

Anterior square-plate fixation of sacroiliac disruption

2–8 years follow-up of 23 consecutive cases

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21 consecutive patients with 23 rotationally and vertically unstable sacroiliac joint disruptions were operated on through an anterior approach. Open reduction and internal fixation with a 2-hole square plate

was performed. At follow-up after 5 (2–8) years, 18 patients were rated excellent or good and 3 patients poor. In all the cases the reduction of the SI-joints was maintained.

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Sacroiliac joint (SI-joint) disruptions constitute one sixth of the posterior lesions among the unstable pelvic ring fractures (Huittinen and Slätis 1972). Closed treatment leads to late problems with pain and impaired gait in more than half of the patients where the posterior ligamentous complex is torn (Räf 1966, Tile 1984). External fixation may control bleeding in the acute management. However, it is not sufficient as definitive treatment; internal fixation of the SI-joint combined with an anterior fixation has been advocated (Wild et al. 1982, Tile 1984). We evaluated the results of open reduction and internal fixation through an anterior approach of SI-joint disruptions with a 2-hole square plate.

Patients and methods

21 consecutive patients with 23 SI-joint disruptions were operated on at our hospital during the period 1983–1988. There were 16 men and 5 women, median age 30 (16–52) years. Traffic accident was the cause in 14 patients, crush injury in 4, fall from a height in 2, and skiing injury in 1 patient. All had rotationally and vertically unstable injuries, i.e., Type C according to Tile (1988). They were unilateral in 11 patients, bilateral in 2, and associated with an acetabular fracture in 8 patients (Table 1). The lumbosacral plexus was injured in 8 patients. 37 other associated injuries were present in 17 of the patients (Table 2). The delay to operation was 0–31 days, median 9 days. The patients were followed for 29–97 months, median 70 months. Follow-up consisted of a questionnaire, clinical and radiographic examinations; anteroposterior, pelvic outlet and inlet views were obtained. Function outcome

was evaluated with the Harris (1969) hip score. The result was graded excellent at a score of 90–100, good at 80–89, fair at 70–79, and poor below 70 points.

Operative technique

The patient was placed in a supine position. The leg was draped free, allowing flexion of the hip and knee in order to release tension of the iliopsoas muscle and lumbosacral plexus. A 10–15 cm incision was made along the iliac crest and the medial fascial attachment to the crest was divided. The lateral femoral cutaneous nerve was retracted medially. The iliacus muscle was dissected subperiosteally and retracted medially to expose the SI-joint. To avoid injury to the L5 nerve the dissection did not extend more than 10–15 mm medial to the joint with the hip and knee flexed. The soft tissues were held retracted by 3 mm Steinman pins inserted into the sacrum. The joint was debrided. Reduction was performed through manipulation of the ilium. A pelvic reduction clamp, fixed cranially on the iliac side and caudally on the sacral side of the joint, facilitated the reduction maneuver. The reduction was provisionally held by a Steinman pin introduced percutaneously from the lateral side through the SI-joint. For the internal fixation a square plate (Olmed Medical AB, Sweden), 27 × 24 × 4 mm, was used. The plate has 2 extended oval compression screw holes, each giving place for 2 fully-threaded 6.5 mm AO/ASIF cancellous screws. The plate was placed across the front of the SI-joint and fixed to the sacrum and iliac wing (Figure 1). The screws were directed posteromedially parallel to the joint plane. Bone grafting of the SI-joint was done in 2 cases. The internal fixation was reinforced by an external fixator in 5 patients, a symphyseal plate in 6 patients and a com-

Table 1. Observations in 21 patients with 23 operated on sacroiliac joint disruptions

A	B	C	D	E	F	G	H	I	K	L	M	O	P	R	S	T	U	V	X
1	30	2	2	27	1	1	-	-	97	1	1	1	1	1	1	1	1	1	1
2	30	2	2	27	1	1	-	-	97	1	1	1	1	1	1	1	1	1	1
3	33	1	3	29	1	3	3	-	97	5	3	2	2	2	1	3	3	4	1
4	30	2	1	0	1	3	2	3	96	4	2	1	2	2	1	1	2	2	2
5	19	1	3	12	1	3	4	-	88	3	1	1	1	1	1	3	1	2	1
6	22	2	3	8	1	3	-	-	84	1	1	1	1	1	1	1	1	1	1
7	25	1	3	11	1	1	1	-	83	2	1	1	1	1	1	3	1	1	1
8	45	1	1	5	1	4	-	-	76	3	3	1	1	1	1	3	4	1	1
9	21	1	1	16	2	4	-	-	75	1	1	1	1	1	2	1	3	1	1
10	21	1	1	1	2	3	6	1	72	2	1	1	1	1	1	1	3	1	1
11	18	1	1	4	1	2	-	-	70	3	2	1	1	1	1	3	1	2	1
12	18	1	2	9	1	2	-	-	70	1	1	1	1	1	1	1	1	1	1
13	18	1	2	9	1	2	-	-	70	1	1	1	1	1	1	1	1	1	1
14	30	2	1	12	1	1	-	-	66	3	3	2	1	1	1	3	1	4	1
15	43	1	3	2	1	4	-	-	62	1	1	1	2	1	1	1	1	1	1
16	38	2	1	1	1	3	1	-	60	3	1	1	2	1	1	1	2	2	1
17	41	1	1	1	2	2	-	-	52	2	1	1	1	1	1	1	1	2	1
18	16	1	1	31	1	4	-	-	50	1	1	1	1	1	1	3	1	1	1
19	21	1	3	0	1	2	-	-	48	1	1	1	1	1	1	1	1	1	1
20	40	1	3	7	1	2	5	-	45	1	1	1	1	1	1	2	1	1	1
21	52	1	3	16	2	4	7	2	36	5	4	2	1	2	2	3	4	4	1
22	20	1	1	18	1	4	-	-	36	1	1	1	1	3	1	4	1	2	1
23	37	1	1	0	1	4	-	-	29	1	1	1	1	1	1	1	5	1	1

A Case (1 and 2, and 12 and 13 bilateral)

B Age

C Sex

1 male

2 female

D Type of injury (Tile 1988)

1 C 1 (unilateral)

2 C 2 (bilateral)

3 C 3 (associated with an acetabular fracture)

E Operative delay (days)

F Quality of reduction

1 < 5 mm

2 5-10 mm

G Type of anterior reinforcement

1 none

2 external fixation

3 internal fixation (symphyseal plating)

4 combined internal-external fixation

H Complication

1 adult respiratory distress syndrome

2 seroma

3 deep infection

4 neural injury (lumbo-sacral plexus)

5 neural injury (n cutaneous femoris lateralis)

6 non-union

7 unsatisfactory reduction

I Reoperation

1 re-fusion

2 re-reduction

3 excision of a bone spike

K Follow-up time (months)

L Pain

1 none

2 slight, not requiring analgetics

3 mild, occasional analgetics

4 moderate, some limitation of ordinary activity

5 marked, serious limitations of activities

6 disabled

M Limp

1 none

2 slight

3 moderate

4 severe

O Support

1 none

2 cane

P Sitting

1 no pain

2 slight pain

R Sexual function

1 no problem

2 impaired function because of pain

3 erection disturbance

S Leg length discrepancy

1 ≤ 1 cm

2 ≤ 2 cm

T Neurology at follow-up

1 normal

2 injury to the lateral cutaneous femoral nerve

3 injury to the lumbo-sacral plexus (drop foot)

4 erection disturbance

U Working

1 full-time in previous occupation

2 part-time in previous occupation

3 full-time in a more sedentary occupation

4 part-time in a more sedentary occupation

5 not working

V Clinical follow-up; Harris hip score (1969)

1 excellent

2 good

3 fair

4 poor

X Radiographic follow-up

1 unchanged compared to postoperative radiographs

2 broken screw in the plate

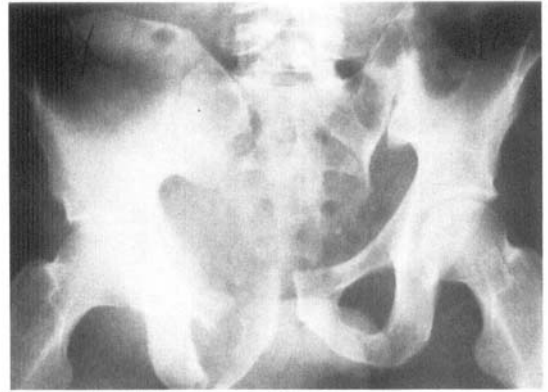
Table 2. Associated injuries in 17 patients

Head	4
Spine	4
Chest	5
Abdomen	8
Extremities	
upper	5
lower	11
Total	37

Figure 1. Case 8.



Unilateral disruption of the left SI-joint and fracture of the right pubic rami.



The left SI-joint is reduced and anteriorly fixed with a square plate. The rami fractures are stabilized anteriorly with a plate from the left side of the symphysis to the right iliac wing.

bination of symphyseal plate-external fixator in 7 patients.

The patients were mobilized during the first week with partial weightbearing; full weight bearing was permitted after 3 months. The 3 patients without an anterior reinforcement were not weightbearing at all until 3 months postoperatively.

Results

Full reduction or a displacement of less than 5 mm as measured on the radiographs was achieved in 19 of the 23 disrupted SI-joints. In the remaining 4 cases there was a postoperative rotation of the iliac wing and the vertical and/or horizontal dislocation was 5-10 mm.

Complications

2 multiple-injured patients developed adult respiratory distress syndrome with uneventful recovery. There was 1 case of deep infection; a patient in whom a peroperative vascular injury occurred necessitating ligation of the left internal iliac artery and an abscess developed in the remaining hematoma which had to be evacuated. There was no case of wound infection. 1 patient with ipsilateral SI-joint disruption and acetabular fracture developed a L 5 palsy preoperatively, and in another patient the lateral cutaneous femoral nerve was preoperatively injured. In 1 case the reduction of the disrupted joint was unsatisfactory and the patient was reoperated after 2 weeks. 1 patient developed a non-union of the SI-joint with gluteal pain. At reoperation 1 year later the SI-joint was refused and the end

result was graded excellent. Finally, in 1 patient with a contusion of the soft tissues, a subcutaneous seroma developed. The seroma did not fistulate and there was no sign of infection. A painful bone spike at the donor graft site at the anterior iliac crest communicating with the seroma was excised after 8 years and the pain disappeared but the seroma remained.

Clinical follow-up

Pain. 13 patients had no or occasional pain not requiring analgetics. 6 patients had mild to moderate pain requiring occasional analgetics. 2 patients had pain requiring daily analgetics. Both patients had an injury to the lumbosacral plexus, with radiating pain and a drop foot.

Gait. 17 patients had no or slight limp. 4 patients had moderate to severe limp due to a drop foot and/or residual radiating pain in the leg, and 3 of these needed a cane for walking.

Sitting. 17 patients had no problems while 4 patients had a slight pain when sitting.

Sexual function. 17 patients had no sexual problems. 3 patients had impaired function mainly because of pain and 1 patient had an erection disturbance.

Leg length. In 1 case there was a 2 cm shortening of the injured side. 1 patient had a 2 cm shortening of the leg of the injured side in sitting but had equal leg length in standing, indicating a rotational deformity at the SI-joint.

Neurological deficit. In the 10 patients with pre- or postoperative neurological deficits these were mainly unchanged at follow-up.

Work. 20 patients returned to work. Of these, 15 returned to their previous occupation while 5 changed

to a more sedentary job. 5 patients worked part-time. 1 patient with drug problems and not working before the accident was still without work at follow-up.

Harris hip score. 12 patients were graded excellent, 6 good, 0 fair and 3 poor. The patients graded poor had a neurological injury with radiating pain or a palsy.

Radiographic follow-up

At follow-up the position of the SI-joints remained unchanged in all patients compared to the postoperative radiographs. The position of the plate and the screws were unchanged in 22 cases. In 1 case a screw was broken and the patient had a slight pain from the gluteal region. However, manual provocation of this SI-joint did not reproduce the pain and a technetium bone scintigram showed no increased uptake. Thus, this joint was considered to be fused, as were the other cases with unchanged position of the joints and implants at follow-up.

Discussion

Disruption of the sacroiliac joint where the posterior ligaments are torn is an unstable injury. The triplane displacement of the hemipelvis is cephalad, posterior and rotational (Bucholz 1981). Biomechanical studies have shown that internal fixation is the most adequate way to stabilize this injury, and symphyseal plating or an external fixator in addition may improve the stability further (Tile 1984, Leighton et al. 1991). Accurate reduction of the disrupted SI-joint will increase the loadbearing capacity (Shaw et al. 1985).

Internal fixation with laterally-inserted screws through a posterior approach has been reported by Regazzoni et al. (1983). There may, however, be a risk of malreduction if the joint is not visualized. There may also be a risk of nerve injury due to insertion of a screw into the spinal canal. With the posterior approach, high infection rates (18–25 percent) have been reported, due to wound breakdown (Goldstein et al. 1986, Kellam et al. 1987). The anterior approach used in this study (Avila 1941), has several advantages. It provides good access to the anterior aspect of the SI-joint. It can be extended in case of other pelvic ring fractures which have to be exposed to facilitate reduction or in case of a concomitant acetabular fracture. There is a small risk of wound complications. The anterior approach has been advocated for internal fixation of posterior pelvic disruptions (Olerud and Hamberg 1987, Simpson et al. 1987, Tile 1988).

For an optimal end-result it is important to have a firm fixation of the SI-joint. Failure of the internal fix-

ation with loss of reduction is associated with an unfavorable result (Simpson et al. 1987). Loadbearing tests have revealed that plates applied to the anterior aspect of the SI-joint are significantly stronger than staples, and this has also been confirmed clinically (Simpson et al. 1987). Fixation with two 2-hole dynamic compression (DC) plates gave no loss of reduction and a good clinical outcome (Leung et al. 1992).

The square plate used in the present study has some theoretical advantages. The square design of the plate with the 2 extended oval screw-holes allows four 6.5 mm cancellous screws to be inserted close to each other and to the joint line. This will give possibilities for strong compression of the reduced joint. On the iliac side, close to the SI-joint, the cancellous bone mass is thick and it is easy to direct the screws towards the posterior superior iliac spine to achieve optimal screw anchorage. The distance between the screw-holes of the 4.5 mm 2-holes DC plate is 16 mm longer compared to the square plate. Thus, this necessitates a more lateral insertion of the iliac screws where the bone is thinner, which may increase the risk of screw-loosening. Furthermore, the DC plate permits angulation of the cancellous (cortical) screws up to only 15° (25°) longitudinally (compared to 40° for the square plate), which restricts the possibility of an optimal direction of the screws.

We conclude that the anterior approach is adequate, as the joint is explored and the reduction can be confirmed, and there is a small risk of wound complications. The square plate offers a possibility to achieve the necessary firm fixation of the disrupted SI-joint to minimize the risk of redislocation.

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