

Bladder perforations in children

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Abstract

Context: Bladder perforations in children occur due to several different reasons.

Aim: In this clinical series study, we focused on bladder perforations due to the pelvic injury, and our aim also was to create awareness for a rare type of bladder injuries.

Setting and Design: This was a retrospective study of the patients who were treated in our clinic for bladder perforation between 2006 and 2011.

Subjects and Methods: We reviewed the documents of childhood bladder perforations, and demographic and clinical characteristics of the patients were obtained. No statistical analyses were used because of the limited number of cases.

Results: There were ten patients who suffered from bladder perforation in 5-year period; 5 were male, and 5 were female. The mean age of the patients was 4.35 years. Four patients (40%) experienced iatrogenic perforation and six patients (60%) experienced perforation due to the accident. Common symptoms were hematuria, abdominal tenderness, and inability to urinate. Three patients were diagnosed via emergency laparotomy, without any radiological examinations performed before surgery. Four patients suffered from the intraperitoneal perforation, three patients suffered from extraperitoneal injury and three of them both of intraperitoneal and extraperitoneal injuries. Mean recovery time for patients was 15 days. One patient developed a urinary tract infection and one newborn died due to accompanying morbidities. Nine patients were discharged from the hospital.

Conclusion: If the patients had a pelvic injury, surgeons must pay attention for the bladder perforation. Isolated bladder perforations are rare, and they are generally associated with iatrogenic injuries. Clinicians should pay attention to findings such as anuria, inability to insert a urinary catheter, and free fluid in the abdomen in order to diagnose the bladder perforation in newborns. Novice surgeons should pay more attention to avoid causing iatrogenic bladder perforation during inguinal hernia repair.

Key words: Bladder, child, iatrogenic, perforation, trauma

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Introduction

Bladder perforations in children occur due to several different reasons. One of the most common reasons is pelvic injuries associated with motor vehicle accidents. Bladder injuries occur in 20% of children with pelvic fracture.^[1,2] Isolated bladder perforations are rare, and they are generally associated with iatrogenic injuries. Bladder catheterization or umbilical catheterization in the neonatal period may result in bladder perforation.^[3,4] Iatrogenic bladder perforation may be a serious complication seen during surgery involving the inguinal region in infancy.^[5]

Cystography is the most efficient diagnostic tool for the bladder perforation.^[6]

Retroperitoneal perforations are usually treated with only catheter implantation; however, peritoneal ones must require surgical repair.^[7] In this study, we focused on bladder injuries due to several different reasons in childhood and our aim was to create awareness for a rare type of injuries.

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Subjects and Methods

We retrospectively reviewed the patients who were treated due to bladder perforation in our clinic from 2006 to 2011. We assessed their demographic characteristics, primary diagnosis, causes of injury, symptoms, clinical findings, tools for diagnosis, time of diagnosis, surgeries, and types of bladder injuries, durations of catheter, complications and lengths of hospital stay. Patients were followed-up average 2 years by our clinic.

Results

There were 10 patients who suffered from bladder perforation; 5 were male, and 5 were female. The mean age of our study population was 4.35 years (6 days to 15 years). Bladder perforation occurred secondary to motor vehicle accidents in five patients. In another one trauma patient, bladder perforation occurred following rectal impalement and perineal injury after falling on a rebar in. Two of our

patients were neonates when their bladder perforations occurred due to urinary catheterization. Bladder perforation occurred during voiding cystourethrogram (VCUG) process in one patient, and during inguinal hernia operation as a complication at state hospital of another city in the other one patient [Table 1].

One of our neonatal patients was a premature newborn who had a bladder catheter implanted and who suffered from respiratory distress in neonatal intensive care unit. In another newborn, gastroschisis repair was performed, and intraperitoneal bladder injury occurred due to Nelaton catheter that was implanted in the bladder after the repair. Abdominal distention, ascites, anuria, and uremia were the common clinical findings observed in both newborns. The first baby was diagnosed via laparotomy, and the second baby was diagnosed via VCUG [Figure 1].

Extraperitoneal bladder perforation developed during VCUG in a 6-month-old occurred in the study who was diagnosed with meningomyelocele and was suspected to

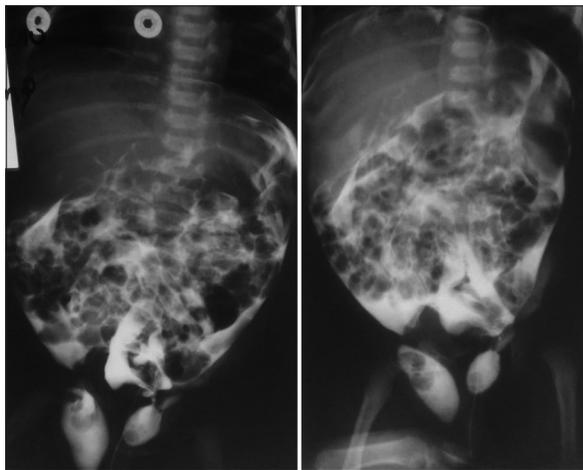


Figure 1: Peritoneal spread of contrast material during voiding cystourethrogram in newborn. Opening in both inguinal canal



Figure 2: Bowel airs surrounded with fluid in the middle abdomen



Figure 3: Voiding cystourethrogram is showed extravasation of contrast (A-P view)



Figure 4: Voiding cystourethrogram is showed extravasation of contrast (oblique view)

Table 1: Demographic data of cases with bladder perforation

Case	Age/ year-gender	Primer diagnosis	Cause of injury	Symptoms, findings	Diagnostic method (s)	Treatment	Injury type of bladder	Catheter duration/days	HS/day	Complication, result
1	6/365 female	Prematurity, respiratory distress	Iatrogenic, catheter	Anuria distention of abdomen, uremia, fluid in abdomen	Laparotomy	Laparotomy, primary repair, cystostomy	Dome perforation	S: 12, F: 18	19	Exitus
2	11/12 female	MT, SAB, bilateral femur fractures	Trauma, MVI	Anuria, hematuria	VCUG, CT	Laparotomy, primary repair, cystostomy	Dome perforation	S: 12, F: 6	14	Discharge
3	5.5 years, male	MT, left femur and left pubic fractures	Trauma, MVI	Anuria, hematuria	VCUG, CT	Foley catheter	Extraal perforation	F: 15	16	Discharge
4	7/365 female	Gastroschisis	Iatrogenic, catheter	Anuria, distention of abdomen, uremia	VCUG	Laparotomy, primary repair, cystostomy	Dome perforation	S: 11, F: 5	12	Discharge
5	1.5 years, male	Right inguinal hernia operation	Iatrogenic	Anuria, distention of abdomen	US, VCUG	Laparotomy, primary repair, cystostomy	Extra and intraperitoneal	S: 14, F: 12	15	Discharge
6	6/12 years, male	Operated MMC	Iatrogenic, VCUG	Acute abdomen	VCUG	Foley catheter	Extraperitoneal	F: 6	8	Discharge
7	2 years, female	PA, perineal injury	Trauma, MVI	Anuria, distention of abdomen	VCUG	Laparotomy, primary repair, cystostomy	Dome perforation	S: 12, F: 14	15	Discharge
8	15 years, female	MT, liver injury	Trauma, MVI	Acute abdomen	Laparotomy	Laparotomy, primary repair, cystostomy	Extra and intraperitoneal	S: 12, F: 9	13	Discharge
9	7 years, male	Rectal impalement, rectal and genital laceration, intestinal perforation	Trauma, falling, rebar injury	Acute abdomen, hematuria	Laparotomy, rectoscopy	Laparotomy, primary repair, cystostomy	Extra and intraperitoneal	S: 12, F: 9	13	Discharge
10	11 years, male	PA, perineal injury, pelvic fracture	Trauma, MVI	Acute abdomen	VCUG	Cystostomy	Extra peritoneal	S: 20, F: 22	24	ITE: Candida (+), discharge

MT=Multiple trauma; VCUG=Voiding cystourethrography; MMC=Meningo-myelocele; MVI=Motor vehicle injury; CT=Computed tomography; US=Ultrasonography; HS=Hospital stay; SAB=Subarachnoid bleeding; PA=Pedestrian accident



Figure 5: After the surgery, decreased bladder volume

have neurogenic bladder. The patient had been treated with only urinary catheterization.

A 1.5-year-old male patient who had inguinal hernia repair at another institution was referred to our hospital with symptoms of inability to urinate, vomiting, and abdominal distention on postoperative day 3. He had abdominal tenderness and distention [Figure 2]. The patient's blood urinary nitrogen level was elevated. Ultrasonography showed free fluid in the abdomen therefore VCUG was performed [Figures 3 and 4]. The injury and defect in the right anterolateral region of bladder were observed consequently, cystotomy and bladder repair was performed. During the procedure, we found that the inguinal hernia remained, and an incision was made in the medial side of the inguinal canal from the upper right-front corner of bladder and mucosa was peeled off. We also performed a right inguinal hernia repair and observed that the capacity of the bladder was reduced due to the dissection [Figure 5].

A patient who fell on a rebar and had subsequent anal, rectal, and bladder injuries complained of acute abdominal pain and hematuria following the injury. Laparotomy was performed, and the retroperitoneal injury was detected. Primary repair of the rectum and bladder was performed which included a cystostomy. The patient had a Foley catheter inserted after surgery.

Five out of ten patients who experienced bladder perforation were diagnosed via cystography; two were diagnosed via both computed tomography (CT) and cystography. Two trauma patients and one newborn were diagnosed during laparotomy.

Mean duration of determining a definitive diagnosis was 2.1 h. Four patients suffered from intraperitoneal injury, three patients suffered from extraperitoneal injury, and three patients suffered from both intraperitoneal and extraperitoneal injuries. Three patients, who experienced bladder perforation due to motor vehicle accidents, also suffered from pelvic fracture. Another patient also had an intracranial hemorrhage, while another one had a liver injury. Two additional patients had a perineal injury.

Laparotomy and cystostomy were performed in seven of the patients. Three patients with peritoneal injury were treated with percutaneous cystostomy catheters while two were treated with Foley catheters. The duration of cystostomy catheters was 15 days, and the urethral Foley catheter was 11 days. Mean recovery time for patients was 15 days. One patient developed a urinary tract infection and one newborn died due to accompanying systemic illness. Nine patients were discharged from the hospital without any complications [Table 1].

Discussion

Bladder perforations in children are reported more often in boys with a male: female ratio of 2:1.^[8] Our study showed equal gender distribution. Bladder perforations in children are classified into two groups: Perforations with multiple accompanying injuries and isolated iatrogenic perforations. Traumas (motor vehicle accidents and falls from heights) are the most common reasons. Bladder perforation must always be kept in mind in serious traumas associated with pelvic injury. Bladder perforation is more likely if the bladder is full during the trauma.^[9] Six patients in our study developed bladder perforation due to multiple traumas. Five patients developed bladder perforation due to injury from motor vehicle accidents, and the remaining patient had a rectal-bladder perforation secondary to an impalement injury after a fall from a height [Table 1].

Additional organ injuries usually accompany traumas that result in perforation. Five patients in our study also experienced pelvic fracture and two experienced femur fractures including one of which was bilateral. The prevalence of bladder perforation in children with pelvic fracture is reported as 2.5%.^[9] Subarachnoid hemorrhage, liver, and perineal injuries are remote organ injuries that may be concurrent with bladder perforation.^[10]

Hematuria is an important sign of bladder perforation. The frequency of hematuria in bladder perforation is

reportedly 95%.^[2] However, only three patients from our study suffered from hematuria. Six of our patients had anuria, and seven had uremia and acute abdominal pain. We think that hematuria may have not been observed in iatrogenic injuries due to a small perforation on the bladder wall.

Bladder injuries are best diagnosed via cystography and during exploratory laparotomy. Cystography provides more information about bladder injuries compared to CT.^[10] It can also be diagnosed during surgery in case of a need for emergent laparotomy due to multiple injuries. Seven of our cases were diagnosed via cystography, and three were diagnosed via laparotomy. In our study, mean duration of determining a definitive diagnosis was 2.1 h. A prior study by Hsieh *et al.* reported this duration as 3.2 h.^[10]

Primary repair of the bladder and cystostomy is required for peritoneal injuries of bladder; however, with the exception of large ruptures, treatment, and drainage with Foley catheter can be performed for extraperitoneal injuries. The repair of posterior wall via opening bladder is required if the extraperitoneal leak is large.^[2] Three patients experienced extraperitoneal injury; one was treated by cystostomy and urethral catheterization while two were treated and followed-up with urethral catheterization. Seven patients with intraperitoneal injury and extraperitoneal injury were treated and followed-up with laparotomy, cystostomy, and urethral catheterization. The length of hospital stay was longer in patients who had a laparotomy. This situation was not related to the amount of time it took for the bladder to heal after surgery; it was, however, influenced by additional organ injuries. Other studies have findings consistent with our study, but the mean length of hospital stay (15 days) was shorter in our study compared to other studies conducted on this topic.^[10]

Iatrogenic traumas may occur as a complication during urethral catheterization, VCUG, umbilical artery catheterization, and inguinal surgery. They generally cause isolated bladder injuries.^[5,7]

Bladder perforation is rarely seen in the neonatal period. Bladder perforation should be considered in cases of anuria, uremia, respiratory distress, and generalized free fluid in the abdomen despite the presence urinary catheter inside the bladder.^[11] Catheterization performed in children of this age group should be accepted as a standard procedure with minimal harmful effects. Our first presented case in this study was a 6-day-old premature baby who suffered from respiratory distress in neonatal intensive care unit. The baby had an operation due to free fluid in the abdomen. Bladder perforation was observed during laparotomy. The patient died due to accompanying additional systemic illness on postoperative day 22. Gastroschisis repair was

done in another newborn whose bladder was also situated outside of the abdominal wall (bladder herniation). Abdominal distention and anuria developed despite urethral catheterization after abdominal wall repair. There are a few cases of gastroschisis with accompanying bladder herniation reported in the literature. Bladder perforation had developed in only one of these published cases.^[4] Perforation may also occur in newborns suffering from severe infection and sepsis.^[3]

Although VCUG is important for diagnosing bladder disorders, it may cause bladder perforation during the procedure. There are two prior case reports in which patients developed bladder perforation during a VCUG.^[12] VCUG should be performed under fluoroscopy and without administering any pressurized fluid especially in infants whose bladder muscle tissue is thin. In addition, VCUG should be avoided if there is an underlying condition such as neurogenic bladder.^[13] In our study, bladder perforation also developed following administration of pressurized fluid.

Inguinal hernia repair is the most common type of surgery performed in childhood. Bladder perforation rarely occurs during surgery in the inguinal region (0.08–0.3%).^[5,14-16] At another city institution, one baby boy experienced bladder perforation during inguinal hernia repair due to an incision that was made on the medial side of the inguinal canal. He was referred to our hospital without completion of the inguinal hernia repair and his bladder mucosa was retracted on admission. He also had an intra and extraperitoneal injury secondary to dissection of the bladder mucosa. This complication was not noticed by the initial operating surgeon, and the patient was sent to our hospital because of symptoms of inability to feed, abdominal distention, inability to urinate, and development of early stage acute renal failure on postoperative day 3. Abdominal distention regressed after urinary catheter implantation but during a VCUG, the contrast agent spread to the abdominal cavity indicating a bladder perforation. A large portion of the bladder mucosa, such as a one cm width strip circumferentially, was retracted and excised. The detrusor muscle was also dissected in the initial surgery. A primary repair of the bladder was performed. Although we were only able to partially repair the bladder, bladder integrity was maintained, and we also repaired the patient's inguinal hernia. The patient was discharged on postoperative day 15.

Conclusion

Bladder perforation should always be considered when evaluating patients suffering from pelvic injuries secondary to trauma. Iatrogenic traumas usually cause isolated injuries and may occur due to catheterization, VCUG, or inguinal hernia repair.

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