Percutaneous fusion of the sacroiliac joint with hollow modular anchorage screws
CLINICAL AND RADIOLOGICAL OUTCOME

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We reviewed 15 consecutive patients, 11 women and four men, with a mean age of 48.7 years (37.3 to 62.6), who between July 2004 and August 2007 had undergone percutaneous sacroiliac fusion using hollow modular anchorage screws filled with demineralised bone matrix.

Each patient was carefully assessed to exclude other conditions and underwent pre-operative CT and MR scans. The diagnosis of symptomatic sacroiliac disease was confirmed by an injection of local anaesthetic and steroid under image intensifier control.

The short form-36 questionnaire and Majeed’s scoring system were used for pre- and post-operative functional evaluation. Post-operative radiological evaluation was performed using plain radiographs.

Intra-operative blood loss was minimal and there were no post-operative clinical or radiological complications. The mean follow-up was for 17 months (9 to 39). The mean short form-36 scores improved from 37 (23 to 51) to 80 (67 to 92) for physical function and from 53 (34 to 73) to 86 (70 to 98) for general health (p = 0.037). The mean Majeed’s score improved from 37 (18 to 54) pre-operatively to 79 (63 to 96) post-operatively (p = 0.014). There were 13 good to excellent results. The remaining two patients improved in short form-36 from a mean of 29 (26 to 35) to 48 (44 to 52). Their persistent pain was probably due to concurrent lumbar pathology.

We conclude that percutaneous hollow modular anchorage screws are a satisfactory method of achieving sacroiliac fusion.

The sacroiliac joint may be the source of pain in 10% to 32% of patients presenting with low back pain.1,2 There is no consensus about the management of sacroiliac joint pain. Several methods of treatment have been described, with varying degrees of success.1,3,4 Operative treatment usually takes the form of sacroiliac fusion.5,6 Open arthrodesis has been described using the Smith-Petersen’s7 or a midline fascial-splitting approach,7 which can cause wound problems.

In this study, we describe a technique of percutaneous sacroiliac fusion and present its clinical and radiological outcome.

Patients and Methods
We reviewed 15 consecutive patients who had undergone a sacroiliac fusion at our hospital for a chronic non-traumatic condition between July 2004 and August 2007. These who had additional pelvic pathology or required further surgery were excluded from the study, as were others operated on for injuries of the sacroiliac joint. We recorded the patient’s demographics, diagnosis and post-operative complications. There were 11 women and four men, with a mean age of 48.7 years (37.3 to 62.6).

Each patient had a sacroiliac fusion by a percutaneous technique using hollow modular anchorage screws (Aesculap Ltd, Tuttlingen, Germany) packed with a bone substitute.

Diagnosis. The diagnosis of sacroiliac joint disease was based on the clinical presentation, radiological investigations and diagnostic injections. The aetiology in these patients is shown in Table I. Clinical evaluation consisted of Patrick’s test,8 Gaenslen’s test,9 and tenderness over the posterior sacroiliac joint. A full clinical and neurological examination, including sacroiliac joint injections, was performed to exclude any other cause of low back pain. Plain radiographs focused on the sacroiliac joint were used to identify signs of arthritis or sclerosis. Further radiological examination included a CT scan of the sacroiliac joint and an MR scan of both the lumbosacral spine and the sacroiliac joint to demarcate the joint pathology in detail. An MR scan is a more
accurate method of identifying coexisting neurological pathology or compression in the lumbosacral spine, whereas a CT scan will confirm the extent of arthritis of the sacroiliac joint. Confirmatory diagnostic injections into the sacroiliac joint were performed by a consultant radiologist under fluoroscopic guidance with the patient lying prone and with a caudal tilt of approximately 20° of the C-arm. Non-ionic contrast was used to confirm that the needle was in the joint and local anaesthetic and corticosteroid were introduced. Surgery was offered to patients only when the clinical symptoms and signs were confirmed by the radiological findings, the injection relieved the patient’s pain, and no other pathological process could be identified. Of the 15 patients, six had undergone spinal surgery previously. Each patient had low back pain or pain in the buttock as their principal symptom. Unilateral fusion was carried out in 11 cases and bilateral procedures in four.

**Surgical technique.** Adequate bowel preparation is of paramount importance to ensure a clear fluoroscopic view of the sacrum and screws. Patients are given a liquid diet for 24 hours pre-operatively and laxatives on the night before surgery. Patients are positioned supine on a radiolucent operating table and a lateral view is taken to identify the starting point for the guide wire. An incision of approximately 1.5 cm is used and a guide wire is introduced into the centre of the triangular portion of the sacroiliac joint, just under the iliac overhang. Inlet and outlet views are used to advance the guide wire. The inlet view is used to guide the wire in the anteroposterior (AP) plane (Fig. 1) and the outlet view gives a true AP view of the sacrum. The aim is to place the guide wire between the superior and inferior end-plates of the first sacral vertebra (Fig. 2). Once the guide wire is in a satisfactory position, a 10 mm hollow modular anchorage screw is inserted over it. The cannulated screw is packed with a bone substitute (DBX, Demineralised Bone Matrix, Synthes Inc, West Chester, Pennsylvania). Post-operatively, patients were mobilised partially weight-bearing for six weeks, after which they gradually increased the weight taken until they were fully weight-bearing at 12 weeks.

**Outcome measures.** The outcome was assessed independently by two authors (AK and ARG). Pre- and post-operative functional evaluation was performed using the short form (SF)-36 questionnaire and Majeed’s scoring system. The SF-36 is a reliable, validated scoring system which gives a measure of quality of life. Majeed’s scoring system was originally developed to assess functional outcome after pelvic injuries. It is based on five criteria: pain, standing, sitting, sexual function and performance at work.

Each patient had AP, inlet and outlet views of the pelvis taken at three and six months post-operatively, and at final follow-up. These are not a very accurate method of confirming fusion, but we took the absence of clinical symptoms and signs and the absence of any radiological signs of metal failure or lucency to indicate fusion of the sacroiliac joint. Further radiological evaluation was performed only if patients reported continuing symptoms. In these cases we obtained a CT scan to determine whether or not fusion had occurred, and an MR scan to identify any alternative source of pain. Two patients reported continuing symptoms after 12 months’ follow-up and underwent CT and MR scanning.

**Statistics.** Wilcoxon’s signed-ranks test was used as a non-parametric alternative to the t-test to compare the pre- and post-operative results. Statistical calculations were performed using SPSS software version 14 (SPSS Inc., Chicago, Illinois). A p-value < 0.05 was considered significant.

**Results**

The mean follow-up was for 17 months (9 to 39). The mean SF-36 scores improved from 37 (23 to 51) to 80 (67 to 92) for physical function and from 53 (34 to 73) to 86 (70 to 98) for general health (Table II). These differences were statistically significant (p = 0.037). The mean Majeed score improved from 37 (18 to 54) pre-operatively to 79 (62 to 96) post-operatively (p = 0.014). Based on Majeed’s score, 13 patients had good or excellent results. The remaining two improved from 21 and 33 to 57 and 64, respectively. Their SF-36 scores improved from a mean of 29 (23 to 35) to 48 (44 to 52).

Intra-operative blood loss was minimal (< 50 ml) in all cases. No patient required autologous bone grafting. There were no post-operative neurological or wound complications. There were no obvious problems with screw placement, such as breach of the anterior cortex or the nerve root foramen. There were no cases of implant failure. The mean post-operative hospital stay was 2.7 days (1 to 7). Fusion was obtained in all patients and none required further surgery. In the two patients with a fair result, fusion was confirmed with a CT scan.

**Discussion**

The sacroiliac joint may be the source of pain in a significant number of patients with low back pain and may be a source of persistent pain after lumbar fusion. It allows approximately 2° to 4° of movement in the sagittal plane. As it is a synovial joint, it can develop degenerative changes. Sacroiliac dysfunction is a term used to describe pain from the joint with no demonstrable lesion, but with a presumed underlying biomechanical disorder. It is diagnosed by Patrick’s and Gaenslen’s tests.
tests, in the absence of any other obvious pathology.\textsuperscript{13,14} Post-partum sacroiliac instability\textsuperscript{15} and inflammatory arthritis,\textsuperscript{6} crystal arthropathy and infection\textsuperscript{12} are other known causes. Our study group had a preponderance of patients with sacroiliac arthritis or dysfunction (Table I).

Non-operative treatment for sacroiliac pain includes physiotherapy, radiofrequency neurotomy and intra-articular injections.\textsuperscript{1,4} The efficacy of these measures has not been proven.\textsuperscript{1} Operative intervention has been described in the form of sacroiliac joint debridement\textsuperscript{3} or fusion.\textsuperscript{5,7,16} A thorough clinical assessment and accurate diagnosis and good patient selection are of paramount importance if surgery is to succeed. An accurate diagnosis can be difficult to make, as patients may present with a variety of symptoms and there is no single reliable diagnostic test.\textsuperscript{5} However, injection of corticosteroid and local anaesthetic under image intensifier control may assist in making the diagnosis.\textsuperscript{2,5}

Haufe and Mork\textsuperscript{3} reported that 53% of their patients improved by more than 75% two years after having had a sacroiliac joint debridement without instrumentation.

Buchowski et al\textsuperscript{5} evaluated the functional and radiological outcome in 20 patients after an open sacroiliac fusion using the Smith-Petersen approach. They reported improvement in both pain and function. However, the mean blood loss in their series was 290 ml (SD 186) and the mean duration of post-operative stay was 5.2 days (SD 3.8). In their series, two patients developed a deep infection and three a non-union requiring further surgery. The incidence of significant complications after open sacroiliac fusion has been reported to be between 6% and 25%.\textsuperscript{5,16} The percutaneous technique avoids wound-related complications and achieved union in all cases in this series. A similar percutaneous procedure has been reported for patients with disruption of the posterior pelvic ring and those with sacral insufficiency fractures.\textsuperscript{17-19} Percutaneous fixation in these
patients provides early stabilisation with minimal operative time, minimal blood loss, and little wound-related morbidity. We have not, however, been able to find any report of percutaneous sacroiliac joint fusion for non-traumatic sacroiliac joint pathology in the literature.

In this study 13 patients (87%) had good or excellent results. The remaining two showed some improvement in their Majeed and SF-36 scores. Follow-up CT scans in both these patients showed that fusion of the sacroiliac joint had been obtained. Their MR scans suggested an arthropathy of the lower lumbar facet joints as well, which may explain the persistent pain. This was also present in their pre-operative scans. They were offered sacroiliac fusion because of tenderness and arthropathy and a satisfactory response to the diagnostic injections. Post-operatively, these patients reported remission of localised sacroiliac symptoms. It does, however, highlight the need for accurate diagnosis with confirmation by diagnostic injections. Patients with possible alternative sources of pain should be warned of the risk of failure.

Xu et al\textsuperscript{20} and Tonetti et al\textsuperscript{21} concluded in separate studies that pelvic CT should be carried out pre-operatively to demonstrate the precise anatomy of the patient. This enhances the safety of iliosacral screw placement. The inlet view (Fig. 3) shows the orientation of screws relative to the coronal plane and will show any screw tip perforating the ala anteriorly, and the outlet view (Fig. 4) will show those extending into the sacral foramina or superior to the ala.\textsuperscript{20}

We conclude that the insertion of percutaneous hollow modular anchorage screws fused with demineralised bone matrix is a satisfactory method of achieving sacroiliac stabilisation in the appropriate patient.

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No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References


