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Complications of pelvic ring fixation in patients requiring laparotomy



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ABSTRACT

Background: Pelvic ring disruptions in blunt trauma are rarely an isolated finding. Many individuals needing operative pelvic fixation also require laparotomy for other injuries. Pelvic fixation can be performed by open reduction and internal fixation (ORIF) or external fixation (Ex-fix). Often when a laparotomy incision is present, ORIF is performed by extending this incision. We hypothesized ORIF performed by extending the laparotomy incision would result in higher rates of ventral hernia and wound complications versus Ex-fix.

Methods: All patients admitted from 2004–June 2014 who underwent laparotomy and pelvic fixation either by ORIF through extension of a laparotomy incision (ORIF group) or definitive Ex-fix group were identified. Injury severity score, demographics, associated injuries, and complications were collected.

Results: A total of 35 patients were identified who underwent laparotomy and pelvic fixation, 21 underwent Ex-fix, whereas 14 underwent ORIF through an extended laparotomy incision. There were no differences in injury severity score, demographics, associated injuries, or rate of ventral hernia. The ORIF group had more laparotomy incision infections (50.0% versus 4.8%, $P < 0.01$) and pelvic abscesses (42.9% versus 9.5%, $P < 0.05$). They required more procedures to address their complications (13 versus 5, $P < 0.05$).

Conclusions: Individuals who have undergone laparotomy and pelvic fixation are a complex group of patients with multiple injuries. These data suggest that when surgical repair of a pelvic ring disruption is indicated and the patient has undergone laparotomy, careful consideration to the method of fixation should be given.

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1. Introduction

Pelvic fractures occur in approximately 10% of blunt trauma patients [1]. These injuries are often the result of high energy mechanisms, and the considerable force required to fracture the pelvis is delivered to other areas of the body, frequently

resulting in associated injuries [2]. Additionally, the fractures themselves are associated with significant morbidity and mortality. Approximately 30% of blunt trauma patients with severe pelvic fractures will have an associated intra-abdominal injury and require exploratory laparotomy before definitive treatment of their pelvic fractures [1].

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After stabilization of other life-threatening injuries, definitive surgical fixation of the pelvic ring should be undertaken when indicated. Surgical repair of a pelvic ring disruption depends on whether there is instability of the pelvic ring in the anterior ring, posterior ring, or both. Fixation of posterior ring injuries is frequently achieved with screw fixation, either sacroiliac or transilio–transsacral, either through an open or closed reduction [3]. Stabilization of the anterior pelvic ring can be accomplished by a number of methods, most commonly by open reduction and internal fixation with plating of the pubic symphysis (ORIF) or external fixation (Ex-fix) [4]. The anterior pelvis can be approached either through Pfannenstiel or low midline incision. The Pfannenstiel incision can be extended into an ilioinguinal approach if further dissection is necessary. The low midline approach is most frequently used as a caudal extension of a previous laparotomy performed for intra-abdominal injuries [5]. The use of Ex-fix of the pelvis can be temporary or definitive [4]. With fixation of the pelvis, patients' weight-bearing is limited for a period of between 8 and 12 wk to allow for sufficient healing, limiting the risk of fixation failure and displacement.

Although complications from each method have been described, a review of the literature [6–9] shows no recent articles pertaining to the timing or method of anterior pelvic ring fixation in those individuals who have recently undergone laparotomy. The optimal method of fixation in this patient population is not known. We hypothesized that ORIF performed through extension of the midline laparotomy incision would result in a clinically relevant increase in rates of ventral hernia and wound complications when compared with definitive Ex-fix. The purpose of this study was to review the methods of anterior pelvic ring stabilization in patients who also underwent laparotomy at the University of New Mexico Hospital and identify any association with subsequent complications.

2. Methods

The Human Research Review Committee at the University of New Mexico Health Sciences Center approved the study design and the retrospective review. The University of New Mexico Hospital trauma database was used to identify all patients with a pelvic fracture, identified by International Classification of Diseases, Ninth Revision codes, and who had an exploratory laparotomy, identified by current procedural terminology code, admitted from January 2004–June 2014. Patients who were evaluated and stabilized at another hospital and subsequently transferred to our facility were included. Each patient's chart was then reviewed to determine if they underwent only laparotomy without pelvic fixation, laparotomy and ORIF, or laparotomy and Ex-fix of their pelvic fractures. Those only undergoing laparotomy were excluded.

The University of New Mexico Hospital trauma database was used to obtain age, sex, length of stay, associated injuries, abbreviated injury scale scores for each anatomic system, injury severity score (ISS), and mechanism of injury. Two independent reviewers then performed a retrospective review of the identified charts, and a number of other criteria were extracted in an effort to reflect the severity of the injury for

each patient. These included the systolic blood pressure, temperature, and heart rate obtained at initial evaluation in the emergency department. The total number of packed red blood cells, fresh frozen plasma, and platelets administered in the first 24 h and during the entire hospitalization was recorded as was the need for angioembolization of the pelvis. Additionally, the indication for laparotomy, the presence of a bowel injury, the presence of a bladder injury, the number of days from laparotomy to pelvic fixation, and the number of days the patient had an open abdomen were recorded.

Complications associated with the method of fixation were extracted from the record. These included ventral hernia, laparotomy incision infection, pelvic abscess, fascial dehiscence, and death. Complications were defined as present before discharge from the initial hospital admission. Additional operative or interventional procedures performed before discharge from the initial hospital admission to manage a complication related to the method of fracture stabilization were collected.

The patient's length of stay in days and discharge disposition was recorded as long-term acute care hospital (LTAC), skilled nursing facility, inpatient rehab, or home. Discrepancies in the extracted data set were discussed and reconciled by the reviewers. Additionally, two orthopedic surgeons reviewed the computed tomography imaging for each pelvic fracture and classified them according to the Young–Burgess system. Two acetabulum fractures were included in this study as the laparotomy incision was used for exposure and fixation. Any discrepancies encountered were similarly discussed and reconciled by the two orthopedic surgeons.

Patients who had a temporary external fixator placed who subsequently underwent ORIF were placed in the ORIF group. Similarly, if a patient had a temporary external fixator placed, which was converted to a definitive external fixator, they were placed in the Ex-fix group.

Statistical analyses were carried out using the Mann–Whitney *U*-test for continuous variables, and the Fisher exact test was used to determine statistical significance of categorical data.

3. Results

During the 10-y review period, 38 patients met inclusion criteria of operative pelvic fracture with exploratory laparotomy. Three were excluded secondary to undergoing ORIF of the pubic symphysis through a separate Pfannenstiel incision. Fourteen patients underwent laparotomy and ORIF of the anterior pelvis through a caudal extension of their laparotomy for definitive pelvic fixation (ORIF group). Twenty-one underwent laparotomy and definitive anterior Ex-fix group. There was no difference in the age, length of stay, ISS, or gender. Additionally, there was no difference in initial heart rate, systolic blood pressure, or temperature. There was a statistically significant difference between the body mass index (BMI) of the two groups with the ORIF group having a higher BMI of 32.4 versus 27.2 ($P < 0.01$) as seen in Table 1.

Review of associated injuries demonstrated no difference in the presence of bowel injury, genitourinary injury, or need for pelvic artery embolization. The indication for laparotomy

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