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Demographics of Bladder Injury and the Role of Cystography: A 7-Year Review of Trends in New South Wales, Australia

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ABSTRACT

INTRODUCTION: Patients who sustain direct bladder trauma are at significant risk of bladder rupture. Contemporary literature supports conservative management for extraperitoneal (EP) bladder rupture using catheterized bladder drainage, and surgical repair with postoperative catheterization for intraperitoneal (IP) bladder rupture. A cystogram is standard practice for evaluating the integrity of the bladder prior to catheter removal, but indications and timing are not clearly defined. The aim of this retrospective study was to review the types of bladder injury and the results of cystography follow-up.

METHODS: A total of 15,046 patients were admitted to the authors' hospitals with traumatic injuries (including iatrogenic injuries) between January 2000 and March 2006. Patients with isolated, noncomplex bladder injuries were further evaluated for age, sex, cause of the injury, diagnostic methods used, type of management, follow-up results, and complications.

RESULTS: A total of 40 patients (0.03%) had isolated bladder injuries. The median age was 40.9 years. There were 24 males and 16 females. The bladder injuries were iatrogenic in 18 patients (45%), due to blunt trauma in 16 patients (40%), and due to penetrating gunshot wounds in 6 patients (15%). Of the 18 iatrogenic injuries, 12 were secondary to gynecological procedures; 14 of the 16 blunt trauma injuries were secondary to motor vehicle accidents. IP bladder ruptures were found in 24 patients (60%); EP bladder ruptures were found in 16 patients (40%). All patients underwent either surgical (70%) or conservative (30%) management and follow-up fluoroscopic cystography 7-21 days later. All cystograms were normal.

CONCLUSION: Iatrogenic and blunt injury represented the majority of bladder injuries. Follow-up cystograms were all normal and may not be required if catheter removal is planned after 14 days of drainage and the patient is asymptomatic. This recommendation applies to conservatively managed isolated EP and surgically repaired noncomplex IP bladder injuries only.

KEYWORDS: Cystography; Urinary bladder; Intraperitoneal and extraperitoneal injury; Iatrogenic

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Abbreviations and Acronyms

CT = computed tomography
IDC = indwelling disposable catheter
EP = extraperitoneal
IP = intraperitoneal

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original study

Demographics of Bladder Injury and the Role of Cystography: A 7-Year Review of Trends in New South Wales, Australia

INTRODUCTION

Patients who sustain direct blunt trauma to the lower abdomen are at significant risk of urinary bladder rupture [1]. Contemporary literature supports conservative management using catheterized bladder drainage for extraperitoneal (EP) bladder rupture [2]. In contrast, surgical repair with postoperative catheterization remains the standard of care for intraperitoneal (IP) bladder rupture [1,2].

A cystogram is regarded as standard practice to evaluate the integrity of the bladder prior to catheter removal after surgical or conservative bladder trauma management. However, indications and timing of cystograms are not clearly defined in the current literature [1]. The purposes of the present study were to: (1) review the types of bladder injury seen in a large metropolitan urology center, (2) evaluate bladder integrity and the need for cystography after conservative or surgical management of isolated EP injuries and surgical repair of isolated IP bladder injuries.

METHODS

A total of 15,046 patients were admitted to the authors' hospitals with traumatic injuries (including iatrogenic injuries) between January 2000 and March 2006. They were all registered in the hospital trauma and operative database.

The database was examined retrospectively for type of injury, and patients with isolated bladder injuries were further evaluated. The authors excluded patients with complex bladder injuries, such as those with trigonal, ureteric, urethral, vaginal, or rectal damage, prolonged indwelling catheter in situ, or concomitant pelvic ring fracture. For the remaining patients with isolated, noncomplex bladder injuries, the examined variables were age, sex, cause of the injury, diagnostic methods used, type of management, follow-up results, and complications.

RESULTS

Patient Sample

Out of the 15,046 patients with traumatic injuries, 40 patients (0.03%) sustained noncomplex, isolated bladder injury. The median age was 40.9 years (range, 18-78 years). There were 24 males and 16 females.

Table 1 contains information about the causes of the bladder injuries. The bladder injuries were iatrogenic in 18 patients (45%), due to blunt trauma in 16 patients (40%), and due to penetrating gunshot wounds in 6 patients (15%). The 18 iatrogenic cases were due to gynecological, surgical, and urological causes. Six of the 12 gynecological injuries were the result of vaginal hysterectomy. The surgical injuries were due to laparoscopic appendicectomy, open herniorrhaphy, and endoscopic bladder biopsy and diathermy for superficial transitional cell carcinoma of the bladder. The blunt bladder injuries were due to motor vehicle accidents and a fall from a high level.

Table 1. Causes of Bladder Injuries in Patient Sample (N = 40). doi: 10.3834/uij.1944-5784.2010.06.20t1

Cause	n	%N
Iatrogenic	18	45
Gynecological	12	
Surgical	4	
Urological	2	
Blunt trauma	16	40
Motor vehicle accident	14	
Fall from high level	2	
Penetrating gunshot wound	6	15

IP bladder ruptures were found in 24 patients (60%); EP bladder ruptures were found in 16 patients (40%). Table 2 contains a list of the injuries associated with all bladder ruptures. The most common injury was a pelvic fracture, which occurred in 19 patients (48%). Other injuries associated with bladder rupture were a motor vehicle accident, fall from a high level, gunshot wound, and small bowel injury.

Diagnostic Methods

The bladder injuries were diagnosed by surgical exploration (65%), computed tomography (CT) cystogram (30%), and conventional cystogram (5%). The numbers of patients with iatrogenic injuries, blunt trauma, and penetrating gunshot wounds that were diagnosed by each of these modalities is contained in Table 3.

Management and Follow-up Cystography

Overall, 70% of the injuries were repaired surgically, including all IP bladder ruptures. There were 24 laparotomies (2 through inguinal hernia repair and 2 through laparoscopic repair during ovarian cyst removal). The remaining 30% were EP injuries (10 patients with blunt trauma; 2 patients with penetrating injuries). These patients were treated conservatively with indwelling disposable catheter (IDC) drainage. The drainage was used for a median of 14 days (range, 7-21). The mean hospital stay was 12 days for patients with IP bladder ruptures and 9 days for patients with EP bladder ruptures.

All patients underwent a follow-up fluoroscopic cystogram,

Table 2. Injuries Associated With Bladder Rupture (N = 40). doi: 10.3834/uij.1944-5784.2010.06.20t2

Cause	n
Pelvic fracture	19
Motor vehicle accident	14
Penetrating gunshot wound	3
Fall from high level	2
Small bowel injury	2

scheduled 7-21 days from the time of their injury and prior to catheter removal. The cystogram was standardized with a total of 300-400 mL of nonionic iodine contrast that was instilled at a 1 meter height above the supine patient. X-ray views were obtained using anteroposterior, oblique, 2 lateral, and postdrainage films. The results were reported by experienced consultant radiologists. All follow-up cystograms were normal.

Complications

A total of 4 patients with IP injuries developed vesicovaginal fistulae with clinical symptoms a few weeks after IDC removal. The pathology for these 4 patients was endometrial cancer (n = 2) and severe uterine endometriosis (n = 2). A total of 3 patients with EP injuries had complications: 2 patients developed a urinary tract infection due to Escherichia coli, and 1 patient developed a pulmonary embolism that was treated medically.

DISCUSSION

Use of the conventional (retrograde) cystogram for patients with bladder injuries has been debated since before the turn of the century. Most urologists consider cystography the diagnostic procedure of choice [1-3]. CT cystography has replaced conventional cystography in the evaluation of patients with suspected bladder rupture in most trauma centers, despite earlier reports of CT limitations [4,5]. Chan et al [5] described their experience with modern CT cystography with multiplanar reformation. For EP bladder rupture, the sensitivity and specificity were 92.8% and 100%, respectively; for IP rupture, the sensitivity and specificity were 100% and 99%, respectively. The multiplanar CT cystogram is used as part of the work-up for the stable trauma patient and is considered the current diagnostic tool of choice in all patients with pelvic fracture or abdominal injury [6-9].

Not all trauma centers report using cystography. In 2002, Hsieh et al [10] reviewed all bladder trauma cases in one center. They found that the cystogram was performed in fewer than half of the trauma patients. In addition, patient outcome following treatment of the bladder injury was determined by the severity of the overall injury, rather than by the severity of the bladder injury, specifically.

Review of the contemporary literature showed no consensus regarding the requirement and specific timing of a follow-up cystogram prior to catheter removal in patients with EP and IP bladder injuries [11,12]. It is common practice to perform a cystogram prior to IDC removal, with timing ranging from 7-14 days practiced by most clinicians. Recommendations are not evidence-based.

In the present review, patients with complex bladder injuries were excluded. Cystogram outcomes were reported for all isolated, noncomplex EP and IP bladder injuries. In the authors' hospitals, there is no protocol for the timing of follow-up cystogram for EP and IP bladder injuries; timing is individualized to the preference of each surgeon. All patients underwent a cystogram at an average 14 days (range, 7-21 days) after both conservative management and surgical repair of the bladder. Despite the considerable timing difference in the follow-up cystogram, all were reported normal.

Do all patients with bladder injury need a CT cystogram? It is estimated that the radiation exposure from an abdominal CT is equivalent to that of 500 chest x-rays, and a CT of the abdomen and pelvis is equivalent to 1000 chest x-rays. In addition, it is estimated that 1 in 1000 patients may die from cancer

Table 3. Modalities Used to Diagnose the Different Types of Bladder Injuries (N = 40). doi: 10.3834/uij.1944-5784.2010.06.20t3

Diagnostic Modality	Iatrogenic (n)	Blunt Trauma (n)	Gunshot Wound (n)	Total (%N)
Surgical exploration	16	6	4	65
Computed tomography cystogram	2	8	2	30
Conventional cystogram	0	2	0	5

because of the radiation exposure associated with a single noncontrast abdominopelvic CT scan [13]. These estimations should be considered when planning an imaging modality. If clinical evidence does not indicate extravasations and the total healing of all injuries and catheter removal can be safely deferred till after 14-21 days, should conventional cystoscopy be chosen for the lack of radiation risk? One can only wonder if patients should be counseled about choosing one method over the other. One interesting emerging modality is ultra low-dose CT imaging (7.5 mA seconds) for ureteric stones [13]. Whether it can offer equivalent sensitivity and specificity for detecting bladder leak is unknown. More studies similar to those performed for detecting ureteric stones will be required for patients with bladder leak.

Although the present study is a retrospective analysis, the results indicated that there may be little advantage to doing any follow-up cystograms for isolated bladder injuries that were surgically or conservatively managed because all follow-up cystograms were normal. After 14 days of catheterization, the injuries should have healed. Therefore, if the patients have no clinical symptoms, choosing not to perform a cystogram would avoid additional pain, possible radiation exposure, added cost, or risk of infection. The authors recommend that a cystogram should be performed following repair of more complex bladder injuries.

Of the 40 patients studied, 4 patients with repaired IP bladder injuries who underwent vaginal hysterectomy subsequently developed vesicovaginal fistulae during clinical follow-up. The urologists were not involved in the repair of the bladders of 3 of these patients. Therefore, it is possible that these bladder injuries were not adequately repaired. It is common knowledge that a 7-10 day period of catheterization in radical prostatectomy results in adequate drainage in 90% of patients. An on-table bladder leak test via the IDC during surgery may be an adjunct to prevent delayed fistulas by ensuring a watertight bladder repair.

Finally, there appears to be an increasing trend toward conservative treatment for selected cases of IP bladder injuries in the literature, as is the case in the unstable and clinically comorbid patient. This trend was not observed in the present small cohort. However, 2 of the patients with gunshot injuries were managed conservatively with good outcome. Nonoperative treatment for isolated IP bladder injury in children is justified [14].

Kim et al [15] and Corriere and Sandler [16] recommended that all patients with IP bladder rupture should have formal repair. They advised that EP bladder ruptures be treated with catheter drainage if the urine clears of blood promptly, the catheter drains well, and the bladder neck is not involved in the injury. Otherwise, formal repair was considered mandatory via open or occasionally laparoscopic approach.

CONCLUSION

A review of bladder injuries in the authors' center showed a shifting trend in imaging bladder injury from conventional to CT cystogram over 7 years. This trend is consistent with the existing literature. Follow-up cystograms after surgical or conservative management were all normal. The authors hypothesize that follow-up cystograms may not be required if catheter removal is planned after 14-21 days of drainage for isolated, noncomplex IP or EP bladder injuries.

Conflict of Interest: none declared

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