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Case Report

Laparoscopic repair of combined extra- and intraperitoneal bladder ruptures in a patient with blunt trauma: Use of the bladder suspension method

Yoonjung Heo, Dong Hun Kim^{*}

Department of Trauma Surgery, Trauma Center, Dankook University Hospital, Cheonan, Republic of Korea

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ABSTRACT

Urinary bladder rupture is commonly due to blunt abdominal trauma rather than penetrating trauma. Intraperitoneal bladder rupture (IBR) is a concrete indication of surgical management. On the other hand, surgeons should perform surgeries in patients with extraperitoneal bladder rupture (EBR) solely in complicated cases. Uncomplicated EBR is managed conservatively. Laparoscopic repair is safe and effective for the treatment of IBR. However, there are no contemporary guidelines on the application of laparoscopy for the management of EBR. Herein, we describe a case of combined EBR and IBR in a hemodynamically stable 45-year-old patient who sustained injuries after falling. Intravesical repair of EBR and intracorporeal repair of IBR with the bladder suspension method were successfully performed with laparoscopy. This is a rare case describing the feasibility of laparoscopic suturing for combined EBR and IBR in a patient with blunt trauma.

Introduction

Bladder injuries are typically caused by blunt external force in polytraumatized patients [1]. Blunt trauma accounts for 60–85% of bladder injuries, whereas penetrating trauma makes up 15–51%. Traumatic bladder ruptures can be classified as extraperitoneal (63%) or intraperitoneal (32%) or combined (4%) [2]. Extraperitoneal bladder rupture (EBR) commonly occurs in individuals with pelvic fractures (PFs) caused by shearing forces of bony fragments. By contrast, intraperitoneal bladder rupture (IBR) is attributed to burst rupture of the dome caused by direct force to a distended bladder [3]. Recent advancements in laparoscopy are reshaping the current management of bladder injuries. Traumatic IBR can be safely managed with laparoscopic repair in hemodynamically stable patients, even in those with multiple concomitant injuries [4]. However, to the best of our knowledge, there is no report on the application of laparoscopic repair for EBR. Herein, we describe the first case of combined EBR and IBR successfully treated with laparoscopic repair. Moreover, the use of the laparoscopic suspension method for urinary bladder rupture was described.

Case presentation

A 45-year-old female patient who fell from the third floor of a building presented to our institution. Upon arrival, she was

^{*} Corresponding author at: Department of Trauma Surgery, Trauma Center, Dankook University Hospital, 201 Manghyang-ro, Dongnam-gu, Cheonan, Chungnam 31116, Republic of Korea.

E-mail address: saint7331@gmail.com (D.H. Kim).

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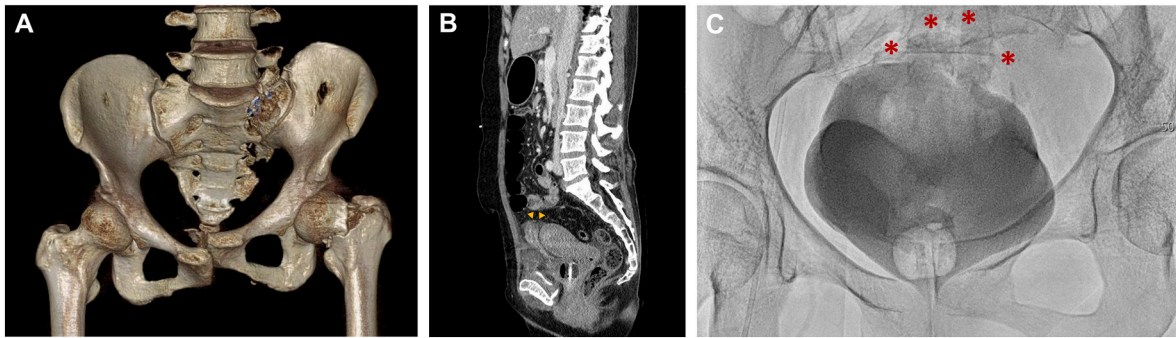


Fig. 1. (A) Three-dimensional pelvic computed tomography scan showing vertical shear type pelvic fractures according to the Young-Burgess classification. Dorso-vertically displaced fracture in the left sacral ala and displaced fracture in the right sided pubic bone of symphysis pubis are noticed. (B) Abdominopelvic computed tomography scan showing ruptured fundus (arrowheads) of the bladder. (C) Retrograde cystography showing disruption of the bladder with intraperitoneal contrast extravasation (asterisks).

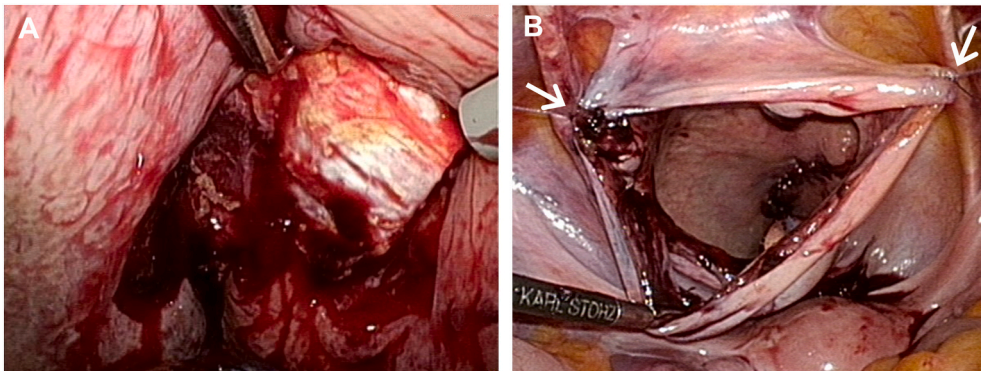


Fig. 2. (A) The displaced fracture in the right side of the pubic bone in the symphysis pubis observed in the bladder lumen. (B) The bilateral suspension sutures (arrows) made at each ventral corner of the intraperitoneal laceration via the skin using a suture passer.

hemodynamically stable, with a blood pressure of 106/68 mmHg and a heart rate of 70 beats per min. Intubation was then performed. The patient's Glasgow Coma Scale score was 7. Moreover, her abdomen was slightly distended, and gross hematuria was noted in the Foley's catheter. Radiologic examinations revealed multiple traumas with an Injury Severity Score of 34. The patient presented with the following: minimal traumatic subarachnoid and intraventricular hemorrhage with basal skull fracture, left-sided rib fractures with hemothorax, vertical shear-type PFs with extravasation, femoral neck fracture, lumbar spine fracture, and IBR, which was confirmed on computed tomography scan and retrograde cystography (Fig. 1A, B and C). However, the presence of EBR was not validated. Then, three-dimensional laparoscopic exploration was performed after embolization of active bleeding in the left lateral sacral artery.

Surgical technique (Video 1)

The patient was positioned in the supine and Trendelenburg position. The surgeon stayed on the patient's left side, and the assistant on the right side. Peritoneal access was achieved via insertion of a 10-mm supraumbilical camera port and two working ports (5 and 12 mm) on each side of the lower abdomen. Then, combined EBR (4 cm) and IBR (7 cm) were identified. The spicules of the displaced pubic bone were exposed in the bladder lumen. Suspension suturing of the fundus at both ventral corners of the IBR was performed to visualize the injured anterior wall (Fig. 2A and B). EBR was repaired via one-layer continuous suturing in the bladder using a 3-0 barbed string (V-Loc™ 90 absorbable wound closure device, Covidien, Minneapolis, MN, USA). The V-shaped avulsive IBR had an ischemic portion, which was trimmed using the Harmonic scalpel (Ethicon Endosurgery, Cincinnati, OH, USA) and was closed continuously with a 3-0 barbed string in a two-layer fashion. Then, indigo carmine diluted with 300 mL of saline was instilled via the Foley's catheter to confirm watertight closure. A Jackson-Pratt (JP) drain was indwelled in the Douglas' pouch after a copious peritoneal irrigation. The total operative time was 220 min. Continuous irrigation via a three-way Foley's catheter was applied until postoperative day (POD) 2 when blood clots were resolved. The JP drain was removed on POD 4 as the content was serous and minimal. On POD 13, a follow-up retrograde cystography was performed, and results showed no contrast leakage. Not only the removal of Foley's catheter but also discharge of the patient was postponed until POD 27 due to managements of other concomitant injuries. The patient had no voiding complaint after removal of the catheter, and she took oral alpha-blocker and cholinergic agonist for 1 week.

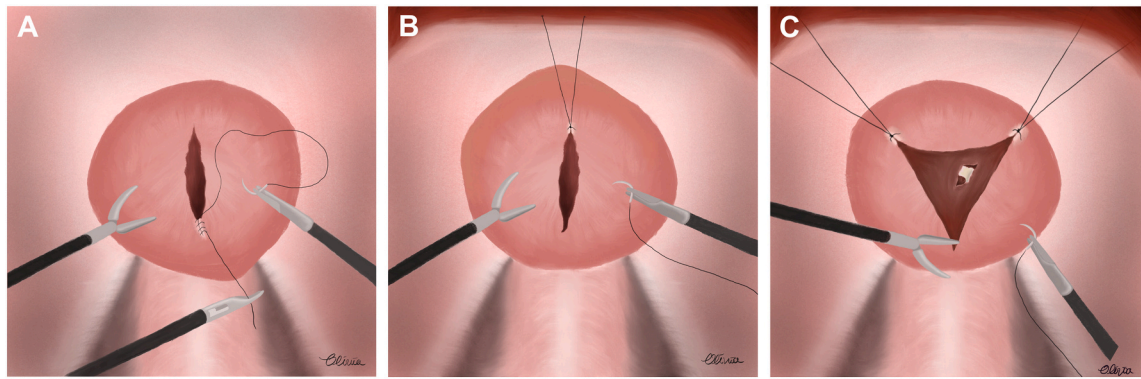


Fig. 3. Techniques of laparoscopic bladder traction. (A) A simple bladder laceration pulled dorsally by an assistant grasper to ease upward continuous suturing. (B) A suspension suture at the ventral end of a simple laceration to promote downward suturing. (C) Two suspension sutures at each ventral corner of a large opening in the bladder to facilitate intravesical suturing.

Discussion

The American Urological Association guidelines recommend that IBR in trauma patients must be surgically repaired whether it is complicated or uncomplicated. However, EBR must be surgically managed only in complicated cases, including those of bony spicule projection into the bladder, or associated injuries in the rectum, prostate, vagina, or bladder neck [5]. Failure of timely management of complicated EBR may lead to delayed healing, paravesical abscess, vesicocutaneous fistula, osteomyelitis, septic shock, or even death [1,6]. When orthopedists perform early open reduction for concomitant PFs, trauma surgeons have an opportunity to simultaneously suture EBR. However, when the treatment of PFs is delayed or external fixation is used, patients cannot receive timely and appropriate treatment, or they must undergo another conventional laparotomy. Minimal invasive surgery for isolated IBR has advantages such as faster recovery and better cosmetic outcomes. Hence, it has gained popularity [6]. However, EBR has not been considered an indication of laparoscopic repair. This rare case showed that complicated EBR is also repairable with laparoscopy when accompanied by large IBR to reduce unnecessary laparotomies.

To the best of our knowledge, this is the first case report of laparoscopic repair for concurrent EBR and IBR in a patient with blunt abdominal trauma. Tsai et al. [6] have reported the use of laparoscopic repair of EBR via the preperitoneal space. However, the presence of IBR was not observed. In the current report, our experienced laparoscopic surgeon was able to view the EBR through the large rupture in the fundus. Bilateral suspension suturing of the fundus contributed to the enhanced visualization of the intravesical anatomy and the anterior wall (Fig. 2B). The suspension method is an appealing procedure as it can prevent the insertion of an additional port. Thus, it has cosmetic benefits and can supplement manpower shortage in some institutions. One should be careful not to create injury in the inferior epigastric vessels by a suture passer during the procedure.

There are critical surgical points that should be emphasized in the laparoscopic repair of bladder ruptures. Prior to the repair (of the bladder), the integrity of the trigone should be evaluated laparoscopically and repaired if there is injury. Either single- or two-layer closure is acceptable, which should be performed with an absorbable suture, with the continuous or interrupted suture technique [7]. The bladder wall should be held steadily using either an assistant grasper or suspension sutures for flawless intracorporeal suture. There are several techniques that can facilitate proper traction of the bladder to facilitate intracorporeal repair of various types of bladder ruptures (Fig. 3A, B and C). According to our experience, the surgical fluency of suture is based on whether a surgeon chooses the right direction of traction when working in difficult angles. The watertight seal should be inspected intraoperatively via instillation of normal saline, methylene blue, or indigo carmine into the bladder [4]. In general, the Foley's catheter can be safely removed after POD 7 at which time a cystogram shows no extravasation. However, the importance of confirmatory follow-up cystography is controversial [2].

Hence, in a hemodynamically stable patient who sustained blunt trauma, laparoscopic repair of combined EBR and IBR may be a feasible option if the surgery is performed by an experienced surgeon who can appropriately visualize the lesions. Further, the bladder suspension method is recommended in such repair. However, prudent selection of candidates is needed as laparoscopic surgery may require longer operation time than open method. With appropriate knowledge of the indications for surgical repair in EBR, trauma surgeons can take proper actions when they encounter unexpected EBR in emergency surgeries.

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Ethics

The institutional review board and the ethics committee of Dankook University Hospital (DKUH) approved the study (DKUH 2020-11-025). Patient written informed consent was obtained before surgery.

CRediT authorship contribution statement

Dong Hun Kim: Conceptualization, Methodology, Writing – Reviewing and Editing. Yoonjung Heo: Visualization, Investigation, Writing – Original draft preparation and editing.

Declaration of competing interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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