

Review

## Bladder Injury during Hernia Repair Surgery in Pediatrics: A Review of Literature

Ali Tavoosian<sup>1</sup>, Sana Ahmadi<sup>2</sup>, Seyed Mohammed Jawad Alwedaie<sup>3\*</sup>

<sup>1</sup>Ziaeeian Hospital, Tehran University of Medical Sciences, Tehran, Iran

<sup>2</sup>Urology and Nephrology Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

<sup>3</sup>Royal College of Surgeons in Ireland Medical University of Bahrain, Manama, Bahrain

### HIGHLIGHTS

- Bladder injuries can occur due to several etiologies, such as traumatic injuries, abdominal surgeries, or even idiopathic.
- One of the most common causes of bladder injuries in pediatrics is abdominal surgeries.
- Several types of iatrogenic bladder injuries were reported that surgeons pay more attention to the specific anatomy of the bladder in kids.

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#### \*Corresponding Author:

Seyed Mohammed Jawad Alwedaie

Email: [Alwedaie@gmail.com](mailto:Alwedaie@gmail.com)

Address: Royal College of Surgeons in Ireland Medical University of Bahrain, Manama, Bahrain.

### ABSTRACT

#### Introduction

Bladder injuries can occur due to several etiologies, such as traumatic injuries, abdominal surgeries, or even idiopathic. One of the most common causes of bladder injuries in pediatrics after traumatic events is abdominal surgery, especially hernia repair surgery.

#### Methods

Several types of iatrogenic bladder injuries due to hernia repair surgery were reported again to suggest that surgeons pay more attention to the specific anatomy of the bladder in kids during supra-pubic and abdominal surgeries, especially the hernia repair surgery.

#### Results

Our analysis showed that most cases were not diagnosed before 24 hours post-operation (61%). Bladder injury has specific symptoms so it can be misdiagnosed. Nine reports claimed that the surgeons found out about the bladder injury right after the injury happened during the surgery. All intraoperative diagnosed cases had their bladder repaired during the inguinal hernia surgery. Most cases were boys (21), 2 were girls, and eight did not mention gender. Most kids (55%) experienced severe or at least moderate to severe symptoms of bladder injury. Three kids passed septic shock as a severe adverse effect of bladder injury.

#### Conclusion

Several types of iatrogenic bladder injuries due to hernia repair surgery were reported again to suggest that surgeons pay more attention to the specific anatomy of the bladder in kids during supra-pubic and abdominal surgeries, especially the hernia repair surgery.

**Keywords:** Bladder Injury; Pediatrics; Hernia

#### Introduction

Bladder injury (BI) is not a life-threatening situation but is one of the most frequent unwelcome events happening during abdominal surgery (1). Inguinal hernia repair is one of the common surgeries in pediatrics. It is a non-complicated procedure known as an “intern case” with a

very short recovery time (2). However, bladder injury is one of the most important complications that can happen due to hernia repair in adults and pediatrics (3, 4).

In this review article, we discuss bladder injury cases as an iatrogenic complication of inguinal hernia repair in pediatrics.

## Methods

We searched in the PubMed database with these keywords; “bladder injury, inguinal hernia repair, herniorrhaphy. The extracted article list is available in the references part of this paper. We characterize the cases based on age, gender, extent, type of injury, surgery management, and outcome. Based on previous studies we categorized the cases into two main groups (5): a mild-moderate bladder injury group and a moderate-sever bladder injury group.

## Result

By searching with the mentioned keywords, almost fourteen articles and thirty-one cases were found with bladder injury caused by inguinal hernia repair operations from 1967 to 2022. We divided these cases into two groups.

### Group 1

The mild to moderate bladder injury happened and was diagnosed during the hernia repair surgery or a little while post-operatively. Fourteen cases were presented in this group. All the cases were less than 12 months old at the time of the bladder injury (Table 1).

### Group 2

Moderate to severe bladder injury happened and, in most cases, got diagnosed after surgery. These cases suffered from a high morbidity rate. Some of them needed second and third repair surgery. Seventeen cases were presented in this group, with a mean age of 20 months (Table 2).

Three-quarters of bladder injuries are found postoperatively. The symptoms usually occur less than three days after hernia repair surgery. The most common symptoms are fluid (urinary) seeping from the surgery wound (25%) and anuria (20%). All the injuries diagnosed during the hernia surgery, which is 9 cases, were repaired completely in the same operation. During the post-operation care, seventeen cases were followed up carefully; four cases were followed by measuring the repaired bladder capacity, and all cases, showed a good result in repairing the bladder.

## Discussion

We reviewed 31 cases and divided them into two groups based on the studies suggested. The patients were between four weeks to ten years old (mean age of; 14 months).

The first group, mild to moderate bladder injuries, contains 14 cases; eight (57%) were found during the primary hernia repair surgery. All the patients were less than one year old. Seventeen kids in the second group presented moderate to severe bladder injuries. One of these 17 cases was found during the primary surgery (hernia repair). Only two of the 31 patients were girls, possibly because of the higher incidence of hernias in the male gender.

We also reviewed the cases' follow-up reports. All of

the follow-up reports from the first group show the typical outcome of bladder repair. Reduction of bladder capacity was reported in three cases; all of them suffered from moderate to severe bladder damage. One of the patients needed more than two surgeries for bladder repair. Nine post-operatively patients were detected in the first three days after the hernia repair surgery. The maximum time for diagnosis of the bladder injury in these reports was two years.

However, the most common symptoms kids experienced were fluid leakage from surgery wounds, anuria, and abdominal distention or discomfort. However, some kids suffered severe damage and symptoms like septic shock. We found that the adverse effect of mismanagement and misdiagnosis of bladder injury can be the reduction of bladder capacity and lifetime demand for urine catheterization. Mild injuries happened in fourteen cases of our study, and severe events happened to seventeen kids. Some cases needed a second or third bladder repair surgery (All postoperative symptoms mentioned in Table 3).

Hernia repair surgery is one of the most common minor surgeries for children (6, 7). Experiences showed that the risk of bladder injury, as an injury with a high morbidity rate, is significant, especially in younger babies (5, 8). One of the most important reasons for bladder injury during inguinal hernia surgery is confusing the bladder with a hernia. However, how can they be mistaken? A structure in some kids' bladders is called the “bladder ear. The bladder.” Ear is a physiologic condition described as a transient protrusion of the urinary bladder into the deep part of the inguinal ring. It can mimic the hernia of the inguinal ring. Surgeons can cause severe damage to the bladder by mistaking the bladder ear for a hernia sac (9).

However, bladder injuries are not a life-threatening condition, but patients with bladder injuries suffer from high morbidity and sometimes lifetime disability for voiding normally. The Bladder injury has non-specific symptoms, but the most frequent symptoms due to bladder injury are Anuria or difficulty in voiding, Suprapubic tenderness, and Hematuria (10). Based on the type of bladder injury, surgeons can fix it operatively or through catheter drainage and other minimally invasive procedures (11).

Based on our findings, all cases happened due to open inguinal hernia surgery. So, we suggest laparoscopic or robotic hernia repair to minimize the risk of urinary bladder injury or any other kind of urinary system injuries.

The most important limitation of this study is that most of the reports did not mention enough about the hernia repair surgery process, the baby's health condition in the first place, how advanced surgeons and hospitals are, surgeons' experience, and so many important details about the bladder injury. Meanwhile, we suggest that all surgeons in any inguinal hernia repair procedures be aware of the risk of bladder and urinary system injuries,

**Table 1.** Mild to Moderate injury

Reference	Time to diagnosis	Sign and symptom	Age (month)	Gender	Presentation of injury	Management	Follow-up
(3)	Intraoperative	-	Unknown	Male	Bladder dissection	Immediate bladder repair+ suprapubic drainage	6d later discharged
(3)	Post-operative	Hematuria, urinary seeping from a wound	Unknown	Male	A suture passing the bladder ear	suprapubic drainage	7d later discharged
(3)	Post-operative	Hematuria, urinary seeping from a wound	Unknown	Male	A suture passing the bladder ear	suprapubic drainage	7d later discharged
(12)	Intraoperative	-	4	Male	Bladder perforation	Immediate bladder closure	2y later: Normal
(13)	Post-operative	Unknown	9	Unknown	Unknown	Unknown	-
(14)	Post-operative	urinary seeping from a wound	Infant	Male		Transurethral drainage	-
(14)	Post-operative	urinary seeping from a wound	Infant	Male		Transurethral drainage	-
(14)	Post-operative	urinary seeping from a wound	Infant	Male		Transurethral drainage	-
(15)	Intraoperative	-	Infant	Unknown		Immediate bladder closure	-
(15)	Intraoperative	-	Infant	Unknown		Immediate bladder closure	-
(15)	Intraoperative	-	Infant	Unknown		Immediate bladder closure	-
(15)	Intraoperative	-	Infant	Unknown		Immediate bladder closure	-
(15)	Intraoperative	-	Infant	Unknown		Immediate bladder closure	-
(15)	Intraoperative	-	Infant	Unknown		Immediate bladder closure	-

**Table 2.** Moderate to Severe injury

References	Time to diagnosis	Sign and symptom	Age (month)	Gender	Presentation of injury	Management	Follow-up
(12)	Post-operative		13	Male	Partial necrosis and resection of the bladder wall, both ureter injury	Sigmoido-colo cystoplasty (SCP), bilateral ureteral reimplantation	1y later: bladder capacity 220ml
(12)	6 days post-op	septic shock, acute abdomen	6	Male	Bladder perforation, urinary peritonitis	Delayed bladder closure	18m later: Normal
(12)	2 years post-op	Recurrent UTI, urinary reflux	3	Male	Extended bladder rupture	SCP, bilateral ureteral reimplantation	-
(13)	Unknown	Unknown	3	Unknown	Partial bladder resection	Unknown	
(14)	Post-operative	Unknown	120	Male	Old threads found in the bladder wall during the bladder diverticulum surgery	Unknown	Unknown
(15)	3days post-op	Free fluid seeping from surgery wound, Hematuria, Fever, Elevated labs, Abdominal distention, Vomiting	3	Male	Bladder perforation in the left wall	Delayed bladder closure	3y later: Normal

References	Time to diagnosis	Sign and symptom	Age (month)	Gender	Presentation of injury	Management	Follow-up
(16)	2days post-op	Abdominal distention, Abdominal tenderness, Anuria, Fever, Vomiting, Dehydration,	3	Female	Subtotal resected bladder	Subtotal cystostomy bladder closure	2m later: bladder capacity 5ml
(17)	24h post-op	Abdominal distention, Abdominal wall, genitalia edema, Anuria, Elevated labs	18	Male	Subtotal bladder resected	Delayed bladder closure	6m later: Normal
(18)	24h post-op	Urine seeping from the surgery wound	84	Male	A defect in the bladder wall sutured to the inguinal ring	Delayed bladder repair	Normal
(19)	24h post-op	Fluid seeping from surgery wound, UTI	3	Male	Partial bladder resection	Delayed bladder closure, SCP, bilateral ureteral reimplantation	20y later: bladder capacity 1200ml
(20)	2days post-op	Anuria, Fever, Rash, Elevated labs	18	Female	Subtotal bladder resection, ureters removed	Unknown	-
(21)	Intraoperative	-	10	Male	Bladder opened accidentally	Immediate bladder closure	2y later: Normal
(22)	3days post-op	Anuria, Abdominal distension, Abdominal tenderness	18	Male	Partial bladder resection	Delayed bladder closure cystostomy	15d later: discharged with normal condition
(23)	24h post-op	Abdominal distension	1	Male	Subtotal bladder resection	Delayed bladder repair	1y later: bladder capacity 60ml/ 2.5y later: Normal
(23)	24h post-op	Anuria	1	Male	Total bladder resection, bilateral ureter resection	Delayed repair surgery, bilateral ureterocele-cystoplasty	6m later: Normal
(24)	Unknown	Anuria, Frequency	Unknown	Male	Para vesical abscess, Sutures for ligation fixed to the bladder wall	Abscess drainage, sutures removed	5y later: Normal
(24)	Unknown	Anuria, Frequency	Unknown	Male	Para vesical abscess, Sutures for ligation fixed to the bladder wall	Abscess drainage, sutures removed	5y later: Normal

**Table 3.** Symptoms (in 21 postoperatively diagnosed patients)

Post Operative Symptom	Number	%
Fluid leakage from the surgery wound	8	36
Abdominal discomfort	8	36
Anuria	6	27
Septic shock	3	13
Elevated in lab data	3	13
Fever	3	13
hematuria	2	9

Note: Symptoms in 21 postoperatively diagnosed patients. Some patients had more than two symptoms.

mainly due to the bladder mimicking the hernia sac.

### Conclusions

Founded cases of bladder injury due to hernia repair surgery experienced a broad spectrum of signs and symptoms, from minor ones like surgery wound abnormality to severe complications such as sepsis. Most of the cases recovered well, but they will suffer from significant life-long complications, especially a reduction of the bladder size. So, we are suggesting that surgeons be aware of the anatomical variations in children's urogenital systems and try to minimize these

adverse effects of urogenital surgeries by using the most advanced instruments and techniques.

#### Authors' contributions

All authors contributed equally.

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#### Conflict of interest

The author declares that there are no conflicts of interest.

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Not applicable.

#### Data availability

Data will be provided on request.

#### Abbreviations

BI Bladder injury

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**Author (s) biosketches**

**Tavoosian A**, Assistant Professor, Ziaieian Hospital, Tehran University of Medical Sciences, Tehran, Iran.

Email: [alitivooosian@gmail.com](mailto:alitivooosian@gmail.com)

**Ahmadi S**, MD, Urology and Nephrology Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Email: [sanaahmadi750525@gmail.com](mailto:sanaahmadi750525@gmail.com)

**Alwedaie SMJ**, MD, Royal College of Surgeons in Ireland Medical University of Bahrain, Manama, Bahrain.

Email: [Alwedaie@gmail.com](mailto:Alwedaie@gmail.com)

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