Role of Acute Negative-Pressure Wound Therapy Over Primarily Closed Surgical Incisions in Hip, Pelvis, and Acetabular Fracture Surgery: A Prospective Randomized Trial

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Purpose: This trial was conducted to determine the effectiveness of using negative-pressure wound therapy (NPWT) over primarily closed surgical incisions used for open reduction and internal fixation (ORIF) of hip, pelvis, and acetabular fracture surgery in decreasing postoperative surgical wound drainage, infections, and hospital stay in a cost-effective manner when compared to standard gauze dressings.

Methods: After IRB approval, 115 patients who underwent an open surgical exposure for hip, pelvis, or acetabular fracture ORIF were prospectively randomized to either receiving standard gauze or negative-pressure dressing applied over the primarily closed incision sterilely in the operating room. NPWT was left on for 2 days or longer if drainage continued. Patients were followed for 12 months. Prospective data points collected include patient demographics, mechanism of injury, fracture type, surgical approach, type of surgical closure, associated injuries and procedures, Injury Severity Score, body mass index (BMI), depth of subcutaneous adipose tissue, condition of soft tissue associated with surgical approach, deep venous thrombosis prophylaxis, ICU stay, antibiotic use, hospital stay, dressing changes, length of wound VAC (vacuum-assisted closure) use, superficial and deep infection, skin maceration/wound breakdown, and drainage. The primary end point was deep infection.

Results: 55 patients were randomized to the NPWT group and 60 patients randomized to the standard dressing group. The NPWT group included 49 patients and the gauze group included 42 patients who completed the 12-month follow-up. The rate of deep infection in the NPWT group was 5/49 (10.2%) and 2/42 (4.8%) in the gauze group ($P = 0.44$). The odds ratio showed that NPWT patients were 2.3 times more likely to develop a deep infection. BMI was not associated with an increased risk of infection ($P = 0.54$). Patients with eventual infections spent a significantly longer time in the ICU ($P = 0.015$) and had a longer hospital stay ($P = <0.001$) during their initial admission. All infections occurred in acetabular fractures that involved the posterior wall or column requiring a Kocher-Langenbeck surgical approach.

Conclusion: In a randomized prospective trial, NPWT use over a primarily closed surgical incision potentially increases the risk of deep infection when compared to gauze dressings in this patient population. This is contrary to a previously published retrospective case series. All deep infections occurred in patients with acetabular fractures involving the posterior wall or column that were treated with a Kocher-Langenbeck surgical approach regardless of BMI.

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Early Treatment of Associated Pattern Acetabular Fractures Via an Anterior Approach Does Not Increase Blood Loss or Need for Transfusion

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Background/Purpose: Despite strong support for early total care in adequately resuscitated patients with long bone fractures, there remain limited data to suggest appropriate timing for surgical fixation of associated pattern acetabular fractures due to concern for excessive procedure-related blood loss. Fracture patterns involving displacement of acetabular columns are associated with considerable blood loss, particularly from exposed cancellous surfaces, which can be difficult to control intraoperatively. Delay to surgery has been hypothesized to limit this low-pressure bony bleeding. The purpose of this study is to determine relationship of the timing of surgery on blood loss and transfusion requirements for associated pattern acetabular fractures stabilized through an anterior surgical approach.

Methods: A retrospective review of our Level I trauma center records from 2006 to 2012 identified 130 patients with associated pattern acetabular fractures classified by the system of Letournel as: associated both-column (ABC), anterior column posterior hemi-transverse (ACPHT), or T-type fractures treated operatively via ilioinguinal or modified ilioinguinal approach. Data points collected include patient demographics (sex, age), body mass index (BMI), past medical history (PMH), and time from emergency department (ED) admission to surgery. Our outcome measures were estimated blood loss (EBL), preoperative and post-operative hematocrit levels, intraoperative red blood cell (RBC) unit transfusions, 1-week postoperative RBC unit transfusions as a function of the timing of surgery, and total RBC unit transfusions. χ^2 and Fisher's exact test were used for categorical and dichotomous variables. Outcome variables were analyzed with the unpaired *t*-test, Mann-Whitney U, Kruskal-Wallis, and Spearman correlation tests.

Results: No difference in EBL was observed for those patients undergoing surgery in less than 24 hours (n = 11), less than 48 hours (n=34), or less than 72 hours (n = 57) when compared to later ($P = 0.54$, 0.45, and 0.82, respectively). When analyzing time to surgery as a continuous variable, there was no correlation with: EBL (Spearman's rho = 0.013, $P = 0.89$), total RBC unit transfusion (Spearman's rho = 0.07, $P = 0.40$), postoperative hematocrit (Spearman's rho = 0.09, $P = 0.30$), and only a small correlation with intraoperative RBC unit transfusion (Spearman's rho = 0.19, $P = 0.02$). The average EBL was 1440 (±762) cc. The average intra-operative RBC transfusion was 2.8 (±2.4) units. The average total volume transfused RBC was 4.4 (±3.3) units. A post hoc power analysis demonstrated that our sample could detect a difference in EBL of 360 mL.

Conclusion: Our results indicate no relationship between estimated blood loss or total transfusion requirements and timing of operative intervention for associated pattern acetabular fractures treated via an anterior approach. Associated patterns may be treated without delay in patients otherwise able to tolerate the procedure without increasing the risk of excessive blood loss or increasing the utilization of RBC transfusion.

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The Value of Thromboelastography in Orthopaedic Trauma Pelvic Fracture Resuscitation

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Purpose: Thromboelastography (TEG) evaluates real-time hemostatic integrity by measuring the ability of whole blood samples to form a clot. Recent combat and civilian trauma research has demonstrated the value of TEG in directing blood component therapy (BCT) during hemostatic resuscitation. Despite the emerging use of TEG at trauma centers in the United States and Europe, its role in orthopaedic trauma remains largely unknown and unreported in the literature. We describe the use of TEG-guided resuscitation in patients presenting to a Level II trauma center with pelvic fractures, and the financial impact TEG had on directing individualized BCT.

Methods: This study retrospectively reviewed patients with acute pelvic fractures treated with standard fracture care and an index TEG to guide their initial resuscitation. Patients were excluded if they were not classified a trauma activation with a pelvic fracture, age <15 years, ISS <9, and / or if a TEG perfusionist was unavailable. Whole blood samples were drawn and analyzed via TEG for the following stages of clot formation: *initiation* (R measurement: reflective of INR / PTT [international normalized ratio / partial thromblastin time] status), *amplification* (α angle: fibrin and fibrinogen activity), *propagation* (maximum amplitude [MA]: strength of clot through fibrin / platelet contact), and *termination through fibrinolysis* of the clot (LY30 [percentage reduction in MA at 30 minutes]) (Figure 1). Based on prior studies, standard BCT resuscitation was defined as a 1:1:1 ratio of packed red blood cells (PRBCs) to fresh-frozen plasma (FFP) to platelets. We compared the standard BCT ratio to ratios of blood products directed from individualized patient resuscitative needs as defined by the TEG. A cost analysis was performed of the actual transfusion requirements compared to anticipated requirements using the 1:1:1 protocol.

Results: From May 2010 to July 2013, 40 patients met criteria for review. The average age was 44.7 years. All types of pelvic and acetabular fractures were included. The average ISS was 30. In the first 24 hours, the cohort received 282 units of PRBCs, with 250 given in the first 6 hours. FFP requirements were a total of 112 units (105 given in the first 6 hours). 54 single-donor apheresis platelets (SDAP) were given, which translates into 324 units of platelets (42 SDAP given in the first 6 hours). Patients with TEG-guided resuscitation were transfused greater volumes of platelets and RBCs versus FFP ($P = 0.017$). Empirical standard BCT 1:1:1 protocols would have misused 42 units of PRBCs and 212 units of FFP. Given the average price of PRBCs and FFP our institution, TEG-guided resuscitation saved $71,086 in 40 patients.

Conclusion: TEG-guided BCT can individualize orthopaedic pelvic fracture resuscitation with cost effective transfusion requirements. When compared to the standard 1:1:1 BCT resuscitation protocol, TEG-resuscitated patients may be exposed to fewer units of component blood products that may otherwise not improve their resuscitation. The increased institutional costs and potential complications of unwarranted transfusions can have detrimental effects.

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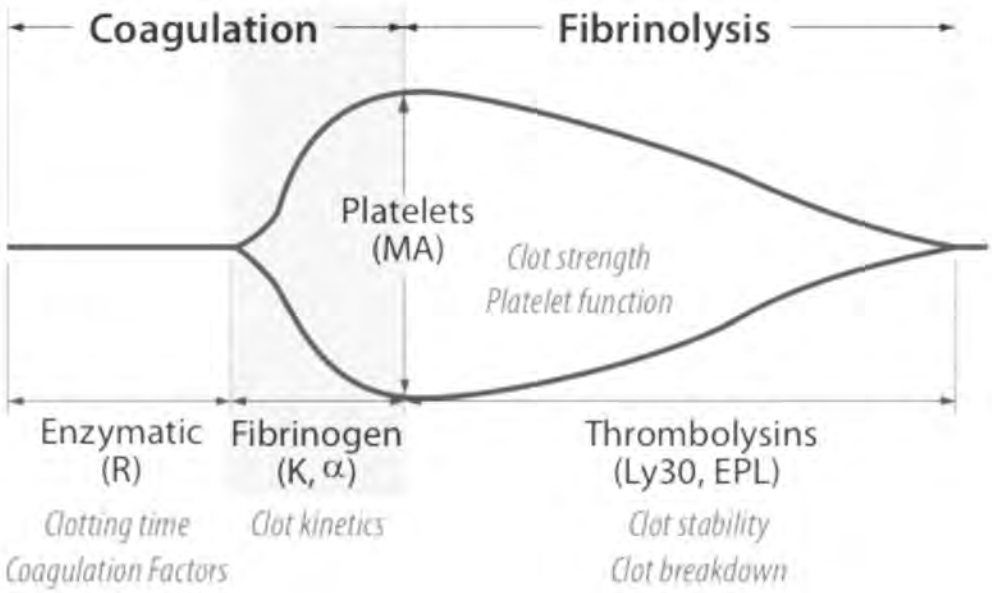
The routine use of TEG may reduce the costs of hemostatic resuscitation in multiply injured trauma patients with pelvic fractures.

Figure 1. Physiologic TEG tracing (reprinted with permission from Haemonetics). EPL = estimated percent lysis.



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Posterior Wall Acetabular Fractures and Stability

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Purpose: The stability of the hip after posterior wall acetabular fractures is difficult to determine radiographically. Historically the percent of the posterior wall involvement was utilized to estimate stability based on cadaveric data. A history of dislocation may also aid in predicting instability. The purpose of this project was to determine if the radiographic parameters of femoral head coverage by the intact posterior wall, acetabular version, and location of fracture or a history of dislocation were determinates of hip stability based on intraoperative fluoroscopic examination after a posterior wall acetabular fracture.

Methods: A retrospective review of prospectively gathered data at a regional Level I trauma center was performed to identify patients who sustained a posterior wall acetabular fracture and underwent a fluoroscopic examination under anesthesia to determine instability. Patients were categorized as either stable or unstable and all comparisons compared these two groups. Measurements obtained using preoperative and postoperative CT scans included: ratio of remaining femoral head coverage at the fovea, cranial exit point of the fracture (mm from dome), roof edge angle, equatorial angle at fracture line, center edge angle, and percent wall involvement based on 3 published methods (Moed, Keith, Caulkin). A history of dislocation in the two groups was also recorded. A positive stress examination was any subluxation on any view of the hip in any position, including flexion, internal rotation, and posterior stress.

Results: 138 total patients underwent fluoroscopic stress examination of the hip under general anaesthesia of which 116 were stable and 22 unstable. Average age in stable group was 39 years old and 41 years in the unstable group. Mechanism of injury included 91 motor vehicle collisions, 6 pedestrian struck, 11 motorcycle collisions, 11 falls, and 19 other mechanisms. Table 1 displays the radiographic parameters studied.

Table 1. Radiographic Parameters

	Dislocations ($P = 0.49$)	Head Coverage at Rovea ($P = 0.7$)	Cranial Exit Point of Fracture ($P = 0.004$)	Roof Edge Angle ($P = 0.85$)	Equatorial Angle at Fracture Line ($P = 0.69$)	Center Edge Angle ($P = 0.97$)	Displaced wall size based on:		
							Moed ($P = 0.02$)	Keith ($P = 0.001$)	Caulkin ($P = 0.96$)
Unstable	15/22 (68%)	33%	5.0 mm	5.2°	13.1°	40.3°	26%	27%	25%
Stable	69/116(59%)	32.7%	9.5 mm	4.8°	12.4°	40.4°	21%	17%	25.3%

Conclusion: Determination of hip stability can be challenging in patients with posterior wall acetabular fractures. While displaced wall fragments over 50% are a reliable indicator of hip instability, radiographic assessment of stability in patients with smaller wall fragments is

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less predictable. Our data suggest that the location of the exit point of the fracture in relation to the dome of the acetabulum may be a radiographic marker that can be utilized to aid physicians in determining stability. Additionally, the presence of a hip dislocation was not associated with instability.

Nonoperative Treatment of Posterior Wall Fractures of the Acetabulum After Dynamic Stress Examination Under Anesthesia: Revisited

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Purpose: Performing an examination under general anesthesia using dynamic stress fluoroscopy (EUA) has been used as a tool to determine hip stability in the acute setting and has been recommended for all fractures with 50% or less of wall involvement. The purpose of this study was to provide additional radiographic and clinical follow-up data, mainly from a source other than the primary advocates of this method, to further evaluate patient outcomes.

Methods: 17 patients with an acute posterior wall fracture who underwent EUA and were found to be stable were treated nonoperatively. Posterior wall fragment size ranged from 6% to 42% with a mean of 24%. Five patients had an associated hip dislocation. Patient follow-up averaged 30 months (range, 6-64 months). Outcome evaluation included the modified Merle d'Aubigné clinical score (MMA) and the Short Musculoskeletal Function Assessment questionnaire (SMFA). Radiographic evaluation consisted of the three standard pelvic radiographs; posttraumatic arthritis was graded according to the criteria described by Matta.

Results: Radiographic evaluation showed all hips to be congruent joint with a normal joint space. 16 of the 17 patients had radiographic outcomes rated as "excellent"; one patient was rated "good" due to the presence of slightly increased sclerosis as compared to the normal side. The MMA could be obtained in 12 patients and the average score was very good, with only one having less than a good clinical outcome (fair). There was essentially no correlation between MMA and fracture size and there was no significant difference between those with or without history of hip dislocation. The patient's SMFA scores (from 11 patients, see table below) were not significantly different from the reported SMFA normals for all indices and categories (Z-test).

Conclusion: This study further supports the contention that hip joint stability after a posterior wall acetabular fracture determined by EUA is predictive of hip joint congruity, an excellent radiographic outcome, and a generally good-to-excellent early clinical outcome after nonoperative treatment. As functional outcome was shown to be not significantly different from normal, performing an EUA appears to be an effective means of determining candidates for nonoperative management of posterior wall fractures of the acetabulum. It should be considered an important evaluative tool for patients with these fractures.

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Short Musculoskeletal Function Assessment Questionnaire Scores

Score	n	Min	Max	Mean	Std. Dev.
Dysfunction Index	11	.00	51.47	20.18	17.2
Daily activities	11	.00	52.50	18.63	20.0
Emotional status	11	.00	64.29	31.17	23.1
Arm/hand function	11	.00	28.13	7.38	11.2
Mobility	11	.00	69.44	24.74	23.1
Bother Index	11	2.08	81.25	25.56	27.8

CT Scan After Acetabulum Fracture ORIF: Is There Value?

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Purpose: In acetabular fracture surgery, failure to obtain an adequate reduction, residual incarcerated osteochondral joint fragments, and intra-articular hardware may result in rapid posttraumatic arthritis. Surgeons utilize intraoperative fluoroscopy and plain radiographs to mitigate these complications; however, these modalities may not provide the same diagnostic accuracy as CT.The purpose of this study was to evaluate the efficacy of routine postoperative CT scan following open reduction and internal fixation (ORIF) of acetabular fractures. We hypothesized that postoperative CT scan following acetabular fracture fixation would identify surgically correctible factors not identified with intraoperative fluoroscopy or plain radiographs.

Methods: A total of 606 consecutive patients who underwent surgical fixation of 612 acetabular fractures were identified from a prospectively collected acetabular fracture database. All patients were evaluated with intraoperative fluoroscopy in addition to three standard plain radiographs (AP pelvis and two 45° oblique Judet views). Reduction and fixation were felt to be adequate and definitive prior to exiting the operative suite based on these imaging modalities. Routine postoperative CT scan of the pelvis was obtained in 563 (93%) of the patients following 569 operative cases. Medical records were reviewed to determine whether postoperative CT scan results prompted revision surgery.

Results: There were no significant differences between index and revision surgery groups with regard to age, gender, body mass index (BMI), fracture pattern, mechanism of injury, or surgical approach ($P > 0.05$). Evaluation of 563 post-operative CT scans of the pelvis resulted in revision acetabular surgery for 2.5% of patients (n = 14). There were six (1.1%) cases of intra-articular hardware not recognized on the intraoperative fluoroscopy or pelvic radiographs. Four (0.7%) patients had residual intra-articular osteochondral fragments deemed too large to leave in the hip joint. There were three (0.5%) cases of unacceptable malreduction, and one (0.2%) case of both malreduction and an intra-articular osteochondral fragment.

Conclusion: A small percentage (2.5%) of patients will benefit from a routine CT scan following acetabular fracture fixation.

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Neurologic Injury in Operatively Treated Acetabular Fractures

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Purpose: Neurologic injury after pelvic fractures is well studied, yet there is a paucity of data regarding the recovery of neural injury in acetabular fractures. Nerve injury in acetabular fractures is typically at the peripheral nerve level rather than at the nerve root and functional recovery may be quite different than in pelvic ring injuries. The purpose of this study is to evaluate a large series of operatively treated acetabular fractures with documented neurologic injury, both fracture-related and iatrogenic, and to track neurologic recovery and outcome.

Methods: All operatively treated acetabular fractures with documented neurologic injury from 8 trauma centers were reviewed in detail. To be included, patients had to be followed for at least 6 months or to neurologic recovery. We excluded patients with associated type 3 posterior pelvic ring injuries, nerve injury unrelated to the acetabular fracture (ie, laceration), spinal cord injury, and preexisting neurologic deficit. Data collected included demographics, injury characteristics, presence of dislocation, and surgical approach. Although these are not root injuries, we documented motor and sensory function by root to clearly document recovery. We tabulated L2-3, L4, L5 and S1 function preoperatively, at 3 months, at 6 months, and at final follow-up. Outcomes included partial or complete recovery, development of CRPS (chronic regional pain syndrome), brace use, and return to work. Motor and sensory injuries were documented separately as either complete (no function) or incomplete (weakness or paresthesias) at all time points.

Results: 137 patients (101 male, 36 female) with an average age of 42 years (range, 17-87) met criteria. Mechanisms of injury included motor vehicle collision (67%), fall from height (11%), motorcycle (9%), and other (13%). The most common fracture types were transverse + posterior wall (33%), posterior wall (23%), and both-column (23%). Median time from injury to surgery was 3 days (range, 0-92), and follow-up was 25 months. The Kocher-Langenbeck (KL) was used in 74%, the ilioinguinal/stoppa in 19%, and 7% were combined. The neurologic deficit was identified preoperatively in 57%, postoperatively with no preop exam (obtunded, etc) in 24%, and was iatrogenic in 19%. Surgical approach (KL versus others) did not have an effect on the development of iatrogenic palsy ($P = 0.8$). A total of 187 motor and/or sensory deficits were identified: 7 in L2/3 (1 complete, 6 incomplete), 18 in L4 (1 complete, 17 incomplete), 114 in L5 (32 complete, 82 incomplete), and 48 in S1 (12 complete, 36 incomplete). Full recovery occurred in 54 (29%), partial recovery in 69 (37%), and 64 (34%)

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had no recovery (Table). Deficits in the sciatic distribution (L5, S1) were least likely to fully recover (26%) and 31% of those with complete injuries had no recovery. Importantly, 48% of iatrogenic injuries did not recover. Hip dislocation had no effect on neurologic recovery ($P = 0.4$). Of L5 deficits that had partial or complete recovery, 36% did so by 3 months and 52% by 6 months. 48 patients wore a brace at final followup, all for L5 dysfunction (48/106, 45%). CRPS developed in 19% (18/94 with data) and 60% (42 of 70 with data) returned to work. Complete versus incomplete injury did not affect development of CRPS ($P = 1$). Nerve recovery had no effect on return to work ($P = 0$ .8).

Table.
Recovery by Functional Level (Both Complete and Incomplete Injuries Included)

Level	No Recovery	Partial Recovery	Full Recovery
L2/3 (n = 7)	2 (29%)	2 (29%)	3 (42%)
L4 (n = 18)	8 (45%)	2 (10%)	8 (45%)
L5 (n = 114)	33 (29%)	51 (45%)	30 (26%)
S1 (n = 48)	21 (43%)	14 (29%)	13 (27%)

Conclusion: Peripheral neurologic injury in operatively treated acetabular fractures is most common in the sciatic nerve distribution. Surgical approach does not influence development of iatrogenic palsy. L5 deficits (extensor hallucis longus, tibialis anterior, and deep peroneal sensation) were most commonly seen in this series and have only a 26% chance of full recovery.

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Does Removal of the Symphyseal Cartilage in Symphyseal Dislocations Have Any Effect on Final Alignment and Hardware Failure?

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Purpose: Multiple factors have been correlated with failure of symphyseal reductions including the use of short plates and the quality of the reduction. The symphyseal cartilage is typically left in place and compression across it is utilized to gain stability. We hypothesized that removal of the cartilage would allow for greater friction with compression creating a more stable construct. The purpose of this study is to compare the results of symphyseal fixation with and without symphyseal cartilage excision.

Methods: We retrospectively evaluated the records and all radiographs of patients at two trauma centers who had APC (anterior posterior compression)-2 or APC-3 injuries with symphyseal dislocation. Bilateral injuries, those with associated acetabular injuries, and those lost to follow-up were excluded. Operative indications were the same for both centers with iliosacral screws used only for type 3 injuries with complete widening and displacement of the posterior ring. Both centers used 6-hole plates through a rectus-sparing approach. One center routinely removed the symphyseal cartilage and the other did not. We compared the postoperative and final separation at the superior and middle of the symphysis, and the incidence of hardware loosening and plate breakage between patients who had their cartilage excised and those in whom it was retained. Multiple screw loosening ± breakage was considered as one event. Plate breakage with screw loosening was considered one event in the combined calculation.

Results: We reviewed 95 patients (88 male, 7 female) aged 19-76 years (mean 48), with ISS 4-51 (mean 15.6) who had 65 APC-2 and 30 APC-3 symphyseal injuries. Motor vehicle and pedestrian struck accounted for 67% of injuries. There was no difference in the demographics between the groups, although the initial displacement in those not "sheeted" was slightly greater in the retention group ($P < 0.05$). The symphyseal cartilage was removed in 50 patients and retained in 45. There was no difference in the reduction of type 2 and 3 injuries so the results are reported together. As expected, the symphyseal space after cartilage excision was less than if retained. This difference was maintained through union and was true for the AP and outlet views. The measurements are shown for the AP radiographs in Table 1. The incidence of screw loosening, plate breakage, and combined hardware problems was statistically lower in those in whom the cartilage was excised (Table 2).

Table 1: AP Radiographic Reduction and Final Position at Union (in mm)

	Initial Postop Reduction			Position at Union		
Location	Excision	Retention	*P* Value	Excision	Retention	*P* Value
Superior	2.0 ± 1.0	6.1 ± 2.4	<0.0001	3.6 ± 2.6	8.3 ± 4.3	<0.0001
Middle	2.5 ± 1.2	6.1 ± 2.8	<0.0001	4.1 ± 2.9	8.2 ± 4.0	<0.0001

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Table 2. Hardware Complications

	Excision (50)	Retention (45)	*P* Value
Screw loosening	9 (18%)	18 (40%)	0.04
Plate breakage	2 (4%)	8 (18%)	0.02
Combined	11 (22%)	22 (49%)	0.009

Conclusion: Hardware failure is common after symphyseal reconstruction. While multiple factors leading to possible failure and displacement have been examined, no data exist regarding excision of the symphyseal cartilage to gain better friction across the symphysis. We sought to evaluate the effect of symphyseal cartilage excision on final alignment and hardware complications. We found that excision led to closer apposition of the symphyseal bodies postoperatively and at final follow-up and that this correlated with substantially lower rates of loosening and plate breakage. Surgeons may elect to use this technique to avoid hardware failure and maintain closer apposition of the symphyseal bodies.

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Biomechanical Analysis of Lumbopelvic Fixation Versus Posterior Sacroiliac and Anterior Pubic Symphysis Fixation in an Unstable Vertical Sacral Fracture Cadaveric Model

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Purpose: Optimal fixation of unstable pelvic ring and sacral fractures is unknown. We hypothesized that a minimally invasive percutaneous lumbopelvic fixation (LPF) would have superior mechanical performance to traditional fixation for unstable pelvic ring fractures. This technique would be especially useful for reduction of blood loss, operative time, and infection in the setting of polytrauma.

Methods: We used seven L4-pelvic fresh-frozen nonosteoporotic cadaveric specimens. They were tested in a bilateral stance testing apparatus in a "floating hip" model. Specimens were tested in flexion-extension (FE), lateral bending (LB), and axial rotation (AR). Each specimen was tested intact. Then a vertical zone 2 fracture was created with a saw and the pubic symphysis was cut to simulate the unstable fracture pattern. Five constructs were tested (Figure 1): (1) LPF (bilateral L5-pelvis fixation using cannulated iliac screws), (2) LPF plus a cross-connector, (3) anterior symphyseal plate with transsacral screws at S1 and S2, (4) combination of LPF with plate and screw, and (5) combination with cross-slink (constructs 2 and 3). We defined our outcome measure of pelvic ring stability as the relative displacement between the iliac crests during maximum range of motion. The measurements were analyzed using one-way analysis of variance ($P < 0.05$).

Results: LPF allowed for significantly more motion in FE (1027%, $P < 0.03$) and AR (980%, $P < 0.02$) compared to all other constructs, and was only comparable to LPF with cross-connect in LB (947%, vs. with cross-connect 754%, $P = 0.901$; $P < 0.01$ for all other constructs in LB) for pelvic ring stability. Surprisingly, the combined lumbopelvic-SI (sacroiliac) fixation with (FE: 108%, LB: 188%, AR: 106%) or without (FE: 129%, LB: 205%, AR: 112%) a cross-link did not impart increased pelvic ring stability as compared to SI fixation with anterior plating (FE: 105%, LB: 154%, AR: 90%, $P = 1.00$ for all comparisons and modes of bending). Cross-links improve the mechanics of LPF, especially in flexion-extension and rotation.

Conclusion: In contrast to our hypothesis, LPF performed relatively poorly in this model and added little mechanical stiffness to the more commonly used pelvic fixation with an anterior plate and transsacral screws. Additionally, anterior plate and posterior screws outperformed LPF (without cross-connects) alone ($P < 0.05$). Use of the floating hip model realistically simulated pelvic instability. In light of this, it is possible that LPF does not provide as much mechanical rigidity to complex pelvis fractures as previously thought.

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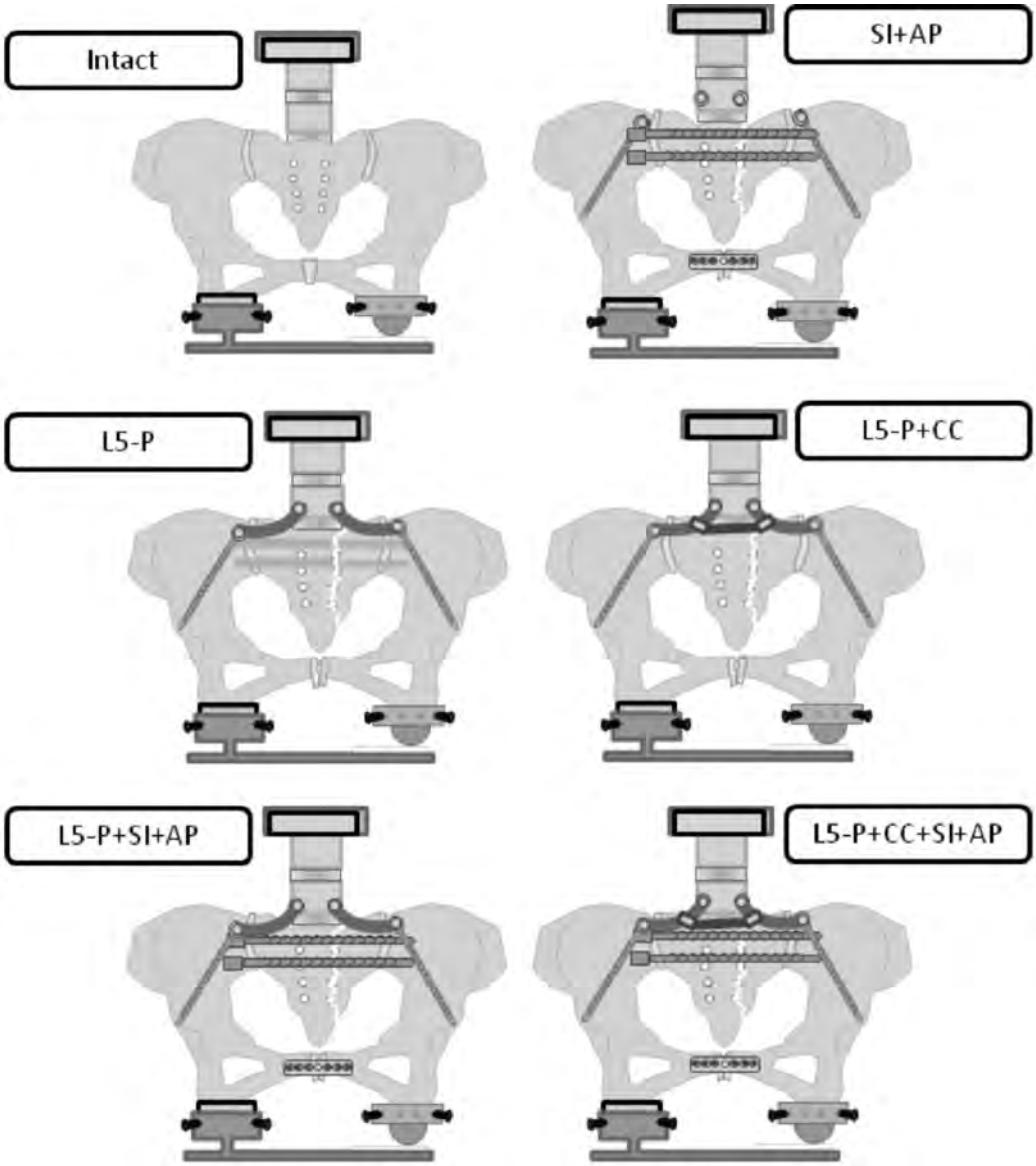

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