

Clinical Outcome of a Precontoured Symphysis Pubis Plate with Tension Band Wiring for Traumatic Symphysis Pubis Rupture in Pelvic Fractures

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Purpose: The optimal method of fixation of symphysis pubis (SP) diastasis in pelvic ring injuries is still controversial. In this study, we investigated the radiological and the clinical results of a precontoured 4.5-mm symphysis pubis (SP) plate with tension band wiring (TBW) after an anterior pelvic injury in pelvic fractures.

Methods: We treated 25 patients with traumatic SP diastasis by open reduction and internal fixation with plates and wires. We used a four-hole 4.5-mm precontoured SP plate with a tension band wiring.

Results: Patients with a SP with TBW fixation achieved excellent or good results at final follow-up. Post-operative complications included two (8%) patients with metal work movement. The mean symphyseal width was smaller in 4.5 mm SP plate with TBW during 1-year follow up period.

Conclusion: A precontoured symphysis pubis plate (4.5 mm) with figure-of-eight fashion tension band wiring shows favorable radiological results, excellent or good clinical outcome, and a lower complication (hardware failure and revision surgery). [J Trauma Inj 2016; 29: 22-27]

Key Words: ORIF, Plate fixation, Tension-band wiring, Symphysis pubis rupture, Pelvic fracture

I. Introduction

The pubic symphysis is a strong band of fibrocartilage creating an anterior joint in the pelvic ring which, together with the posterior sacroiliac joints, allows rotation and expansion of the pelvis during physical activity.⁽¹⁾ Pelvic ring injuries that often result from high energy trauma are relatively rare, with a prevalence of 4.6% of all the fractures.⁽²⁾ Patients who have disruption of the pubic symph-

ysis with instability of the posterior pelvic ring present a challenging problem for orthopedic surgeons. But the optimal method of fixation of symphysis pubis (SP) diastasis in pelvic ring injuries is still controversial. A variety of methods of achieving anterior ring reduction and fixation have been described in the literature; these include anterior external fixation, plate fixation, tension band wiring, and absorbable sutures.⁽³⁻⁵⁾

Although plate fixation has a lower rate of com-

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plications and has become the preferred method of fixation,(6,7) these have showed different results according to the type of plate. Several authors have described rates of hardware failure of between 12% and 31%, and loss of reduction between 7% to 24%, and revision rates between. 3% to 9%.(8–12) This highlights that there are large inconsistencies with results and therefore varying reports about plate fixation.

In this study, we investigate the radiologic and clinical results of a precontoured 4.5-mm symphysis pubis (SP) plate with tension band wiring (TBW) after anterior pelvic injury. The purpose of this study is to analyze the short-term clinical outcome of the SP with TBW in the treatment of traumatic SP diastasis.

II. Materials and Methods

Between 2010 and 2012, we treated 25 patients with traumatic SP diastasis using open reduction and internal fixation with plates. All patients were followed up for a minimum of 2 years (mean, 27 months; range, 2 to 5 years). There were 23 males and 2 females with a mean age of 47.9 years (range, 20 to 74 years).

The AO/OTA classification of pelvic ring injuries

and the Tile classification of pelvic disruption were used to define the injury and help to guide surgical management.(13) The AO/OTA classification was chosen because the study suited a system based in the mechanism of injury and the subsequent direction of hemipelvic movements that result in different types of instability of the pelvic ring.

Our indication for anterior plate fixation included any diastasis of the SP>25 mm with or without posterior pelvic ring injury. Posterior fixation was performed if there was any vertical posterior instability, a significant displaced anterior sacroiliac joint (1)mm) did received posterior fixation, but otherwise was stabilized according to the operating surgeon’s preference (Fig. 1).

Those with open injuries or associated acetabular fractures, of those definitively managed with additional external pelvic fixator devices, were excluded.

All operations were performed through a midline vertical rectus-splitting anterior approach with the Pfannenstiel skin incision. In vertically unstable fractures, posterior fixation was performed after anterior fixation. Anterior fixation was achieved using a Matta pelvic symphyseal plate (Stryker) with the aim of reducing all SP diastases anatomically. Typically, we used a four-hole 4.5-mm precontoured SP plate but actual fixation was dependent

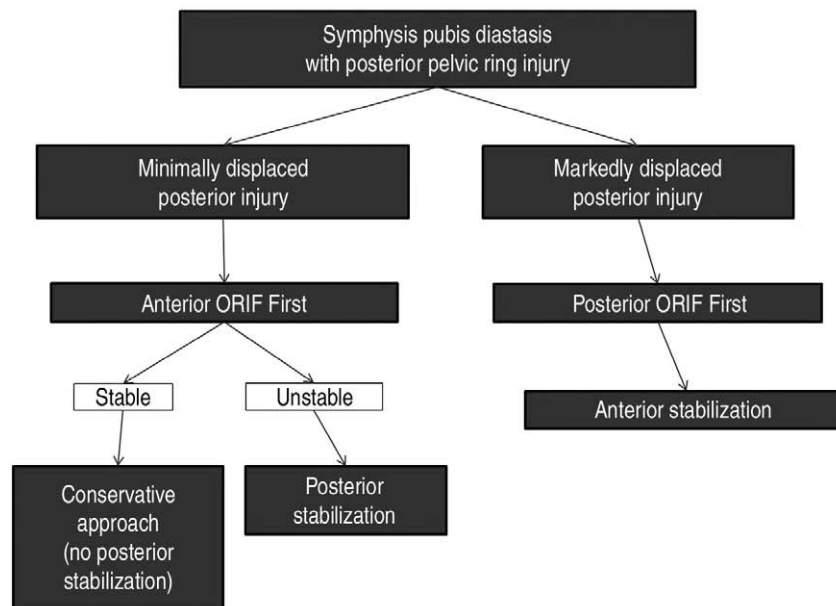


Fig. 1. Flow-chart showing treatment process. A flow-chart showing the decision making process for anterior and/or posterior fixation of pelvic ring injury with symphysis pubis diastasis.

on injury pattern. If the injury involved the pubic rami, then the plate length was extended. When drilling holes for wire after the plate fixation is finished, one or two figure-of-8 fashion tension band cerclage wires (1.25 mm in diameter, Synthes) were augmented over the plate (Fig. 2). Where there was an associated posterior injury, pelvic alternative approaches were used, including the anterior approach for sacroiliac joint or a posterior approach for displaced posterior injuries. Following their surgery, patients were mobilized with toe-touch weight bearing on the side of the hemipelvic injury for 6 weeks. After six weeks, mobilization was increased to 50% partial weight bearing and full weight bearing was started after 12 weeks.

Supplementary posterior ring fixation was performed in 8 patients to stabilize posterior injuries with displaced or comminuted sacral fractures and sacroiliac joint fracture subluxations.

A retrospective review of medical records and radiographic imaging was carried out to compare clinical and radiographic outcomes. Preoperative data, including patient demographics, injury history, fracture patterns, and associated injuries, were compared. Radiographs were taken before primary treatment, after surgery and during follow-up. Signs of movement in the anterior fixation were defined as screw breakage or any degree of backing out of the screws, any change in the position of a plate, or plate failure. Revision surgery was defined as any surgery that involved an open procedure to address a failure of fixation including infection. Degree of the loss of preoperative or postoperative reduction of the symphysis pubis is measured by the

gap of the upper margin of the symphysis pubis (the distance between the two sides of the joint) on anteroposterior, inlet and outlet pelvic radiographs. Diastasis greater than 15 mm on any plain radiographic view indicated an unsatisfactory reduction. Recurrent diastasis was defined greater than 10 mm postoperative radiographs during follow-up period compared to the immediate postoperative one.

Clinical and radiographic evaluations were obtained at 6-week, 3- and 6-month, and 1-year follow-ups. Thereafter, patients were examined at 1-year intervals. The functional outcome at 1 year postoperatively was measured using a scoring system described by Majeed.(14)

III. Results

Eight patients had major injuries included head, chest, abdominal, spine injuries or vascular injury need intervention. Nine patients had AO/OTA 61-C type injuries (Table 1).

All 17 patients who received anterior fixation alone had injuries characterized as partially stable sacroiliac joint disruption or minimally displaced sacral fractures. A total of 8 patients had additional posterior pelvic fixation, 6 of whom were treated with 6.5 mm or 8.0 mm sacroiliac screws. The diastasis of 25 cm in symphysis pubis has been used to judge whether the anterior sacroiliac ligaments become damaged and to differentiate a stable pelvis from a rotationally unstable pelvis. Two patients had an open approach and plate fixation. One patients had double anterior plating, one of whom had an additional sacroiliac fixation. Surgery-relat-



Fig. 2. Tension band wiring technique over the precontoured 4.5 symphysis pubis plate.

ed variables showed that open reduction and internal fixation with precontoured symphysis pubis plate with tension band wiring facilitated accurate and satisfactory reduction in 92% of patients (Table 2).

1. Precontoured 4.5 mm SP plate with tension band wiring

Post-operative complications included two (8%) patients with metal work movement (Table 3). One (4%) patient had recurrent diastasis of symphysis

pubis at the first postoperative visit, but didn't require further surgery because their functional outcome was good (Fig. 3). The mean symphyseal width was smaller in 4.5 mm SP plate with TBW during 1-year follow up period. Symphyseal width of the SP plate with TBW was stable at a 3-month postoperative assessment. In terms of clinical outcome, questionnaire results showed "good" and "excellent" grades occurred in the 4.5 mm SP plate with TBW (Table 4).

Table 1. Dermographic data.

Variable	4.5 mm symphysis pubis plate with TBW (n=25)
Mean age (range), yr	47.9 (20-74)
Gender, No. (%)	
Male	23 (92)
Female	2 (8)
Associated injury, No. (%)	
Major	8 (32)
Minor	17 (68)
Fracture pattern, No. (%)	
AO/OTA 61-B	16 (64)
AO/OTA 61-C	9 (36)

Major injury includes head, chest, abdominal, spine injuries or vascular injury need intervention.
 Minor injury includes lower or upper limb injuries.

Table 2. Surgery-related variables.

	No. (%)
	4.5 mm symphysis pubis plate with TBW (n=25)
Posterior stabilization, No (%)	8 (32)
Reduction Quality No (%)	
Satisfactory	23 (92)
Unsatisfactory	2 (8)
Numbers of screws	5.9

Table 3. Complications.

Complication	No. (%)
	4.5 mm symphysis pubis plate with TBW (n=25)
Wound infection	0 (0)
Metalwork movement or breakage	2 (8)
Hardware removal	1 (4)
Recurrent Diastasis	1 (4)
Revision surgery	0 (0)

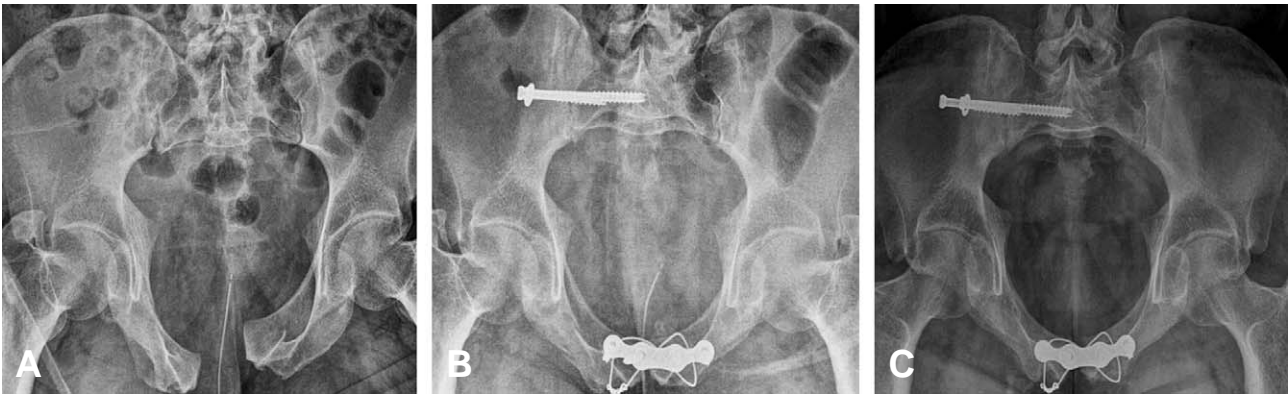


Fig. 3. Plain inlet pelvis radiograph (A) Preoperative image of a 36 year old male after pelvic ring injury (61-B1), (B) A Postoperative image showed anterior fixation by 4.5 mm SP plate with TBW and posterior fixation by iliosacral screw for right S-I joint disruption, (C) A follow up image taken 1 year after surgery showed the screws had not pulled out as well as no recurrent diastasis of symphysis pubis.

Table 4. Clinical outcomes one year after fixation.

Radiologic Result	No. (%)	
	4.5 mm symphysis pubis plate with TBW (n=25)	
Excellent (>85)	16 (64)	
Good (70-84)	8 (32)	
Fair (55-69)	1 (0.4)	
Poor (<55)	0 (0)	

IV. Discussion

Various methods of fixation are available to stabilize pubic diastasis, although proper fixation method is still controversial. Whereas the use of an anterior external fixator can stabilize the pelvic ring, there is a high rate of complications. Pin site infection occurs in 13% to 50% and pin site placement may be inconsistent.(6,15,16) Aseptic loosening of the pins may also lead to loss of reduction and necessitate revision fixation.(16) Loss of reduction may also occur in the presence of a posterior ring injury, which is often not stabilized sufficiently by an anterior external fixator.(16,17) Biomechanical studies have demonstrated that symphyseal plating is effective in restoring anterior ring stability(18) and efficacious outcomes have been confirmed in published case series.(9,10,19,20) Open reduction and internal fixation using a plate and screws across the pubic symphysis facilitates accurate reduction and is now the most popular method of stabilization for pelvic fractures.(1,21) Although anterior plating is the rec-

ommended treatment for pubic symphysis disruption, the incidence and consequences of fixation failure by the kind of plate and the technique of fixation have reported in literatures, which ranged from 12% to 43% and remained a concern.

The aim of this study was to analyze the outcome of precontoured symphysis pubis plate with tension band wiring fixation technique in the treatment of traumatic pubic symphysis diastasis. We performed anterior fixation of the symphysis pubis using precontoured 4,5 mm SP plate and additional tension band wiring. The technique appears to be quite acceptable for maintaining reduction of the diastasis and our results demonstrate efficacious radiographic results. The radiographic success of the fixation technique does appear to often be correlated with clinically functional outcome.

The overall revision rate after open reduction and internal fixation with plates and screws reported ranging from 3% to 30%.(20) Although the revision rate in cases using conventional reconstruction plate is similar with previous literature, no patients with

symphysis pubis plate and TBW had not required revision surgery.

The 4.5 mm precontoured symphysis pubis plate with one or two figure-of-8 fashion tension band wirings provided more sufficient stability compared to the conventional 3.5 mm plate fixation (unpublished data). When drilling holes for wire after the plate fixation is finished, to protect the structures in Retzius space, we usually use Cobb's elevator or a malleable retractor. As an alternative method, wire can be passed through the medial corner of the obturator foramen. However, this method requires more dissection of muscle attached to the pubic tubercle. We found that the original method of making a drill hole on the pubic body was better for several reasons. First, the risk of damaging neurovascular bundles was lower. Secondly, contrary to opinion among some surgeons that making a hole in the pubic body on older patients suffering from osteoporosis poses risks to the patient's bones, especially when tightening the wire, we had no complications of this sort when using this procedure.

Using a 4.5 mm precontoured plate with an additional tension bend wiring may be beneficial in diastasis of symphysis pubis.

V. Conclusion

Precontoured symphysis pubis plate (4.5 mm) with figure-of-eight fashion tension band wiring technique shows favorable radiological results, clinical outcome and lower complication (hardware failure and revision surgery), but the severity of pelvic ring injury is not the risk factor of hardware failure of anterior fixation for symphysis pubis disruption

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