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Original Research

Percutaneous sacroiliac screw *versus* anterior plating for sacroiliac joint disruption: A retrospective cohort study

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ABSTRACT

Background: Sacroiliac joint disruption (SJD) is a common cause of pelvic ring instability. Clinically, percutaneous unilateral S1 sacroiliac screw and anterior plating are always applied to manage SJD. The objective of this study is to elaborate their respective therapeutic traits.

Materials and methods: Patients with SJD fixed with unilateral S1 sacroiliac screw or anterior plating from June 2011 to June 2015 were recruited into this study and were divided into two groups: group A (unilateral sacroiliac screw) and group B (anterior plating). Surgical time, blood loss, frequency of intraoperative fluoroscopy and complications were reviewed. Postoperative radiograph and CT were conducted to assess the reduction quality. Fracture healing was evaluated by radiograph performed at each follow-up. Majeed score was recorded at the final follow-up to assess the functional outcome.

Results: Thirty-eight patients were included in group A and thirty-two patients in group B in this study. There was no significant difference in the demographic data of the two groups. A significant difference existed in the results for average operation time ($P = .022$) and blood loss ($P = .000$) between group A and group B. The mean frequency of intraoperative fluoroscopy was 15.82 in group A and 3.94 in group B ($P = .000$). All the fractures healed in this study. The rates of satisfactory reduction quality and functional outcome showed no significant difference between the two groups ($P > .05$). The complication rate was 15.79% (6/38) in group A and 9.38% (3/32) in group B ($P = .660$).

Conclusion: Compared with anterior plating, percutaneous unilateral S1 sacroiliac screw usage is less invasive; however, more intraoperative X-ray exposure and permanent neurologic damage may accompany this procedure.

1. Introduction

The sacroiliac joint, as an essential part for weight bearing, plays a pivotal role in maintaining normal activities [1]. Sacroiliac joint disruption (SJD) always accompanies fractures of the pelvic rami or dislocation of the symphysis pubis and may be associated with high rates of mortality and late morbidity [2,3]. Poor prognosis, such as impaired gait and pelvic obliquity, may occur for patients receiving conservative treatment. Thus, surgical fixation has become the gold-standard technique for SJD during the past years [4,5]; however, the choice of fixation method is still controversial.

Matta first used percutaneous sacroiliac screws to fix SJD, and the technique was popularized because of its less-invasive incision [6]. However, serious complications such as internal iliac artery and sacral nerve injury may occur because the safe channel for screw insertion is narrow [7–9], and it remains a challenging procedure for most orthopaedists.

Anterior plating, an alternative therapeutic method for SJD, can provide biomechanical stability to the sacroiliac joint [10,11]. Simpson LA et al. reported that satisfactory clinical results could be obtained with this surgical procedure. However, screw loosening may occur during exercise [12]. The objective of this study is to explore therapeutic traits of percutaneous unilateral S1 sacroiliac screw and anterior plating for SJD.

2. Materials and methods

2.1. Patient population

SJD patients admitted to our institution from June 2011 to June

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2015 were recruited into this study. The inclusion criteria for patients were as follows: 18-70 years old, unilateral SJD, normal activity ability before injury, and fixed with unilateral S1 sacroiliac screw or anterior plating. The exclusion criteria of patients were as follows: open fracture, pathologic fractures, fractures in other areas, other associated severe injuries such as traumatic brain injury, preoperative ROM (range of motion) deficiency of the hip, and non-completion of one-year follow-up. Informed consent was obtained from all patients, and the study was approved by the institutional internal review board of the participating institution. Patients who met the inclusion criteria were divided into two groups: group A (unilateral sacroiliac screw) and group B (anterior plating). The work of this study has been reported in line with the STROCSS criteria of the *International Journal of Surgery* [13].

2.2. Surgical techniques

The surgical procedures were conducted by the same team, and all surgeons had more than 10 years' experience in pelvic surgery. Supine position was recommended during the surgical procedure in this study. For the patients with vertical detachment, traction of the ipsilateral lower limb should be performed to reduce the severely displaced fragments. Anterior pelvic ring injury, including pubis symphysis disruption and pubic rami fracture, was stabilized through the Stoppa approach. Then, the SJD was managed as follows.

For patients in group A, the affected side was positioned towards the edge of the operating table to insert the unilateral S1 sacroiliac screw more conveniently. For most cases, the SJD could be indirectly reduced after the anterior ring surgical procedure. However, open reduction had to be conducted if the severe detachment could not be reduced. Then, a unilateral S1 sacroiliac screw would be inserted with the projection technique of S1 pedicle axial view [14]. First, a lateral view of sacrum was obtained to observe the outline of S1 vertebral body (Fig. 1 A). Second, the projection angle was gradually changed cephalad (approximately 35°) and ventrally (approximately 30°) to obtain a clear oval track, which represented the axial projection of the S1 pedicle (Fig. 1 B). Third, the angle of the C-arm was fixed, and the entry point of guiding wire located in the centre of the oval track. Fourth, the orientation of the guiding wire was adjusted to make it parallel to the C-arm projection. Then, the radiograph of the guiding wire became a point in the centre of the oval track (Fig. 1C–D). Fifth, the guiding wire was inserted with battery-powered equipment. Sixth, a cannulated screw could be placed from the posterior ilium across the sacroiliac articulation (Fig. 1 E). To strengthen the stability of the sacroiliac joint for patients with Tile C type injury, an additional screw should be inserted with the same technique (Fig. 1 F).

For group B patients, a 10-12 cm curved incision (iliac fossa approach) along the iliac crest was performed in the affected hemi-pelvis (Fig. 2A). The insertions at the medial fascia were separated from the iliac crest. The lateral femoral cutaneous nerve (LFCN) should be protected during the surgical procedure. The internal organs and soft tissues including the lumbosacral plexus were retracted medially with an abdominal retractor or Hoffman hook. Then, the sacroiliac joint could be visualized directly. The dissection should not exceed 15 mm medial to the sacroiliac joint to avoid iatrogenic neurological injury. Reduction forceps based on two screws inserted in the sacrum and ilium should be applied to accomplish reduction of SJD (Fig. 2B). An anterior plate was placed to gain stability of the sacroiliac joint, and an additional plate was employed for the patients with Tile C type injury. A single screw was inserted into the sacrum for each anterior plate. Two or more screws were placed in the ilium to maintain the reduction effect (Fig. 2C). The procedure described above should be performed extraperitoneally to lower the iatrogenic injury rate of abdominal contents.

2.3. Observational indexes and statistical analysis

Surgical time, blood loss, the frequency of intraoperative fluoroscopy and complications were reviewed. Postoperative radiograph and CT were conducted to assess the reduction quality, which could be classified as excellent (0-1 mm displacement), good (2-3 mm displacement), or poor (> 3 mm displacement) [15]. Follow-up was performed at one, three, six months postoperatively and every six months thereafter. Individualized therapy and exercise could be determined according to the clinical and radiological results at each follow-up. Functional outcome was assessed according to Majeed score at the final follow-up, which could be classified as excellent (> 85), good (70–84), fair (55–69) and poor (< 55) [16]. For the reduction quality and functional outcome, excellent and good were regarded as satisfactory results in this study. Relevant data were processed by SPSS software (version 23.0; SPSS, Chicago, IL), and a value of $P < .05$ was regarded

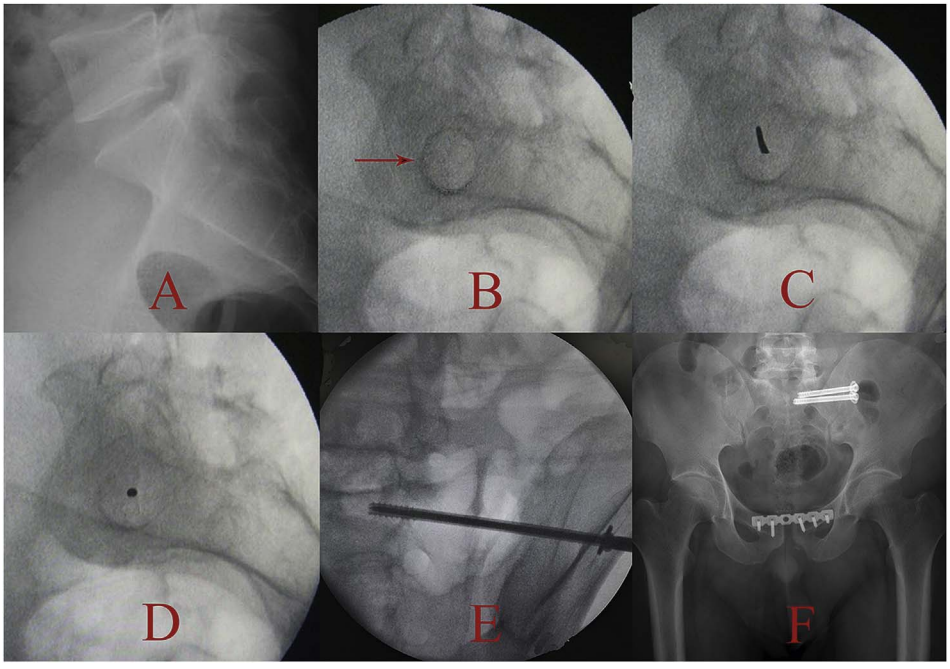

Fig. 1. The application of S1 pedicel axial view for sacroiliac screw inserting was presented. A, the lateral view of sacrum, B, the oval track was indicated by a red arrow, C, the entry point of guiding wire located in the centre of the oval track, D, the radiograph of guiding wire would became a point when the it was parallel to the projection C-arm, E, The placement of guiding wire and screw was obtained, F, additional S1 screw was inserted to strengthen the stability of sacroiliac joint. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)