt bladder trauma are gross hematuria, suprapubic pain, abdominal bruising, extravasation of urine into the perineum and genital organs and thighs [1]. Delayed diagnosis may lead to peritonitis, fistula, and septicemia [1,

2]. In patients with other associated pathology or other associated trauma, undetected bladder injury can even be fatal [1].

Bladder fistula

A less common complication of delayed bladder injury

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diagnosis is bladder fistula [1, 3]. Fistulas are abnormal communications within the genitourinary system or may involve other structures as the gastrointestinal tract, skin, vascular and lymphatic systems [1-3]. Bladder fistulas may involve the urethra, skin, gastrointestinal organs, female reproductive tract, and even pelvic joints [1, 2].

MATERIALS AND METHODS

Because bladder trauma and genitourinary fistulas are so diverse in their anatomy and clinical appearance, we present a review of literature about the less common occurrence of bladder trauma and our experience with this pathology.

Patients' data and imaging were collected from the University Emergency Hospital in Bucharest database.

RESULTS

Tertiary unit hospitals usually confront with multiple trauma patients who need a complex evaluation. Some of these patients come from isolated areas or after being initially partially evaluated in other healthcare facilities.

As described in the literature, most patients with bladder injuries present after obstetrics and gynecology procedures, intra-abdominal injuries (44-68.5%), or pelvic fractures [1-3]. The principal sign of bladder injury is visible haematuria, suprapubic pain, and urinary leakage, but according to the type of injury and the associated complications, bladder trauma diagnosis can be a real challenge for the specialists confronting with it. Usually, urologists and general surgeons are those who operatively manage the cases, but the nature and timing of intervention depend on additional complications and may require a differential diagnosis.

A complication of bladder rupture is a fistula, but rare types of fistulas, such as vesical-cutaneous fistulas associated with pelvic trauma have been sporadically described and no guidelines exist for their management. A particular type of posttraumatic bladder fistula with no immediate clinical manifestations is a vesical-vulvar fistula. As illustrated in the case below, these fistulas can often be mistaken for labial tumors or abscesses.

Posttraumatic bladder injury with vesical-labial fistula

A gynecological and urological consultation was requested for a non-functioning urethral-vesical catheter of a 60 years-old female patient admitted in the Orthopedic Department that underwent surgery with external fixation 2 days prior for a complex pelvic fracture (transverse fracture of the right acetabulum, left obturator ring fracture, left sacral fracture, fifth lumbar transverse apophysis fracture with paralysis of the external left sciatic nerve) (Figure 1).

Figure 1: Preoperative x-ray scan showing a complex pelvic fracture type Tyle C2.



The patient presented with a left labial abscess with spontaneous exteriorization of content. Upon examination, the labial abscess raised suspicions due to the secretions exteriorized that were abundant and liquid, milky at first then clear (Figure 2).

Figure 2: Vesico-labial fistula in a patient with pelvic fracture and suspected bladder injury. The aspect could be easily misdiagnosed as a vulvar abscess.



The suspicion of the vesical-cutaneous fistula was confirmed after administering methylene blue in the bladder via the functioning Foley catheter and observing the dye exteriorizing at the site of the labial orifice, therefore adding the diagnosis of extraperitoneal bladder injury complicated with a cutaneous fistula. The existing 14 CH Foley catheter was replaced with a 22 CH one and the external orifice of the fistula tract was drained with a draining tube.

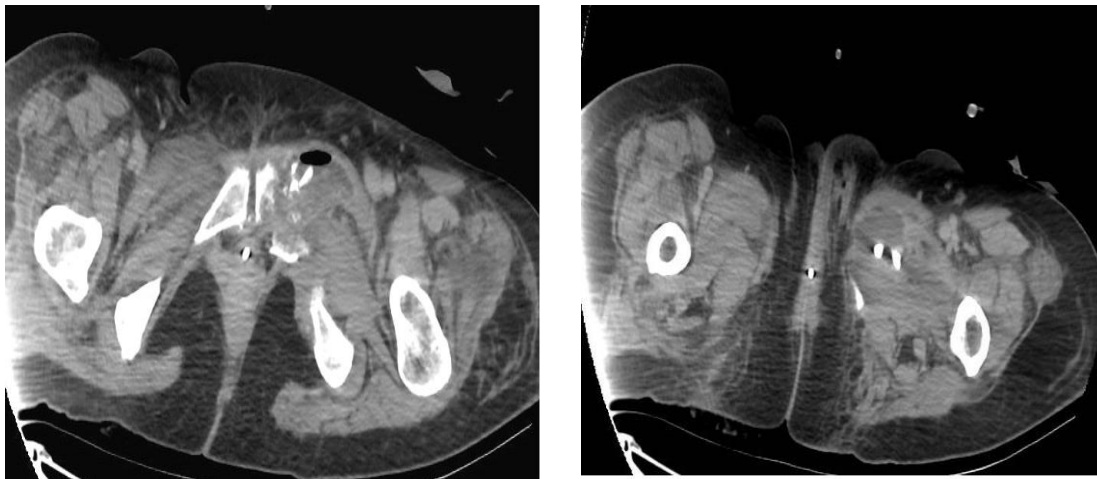
The patient's recent history revealed the above-mentioned fractures with the left bladder wall tractioned laterally with

no contrast extravasation 15 days before the consultation with surgical treatment delayed due to a positive RT-PCR COVID 19 test, the patient being transferred to a SARS-Cov 19 support Hospital. The onset or presence of hematuria in this time interval is not specified. The patient did benefit from bladder drainage, but with multiple clogging and rather

unfunctional drainage before our consultation.

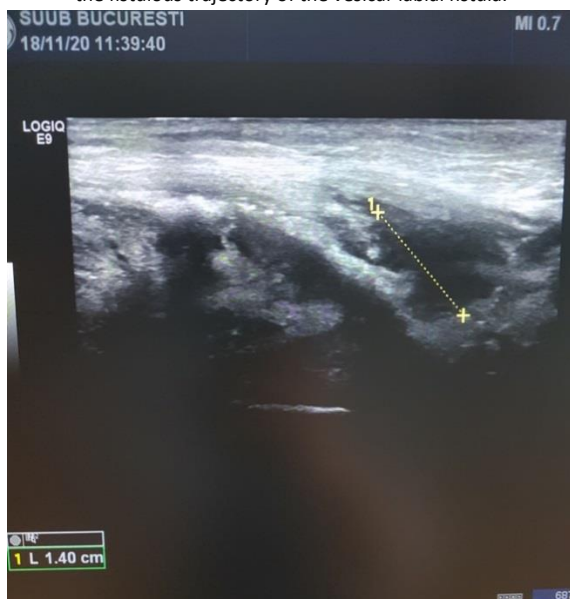
A second CT-scan was requested and confirmed the suspicion of vesical fistula (Figure 3) and revealed fluid accumulation (10/5.5/3cm) in the left external obturator space.

Figures 3: CT-scan showing complex pelvic fracture and the communication between the bladder and the left labia.



A second draining tube was inserted in this space with ultrasonic guidance to drain intramuscular collections (Figure 4).

Figure 4: Ultra-sonographic aspect of fluid and pus collection on the fistulous trajectory of the vesical-labial fistula.



Since the urological consultation and the diagnosis of the fistula took place 2 days after the patient underwent external fixation surgery, the possibility for concomitant primary bladder repair was excluded, leading to the decision

for conservative management, with antibiotic treatment, monitored diuresis, and drainage. In case of a favorable outcome, the conservatively treated bladder injury will be followed by cystography to rule out extravasation. On the other hand, if the conservative treatment fails, the patient will undergo abdominal surgery for bladder repair.

The particularity of this case is that the bladder rupture presented with unspecific signs and symptoms, with a rather unusual fistula. The nature of the pelvic fracture, the malfunctioning catheter drainage, and the postoperative status of the patient leads to a more difficult and delayed diagnosis and management of the bladder injury.

DISCUSSION

Researchers found that 85% to 100% of bladder injuries are associated with concomitant pelvic fractures [1-3]. The bony spicules of a fractured pelvis and the shearing forces are the underlying mechanisms of extraperitoneal bladder rupture. Extraperitoneal injury is almost always associated with pelvic fractures [2]. The highest risk of bladder injury was found in disruptions of the pelvic circle with displacement > 1 cm, diastasis of the pubic symphysis > 1 cm, and pubic rami fractures [3, 4].

Intraperitoneal bladder rupture most commonly occurs on the dome of the bladder because it is the least protected area. Direct blow and deceleration forces are the underlying mechanisms. Urine leaking into the abdomen can be

absorbed by the peritoneum, causing increased urea and creatinine, metabolic alterations, and low urine output. Infected urinomas can cause pelvic abscesses and peritonitis. Mixed intra- and extraperitoneal bladder rupture are less common, occurring in 8% of bladder injuries associated with pelvic fractures [5].

Diagnosis of bladder injuries can be challenging due to the often vague and non-specific presentation. Literature studies found that up to 23% of all bladder and urethral injuries associated with a pelvic fracture are missed at initial evaluation [6]. Moreover, other studies highlight the delay in diagnosis since the patients were from isolated areas, with poor access to a tertiary trauma center [7].

Iatrogenic bladder injuries are not uncommon. The bladder is the most frequently injured organ during obstetric and gynecologic interventions, such as hysterectomies and cesarean sections. Frankman et al. reported an incidence of 13.8 bladder injuries per 1000 procedures in 2010, but as the incidence of cesarean sections has increased worldwide, the incidence of urologic injuries is expected to rise as well [8].

Vesicovaginal fistula is the oldest described type of fistula. It may occur as a complication of childbirth, hysterectomy, irradiation, and trauma. Patients with neoplasms of the cervix and bladder, especially those who underwent irradiation, are more prone to develop vesicovaginal fistulas [1,4]. Vesicocutaneous fistulas occur after surgical procedures or trauma. Those occurring at suprapubic cystostomy sites after catheter removal usually close spontaneously.

A rare complication of pelvic trauma with bladder injury is a vesical-vulvar fistula, which can be misdiagnosed as a labial tumor or abscess. Also, a vesical-articular fistula can involve the hip joint, causing septic arthritis [9].

Imaging diagnostic methods of bladder trauma and fistula

According to literature studies, conventional intravenous abdominal/pelvic CT will miss 40% of bladder ruptures [1, 10]. Absolute indications for bladder imaging include visible haematuria and a pelvic fracture or non-visible haematuria combined with high-risk pelvic fracture (disruption of the pelvic circle with displacement > 1 cm or diastasis of the pubic symphysis > 1 cm) or posterior urethral injury [4]. Cystography is the preferred diagnostic modality for non-iatrogenic bladder injury and a suspected iatrogenic bladder trauma in the postoperative setting [11]. CT cystography has a higher sensitivity and specificity (99-100%). Both the American Urological Association (AUA) and the European Association of Urology (EAU) recommend either plain-film or CT retrograde cystography for detecting bladder injuries in

all suspect patients. In critically ill patients, when cystography cannot be initially performed, a Focused assessment with sonography for trauma (FAST) exam can be used. Bedside ultrasonography with intravesical saline instillation may assist in the early diagnosis of bladder rupture, but it depends on the ultrasonographer's experience [12, 13]. Ultrasonography can also detect intra or extraperitoneal fluid. In the case of pelvic fracture, CT-cystography is superior in detecting bony fragments within the bladder [2, 13]. Cystoscopy is the preferred method for the detection of intraoperative bladder injuries as it directly visualizes the laceration and can localize the lesion concerning the position of the trigone and ureteral orifices [14]. Large perforations are suggested by the lack of bladder distention during cystoscopy.

Imaging diagnostic methods of bladder fistula also include fistulography, cystoscopy, and voiding cystourethrography.

In large vesicovaginal fistulas, urine leaking into the vagina can be easily seen, or methylene blue dye can be used to mark the fistulous path [15].

Management options from international guidelines

The EAU states that the majority of uncomplicated extraperitoneal bladder injuries can be managed with catheter drainage alone and will heal in about 14 days. Conservative management, which comprises of clinical observation, continuous bladder drainage, and antibiotic prophylaxis is the standard recommended treatment in all uncomplicated extraperitoneal injury due to blunt or iatrogenic trauma [16, 17]. In any patient with penetrating or intraperitoneal injury, emergency exploration and repair are recommended even in the absence of pelvic fracture. Bladder neck involvement, bone fragments in the bladder wall, concomitant rectal, or vaginal injury, or entrapment of the bladder wall necessitate surgical intervention [5].

Orthopedic management of pelvic fractures includes internal fixation or temporary external fixation. Given the increased infection risk associated with prosthetic material used in orthopedic surgery, urologists are advised to consider primary repair of uncomplicated bladder injuries to reduce the risk of colonized urine infecting osteo-synthetic material (EAU guideline, Grade B recommendation). Recent studies comparing conservative management to concomitant bladder repair in the setting of internal fixation found an increased risk of infection in patients that did not benefit from concomitant bladder repair [18, 19]. Therefore, bladder repair is recommended at the same time with the internal fixation and exploration for other injuries to decrease the risk for complications and to reduce recovery time [20-22].

Bladder closure is performed with absorbable sutures. There is no evidence that a two-layer is superior to watertight single-layer closure [2, 23].

Follow-up of patients with bladder injury must always include bladder drainage to prevent elevated intravesical pressure and to allow the bladder to heal. Conservatively treated bladder injuries must be followed up by cystography to rule out extravasation and ensure proper bladder healing [4]. The first cystography is planned approximately ten days after injury. In case of ongoing leakage, cystoscopy should be performed to rule out bony fragments in the bladder, and a second cystography is warranted one week later [24, 25]. Cystography is always advised in cases with complex injury (trigone involvement, ureteric reimplantation) or with risk factors of impaired wound healing [13, 15]. In healthy patients with a surgical repair of a simple bladder injury, the catheter can be removed after 10 days without a cystography. Some authors recommend drainage catheter removal after 5 days in conservatively treated internal iatrogenic extraperitoneal bladder perforations and after 7 days for extraperitoneal perforations [11, 22].

Management options for vesico-vulvar and vesicovaginal fistula

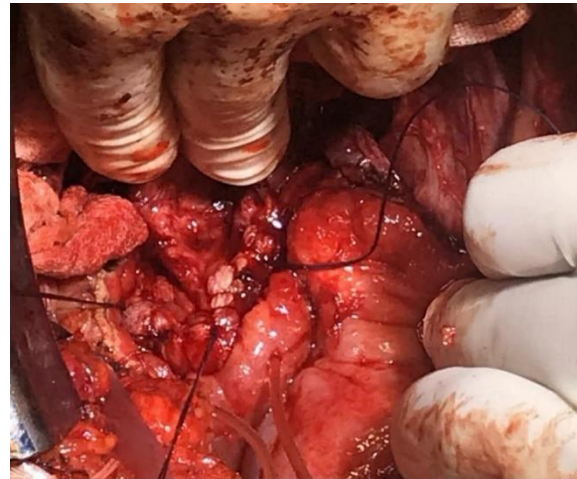
The treatment of choice for vesicovaginal fistulas is surgical, although spontaneous closure of small fistulas with simultaneous permanent catheterization for 19-54 days is mentioned in the literature. Approximately 10% of vesicovaginal fistulas from hysterectomy resolve conservatively if the fistula is small (<1cm, <1.5cm), is recent and the Foley catheter is inserted as soon as possible [26-29].

Thus, if a fistula does not close spontaneously in 4 weeks, surgery is needed. Hillary et al. described high percentages of success for the vaginal approach of fistula repair (90.8%) as compared to the abdominal approach (83.9%) [30]. Studies about fistula approach and follow-up are generally scarce and report small numbers of patients. Kapoor et al., in a study on 52 cases, for which he used vaginal and abdominal approach, found that vaginal approach is superior in uncomplicated cases, with small fistulas, but an intraabdominal repair is mandatory for extragenital fistula, for highly situated fistula, when reimplantation of ureters is needed, or when the vaginal approach is impossible [31].

The best timing to proceed to surgical repair is between 3 to 6 months from the appearance of the fistula. Ideally, the best time would be in the first 2 weeks, before bladder inflammation and fibrosis appear, but unfortunately, it takes more than 2 weeks for the fistulas to be detected.

The surgical approach may be transvaginal, transabdominal, or transvesical. Bilateral ureteral catheterization before intervention is recommended, as illustrated in Figure 5. A Foley catheter will also be kept in place for 14 days and removed after a prior retrograde cystography [32].

Figure 5: Intraoperative image of a transabdominal repair of a vesical-vaginal fistula in a post-hysterectomy patient. Ureteral catheterization was also performed and the bladder was sutured.



Vesico-labial fistulas are rare and have been scarcely described by literature. Their initial appearance which can lead to the misdiagnosis of vulvar abscesses and the need to primarily address the associated lesions makes this type of vesical-cutaneous fistula to have a later diagnosis and lead to a later approach by transabdominal repair.

CONCLUSIONS

Bladder rupture must be suspected in multi-traumatized patients with complex pelvic fractures, even in the absence of immediate onset of common symptoms like gross hematuria.

Because 40% of bladder injuries are missed at first emergency evaluation, repeating CT scans and using additional imaging techniques can reveal the bladder injury and other posttraumatic lesions.

Vesico-labial fistula is a rare complication of a delayed diagnosis of posttraumatic bladder rupture that can be easily misdiagnosed as a vulvar tumor or labial abscess, requiring a different approach to fistula repair.

Conservative management is the treatment of choice in a patient who already underwent surgical external fixation for pelvic fracture as long as the bladder injury is not complicated by infection and the bladder fistula is small. Bladder drainage with a large Foley catheter is mandatory,

with permanent surveillance of catheter functionality and antibiotic prophylaxis. Concomitant bladder repair with internal pelvic fixation or other abdominal wound exploration is recommended to decrease complications and healing time.

The correct diagnosis and management of such cases always require a multidisciplinary team, including urologists,

general surgeons, orthopedists, Ob&Gyn specialists, and radiologists.

Medical teams must raise their awareness of potential insidious complications of bladder injuries as some diagnosis can be delayed or incomplete due to the challenges that come with the COVID19 pandemic.

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