

Evaluating the Role of Operative Repair of Extraperitoneal Bladder Rupture Following Blunt Pelvic Trauma

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Purpose: Catheter drainage has become a standard management strategy for extraperitoneal bladder rupture from blunt trauma. However, data are lacking critically comparing outcomes between operative and nonoperative management. In this study we evaluate management strategies and identify risk factors for complications.

Materials and Methods: Patients with uncomplicated extraperitoneal bladder rupture due to blunt trauma from 2000 to 2014 were identified from our trauma registry. Initial management consisted of early cystorrhaphy or catheter drainage. Outcomes analyzed were incidence of inpatient complications, length of stay and time to negative cystography. Subgroup analysis was performed comparing outcomes between patients who did vs did not undergo cystorrhaphy during nonurological operative intervention.

Results: A total of 56 patients treated with catheter drainage and 24 who underwent early cystorrhaphy were identified. All early cystorrhaphies were performed as secondary procedures during nonurological interventions. There was no difference in demographics, complications, median intensive care unit or median hospital length of stay between the groups. Subgroup analysis comparing patients who did vs did not undergo cystorrhaphy during nonurological operative intervention showed that patients without cystorrhaphy experienced higher rates of urological complications ($p < 0.05$), increased intensive care unit (9.0 vs 4.0 days, $p = 0.0219$) and hospital (18.9 vs 10.6 days, $p = 0.0229$) length of stay, as well as prolonged time to negative cystography (25.5 vs 20.0 days, $p = 0.0262$).

Conclusions: Conservative management of simple extraperitoneal bladder rupture with catheter drainage alone results in equivalent outcomes relative to operative repair in most patients. However, for those undergoing operations for other indications, cystorrhaphy decreases the risk of complications and is associated with decreased intensive care unit and hospital length of stay.

Key Words: urinary bladder, rupture, pelvis, wounds and injuries, wound healing

Abbreviations and Acronyms

CD = catheter drainage
EC = early cystorrhaphy
ICU = intensive care unit
ISS = injury severity score
ORIF = open reduction with internal fixation

Accepted for publication August 21, 2015.

No direct or indirect commercial incentive associated with publishing this article.

The corresponding author certifies that, when applicable, a statement(s) has been included in the manuscript documenting institutional review board, ethics committee or ethical review board study approval; principles of Helsinki Declaration were followed in lieu of formal ethics committee approval; institutional animal care and use committee approval; all human subjects provided written informed consent with guarantees of confidentiality; IRB approved protocol number; animal approved project number.

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Editor's Note: This article is the fifth of 5 published in this issue for which category 1 CME credits can be earned. Instructions for obtaining credits are given with the questions on pages 810 and 811.

BLUNT pelvic trauma represents approximately 10% of all traumatic injuries, with injury to the lower urinary tract a rare associated complication.¹ Although previous

series suggest that up to 10% of patients with blunt pelvic trauma will have concomitant bladder ruptures, more recent studies using the National Trauma Data Bank suggest

the contemporary incidence of bladder rupture to be only 3.4%.^{2,3} When bladder ruptures do occur, approximately two-thirds of these are extraperitoneal.⁴

Historically, extraperitoneal ruptures were managed with operative repair. However, there was a shift in the 1970s and 1980s to conservative management with CD after the publication of several case series demonstrating acceptable outcomes and minimal morbidity relative to operative repair.^{5,6} However, subsequent reports have suggested that nonoperative management may in fact increase the incidence of complications including infection, persistent urinary extravasation, long-term catheterization and the development of urinary fistulas.^{7,8} As such, numerous authors have advocated for bladder repair in any patient undergoing surgical intervention.⁷⁻¹⁰

To our knowledge, there are no published data that objectively compare outcomes between those treated with EC vs CD. In this study we evaluate whether patients with extraperitoneal bladder rupture secondary to blunt trauma who underwent early cystorrhaphy had improved outcomes and fewer complications compared to those treated with catheter drainage alone in a large single institution series. In addition, we determined if nonurological operative intervention represents an indication to proceed with cystorrhaphy by evaluating differences in outcomes between patients who did vs did not undergo bladder repair at that time.

METHODS

Retrospective review of our prospective, single institution trauma registry of the American College of Surgeons database was performed to identify all patients admitted to a large, regional, level 1 trauma center between January 2000 and June 2014. The registry was queried to identify patients with injuries to the lower urinary tract as a result of blunt trauma, indicated by ICD-9 codes of 867.0 or 867.1. Those who died within 48 hours of arrival or experienced penetrating trauma were excluded from the final study cohort.

Chart review of patients coded with traumatic lower urinary tract injury identified patients with isolated extraperitoneal bladder rupture as demonstrated on computerized tomography cystography, plain film cystography or during operative exploration. Indications for dedicated bladder imaging included gross hematuria, blood at the urethral meatus, radiographic concern on initial trauma series and/or clinical suspicion. Only patients with simple extraperitoneal injuries were included in the study. As such, patients with coexistent intraperitoneal bladder ruptures, bladder neck injuries, urethral injuries or bone fragments in the bladder were excluded from the study.

Demographics, mechanism of injury, arrival condition and hospital course were analyzed. Specifically the

clinical courses of patients with extraperitoneal bladder ruptures treated with CD alone were compared to those who underwent EC as part of the initial management strategy. EC was defined as operative repair of bladder rupture as the principal urological management strategy and before the development of urological complications. The primary end points were the incidence of major urological complications as well as ICU and hospital lengths of stay. The secondary end points included the incidence of minor inpatient complications and time to negative cystogram. Inpatient complications were evaluated using the Clavien-Dindo classification scheme for surgical complications.¹¹ Major urological complications (grade III or higher) were defined as those requiring surgical intervention or resulting in significant patient morbidity. Minor complications (Clavien-Dindo grade II or lower) evaluated included inpatient incidence of pneumonia, urinary tract infection, bacteremia and acute kidney injury. Time to negative cystogram was used as a surrogate marker for time to catheter removal, as the complex nature of the injuries sustained in this patient population often precludes catheter removal despite adequate bladder healing while patients continue to recover from associated injuries. However, due to the retrospective nature of this study, the timing of cystography was determined by the treating physician and was not standardized. Subgroup analysis was performed for all patients who underwent nonurological operative intervention, specifically exploratory laparotomy or ORIF of pelvic fractures, to compare clinical outcomes between those who underwent concomitant cystorrhaphy vs those who did not.

Statistical analysis was performed using Stata®/IC v13.1. Categorical variables were compared using chi-square analysis while continuous variables were compared using Student's t-test. All statistical tests were 2-sided with $p < 0.05$ considered statistically significant. Institutional review board approval was obtained.

RESULTS

Review of the trauma registry revealed 203 individuals admitted during the study period with ICD-9 codes for traumatic bladder injury as a result of blunt trauma. A total of 38 individuals (18.7%) were excluded from analysis as there was no evidence of contrast extravasation on dedicated bladder imaging. Of the remaining 165 patients with bladder rupture 60 (36.4%) had intraperitoneal ruptures, 12 (7.3%) had combined intraperitoneal/extraperitoneal ruptures and 9 (5.4%) had extraperitoneal ruptures with associated urethral disruptions. These patients were excluded from the analysis, as were 4 (2.4%) who died within 48 hours of hospital admission.

Overall 80 patients (48.5%) were identified with confirmed isolated extraperitoneal bladder rupture, including 56 (70%) initially treated with CD alone and 24 (30%) who were treated with EC. The 24 patients who underwent EC had repairs performed

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