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Early failure of symphysis pubis plating☆,☆☆

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ABSTRACT

Introduction: Operative fixation of a disrupted symphysis pubis helps return alignment and stability to a traumatized pelvic ring. Implant loosening or failure has been demonstrated to commonly occur at some subacute point during the postoperative period. The purpose of this study is to report on a series of patients with traumatic pelvic ring disruptions to determine the incidence and common factors associated with early postoperative symphyseal plate failure before 7 weeks.

Materials and methods: 126 patients retrospectively identified with unstable pelvic injuries treated with open reduction and plate fixation of the symphysis pubis and iliosacral screw fixation. Preoperative and postoperative radiographs, computed tomography (CT) images, and medical chart were reviewed to determine symphyseal displacement preoperatively and postoperatively, time until plate failure, patient symptoms and symphyseal displacement at failure, subsequent symphyseal displacement, incidence of additional surgery, and patient weight bearing compliance.

Results: 14 patients (11.1%) sustained premature postoperative fixation failure. 13 patients had anteroposterior compression (APC)-II injuries and 1 patient had an APC-III injury. Preoperative symphyseal displacement was 35.6 millimeters (mm) (20.8-52.9). Postoperative symphyseal space measurement was 6.3 mm (4.7-9.3). Time until plate failure was 29 days (5–47). Nine patients (64.2%) noted a pop surrounding the time of failure. Symphyseal space measurement at failure was 12.4 mm (5.6-20.5). All patients demonstrated additional symphyseal displacement averaging 2.6 mm (0.2-9.4). Two patients (14.2%) underwent revision. Four patients (28.5%) were non-compliant.

Conclusion: Premature failure of symphysis pubis plating is not uncommon. In this series, further symphyseal displacement after plate failure was not substantial. The presence of acute symphyseal plate failure alone may not be an absolute indication for revision surgery. Making patient education a priority could lead to decreased postoperative non-compliance and potentially a decreased incidence of implant failure. Posterior pelvic ring fixation aides overall pelvic ring stability and may help minimize further displacement after early postoperative symphyseal plate failure. Further functional outcome and biomechanical studies surrounding early symphyseal plate failure are needed.

Introduction

Unstable pelvic ring injuries can be challenging to treat. In addition to the osseous displacement, the accompanying soft tissue and neurovascular injuries can lead to significant morbidity and mortality [1,2]. Surgical intervention with accurate reduction and stable fixation restores pelvic ring alignment, stability, and allows early patient mobilization [3–5]. Traumatic symphysis pubis disruptions have been managed using both external and internal fixation methods [6–11]. Numerous internal fixation methods have been described including screws and wires, two and multi-hole plates, box-plates, and dual plating constructs [12–17]. Regardless of the technique and implant, multiple studies have noted postoperative fixation failure. Further symphyseal displacement after postoperative fixation failure has been minimal and functional outcomes have been comparable to those without failure [6,7,18–21].

Although several studies have commented on plate failure postoperatively, to our knowledge there has been no prior series

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investigating early failure of symphysis pubis plate fixation. The purpose of this study is to report a series of patients with traumatic pelvic ring injuries treated with symphyseal fixation along with posterior iliosacral screw fixation that experienced symphyseal plate construct failures within 7 weeks postoperatively and evaluate the presence of any associated risk factors.

Materials and methods

After Institutional Review Board approval, a two-year retrospective review was performed from a prospectively collected trauma database at our regional Level 1 Trauma Center. From December 1, 2009 through December 1, 2011 all patients who sustained a traumatic symphyseal disruption and posterior pelvic ring injury were identified. This search identified 126 patients that were all included. The medical records, preoperative and postoperative radiographs and computed tomography (CT) scans, operative reports, postoperative weight bearing protocols, and follow-up visits with clinical and radiographic data were reviewed for each patient. Each patient's chart and radiographs were reviewed for patient gender, age, body mass index (BMI), mechanism of injury, AO/OTA and Young and Burgess injury classification, type of fixation used, preoperative symphysis pubis displacement, postoperative symphyseal space measurement, time until identified construct failure, mode, location, and symptoms surrounding construct failure, symphyseal space measurement at time of failure and subsequent displacement, evidence of secondary surgery, and patient compliance. Instead of just screw loosening, failure was defined as breakage of the symphyseal plate or loss of global construct integrity.

Preoperative imaging was reviewed including anteroposterior (AP), inlet, and outlet radiographs as well as preoperative pelvic CT scans. The pelvic ring injury patterns were classified according to both the Young-Burgess and the AO/OTA classification schemes. Through evaluation of the digital preoperative imaging, the symphyseal displacement was measured using the picture archiving and communication system (PACS). Using the linear measurement tool imbedded in the PACS system, the distance between the most medial aspects of each symphyseal segment was measured on the injury AP pelvis radiograph prior to reduction and sheet placement. Postoperatively, symphyseal space measurement was measured on the axial CT scan at the level of the symphysis. At our institution, postoperative imaging protocol consists of a CT scan with coronal and sagittal reconstructions as well as 5-view series of volume rendered images. The axial CT scan was chosen as the most accurate means of measuring symphyseal displacement.

Open reduction and internal fixation of the symphysis pubis was performed using a standard Pfannenstiel surgical exposure. The midline rectus abdominus muscle raphe was either divided surgically or incorporated into the traumatic soft tissue disruption. The rectus abdominus muscle insertions were incompletely elevated subperiosteally with electrocautery so that only the cranial anterior pubic bone where the plate was to be applied was denuded. The bladder was protected using a malleable retractor. The symphyseal disruption was manipulated and reduced with pointed reduction clamps applied to the pubic tubercles. All patients were treated with a flexible six to ten holed 3.5 mm non-locking pelvic reconstruction plate (Zimmer, Warsaw, IN). The length of the reconstruction plate used was according to the surgeons' assessment of injury and displacement at the time of surgery. Based on evaluation of the preoperative imaging in addition to intraoperative stress examination, all patients were felt to have sufficient posterior ring instability to warrant operative fixation. Iliosacral screws were placed in all patients percutaneously using multiplanar fluoroscopy with the patient positioned supine [22]. There was no formulaic protocol for the posterior pelvic ring fixation placed. The amount and type of iliosacral or transiliac-transsacral screw fixation placed varied with numerous factures including patient age, associated bone quality, injury pattern present, amount of instability detected, anticipated patient compliance, and the amount of osseous fixation pathways present. In general, our practice is to provide multiple points of posterior pelvic ring fixation at multiple levels. This results in combinations of iliosacral and transiliac-transsacral style screws. Each patient and each injury is unique with all of the above variables in consideration and a treatment plan is developed accordingly each time.

All patients had postoperative CT scans to evaluation reduction and implant placement. Postoperative rehabilitation was supervised by a licensed physical therapist and included isometric exercises and protected "toe-touch" weight bearing on the injured hemipelvis for six weeks. Progressive weight bearing and light resistance exercises were then used for the subsequent 6 weeks with full weight bearing occurring at 12 weeks Postoperative follow-up included scheduled clinic visits at approximately 2 weeks, 6 weeks, 3 months, 6 months, and at 1 year from surgery. Each visit included a history, physical exam, and pelvic radiographic evaluations including AP, inlet, and outlet views with the exception of the 2-week, visit which did not have imaging obtained. Patients were evaluated for evidence of early symphyseal plate breakage and overall loss of the prior postoperative anterior osseous alignment. The time frame of 7 weeks was chosen as patients sustaining premature implant failure and potential recurrent displacement in this period did not have sufficient time to allow full ligamentous and soft tissue healing. A chi-square analysis was performed to look at the differences between the mechanisms of injury and rates of early and total failure.

Results

39 of 126 patients (30.9%) experienced symphysis pubis construct failure at some point postoperatively with an average time of 92.4 days (5–342). 14 of 126 patients (11.1%), sustained symphyseal construct failure within 7 weeks of definitive surgery with average time of 29.4 days (5–47). The remaining 25 of 126 patients (19.8%), sustained subacute symphyseal construct failure at an average time of 127 days (51–342). Average patient age in the early failure cohort was 49.3 years (30–65). All patients sustaining early failure were male with an average BMI of 29.1 (25.5–37.8). Injury classification demonstrated 13 patients with 61-B1/APC-II injuries and 1 patient with a 61-C1/APC-III injury. The posterior ring injury of all patients in the early failure patient cohort was a ligamentous sacroiliac joint disruption. The mechanism of injury was variable with equestrian injuries accounting for 6 of 14 patients (43%), fall from height in 4 of 14 patients (29%), motorcycle accidents in 2 of 14 patients (14.5%), automobile accident in 1 of 14 patients (7.25%), and skiing accident in 1 of 14 patients (7.25%).

Average preoperative symphysis pubis displacement in the early failure cohort was 35.6 mm (20.8–52.9). The average time until surgery was 2.1 days (1–4). Average postoperative symphyseal displacement was 6.3 mm (4.7–9.3). Average symphyseal displacement at initial failure was 12.4 mm (5.6–20.5). The location of failure was found in 13 of 14 patients (92.75%) with breakage through a parasymphyseal hole. 1 of 14 patients (7.25%) sustained acute complete unilateral screw disengagement resulting in construct failure with unacceptable increased displacement (Fig. 6). Nine patients (64.2%) noted feeling a "pop" near the time of diagnosed failure. The average additional symphyseal displacement was 2.6 mm (0.2–9.4) with average clinical follow-up of 160 days (31–414). The average clinical follow-up of the subacute failure group was 215 days (85–484). Four of 14 patients (28.5%)