



Poor outcome following bilateral sacroiliac joint fusion for degenerative sacroiliac joint syndrome

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The purpose of this retrospective study was to evaluate the clinical and radiological outcome of bilateral sacroiliac joint (SIJ) fusion, using a new technique, in patients with a chronic SIJ syndrome.

Seventeen patients with chronic low back pain, with a positive response to specific diagnostic tests for the SIJ, were considered candidates for bilateral sacroiliac fusion. The surgical indication was based on the results of local anaesthetic joint infiltration, temporary external fixation or bone scan. Ten patients had had previous surgery on the lumbar spine. Bilateral posterior SIJ fusion was performed with internal fixation and decortication of the sacroiliac joint, using a separate approach to each joint. Local bone grafting was performed.

At the time of follow-up (on average 39 months after surgery), 3 patients reported moderate or absent pain, 8 marked pain and 6 severe pain. Seven patients showed a symptomatic non-union; union occurred in only 6 cases. Eighteen percent of the patients were satisfied, but in the other 82% the results were not acceptable. Reoperation was performed in 65% of the patients.

Our results with bilateral posterior SIJ fusion were disappointing, which may be related with difficulties in patient selection, as well as with surgical technique. Better diagnostic procedures and possibly other surgical techniques might provide more predictable results, but this remains to be demonstrated.

Keywords : low back pain ; sacroiliac joint ; fusion.

INTRODUCTION

In the first three decades of the past century, disorders of the sacroiliac joint (SIJ) presumably responsible for low back pain frequently led to sacroiliac joint fusion using various techniques. The discovery of the intervertebral disc as a source of pain represented a milestone in the treatment of low back pain. It may however have resulted in other potential sources of low back pain remaining underestimated. The SIJ as a source of low back pain took a back seat (35, 51). Sacroiliac joint fusion became infrequent. In 1957, Solonen (47) again steered attention on the SIJ as a possible origin for low back pain. He estimated that there was one SIJ problem for every ten lumbar disc disorders. The SIJ has been considered to be a source of pain in the lower back and buttocks in approximately 15% of the population (8).

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The classical technique for sacroiliac joint fusion was described by Smith-Petersen (44). He used a posterolateral approach with graft insertion through a window cut in the lateral side of the ilium. In 1927 Gaenslen described his technique using the same approach : splitting the dorsal ala of the ilium longitudinally, he reached the sacroiliac joint through the medial part of the ilium (16). The first dorsal locking technique for a unilateral fusion of the sacroiliac joint using an iliac bone graft was described by Albee. A further development of the Albee technique was carried out by Verral (50) and Pitkin (38). This procedure additionally includes removal of cartilage and impaction of cancellous bone in both sacroiliac joints. Using a long allogeneic tibial bone-graft, they built a bridge between the posterior part of both iliac wings, crossing the sacrum dorsally. This transverse interlocking of the sacroiliac joints was based on the assumption, that unilateral SIJ fusion alone is often insufficient, because the pain is caused by pathology in both SI joints.

Metz (34) described 125 cases : 81 patients had a SIJ fusion for painful SIJ degeneration. Lichtblau (24) and Coventry and Tapper (7) performed SIJ fusion in patients who presented with pelvic instability after bone graft harvesting from the posterior iliac crest. SIJ fusions combined with pubic symphysiodesis were also performed in patients with pelvic instability (20, 25, 37, 48). The published results were favourable, without exception. However, the issue of the SIJ as a possible source of pain in degenerative cases remains unsettled (15). Diagnosing pain originating from the SIJ is difficult because the presenting complaints are similar to those of low back pain from other causes (8).

We present the results of a retrospective study of bilateral posterior SIJ fusion using a new technique in patients with a chronic SIJ syndrome.

PATIENTS AND METHODS

Between the years 1990 and 1995, 17 patients (12 female, 5 male) had bilateral SIJ fusion for chronic SIJ syndrome after failure of conservative treatment at the Schulthess Clinic in Zürich. The indication for SIJ fusion was chronic SIJ syndrome due to posttraumatic (5 patients) or idiopathic (12 patients) SIJ degeneration. The mean age at operation was 43.2 years (range 22-

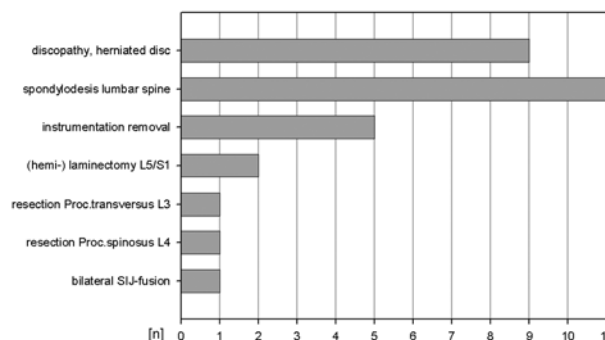


Fig. 1. — Prior operations on the lumbar spine and sacroiliac joints.

76 years). The mean BMI was 22.6 kg/m² (range 18.4-30.1 kg/m²). Ten patients (59%) had one or more prior operations on the lumbar spine ; another patient had prior SIJ surgery (fig 1). SIJ pain after lumbar fusion to the sacrum is a well known problem (21, 29, 30). When asked about the results of prior surgery on the lumbar spine and sacroiliac joint, ten patients (57%) noted only slight or temporary improvement, 29% were not improved and only 14% felt some durable improvement (table I). The preoperative symptoms varied considerably. There was no typical pain pattern. The mean duration of preoperative symptoms was 6.6 years (1-20 years). Preoperatively, all patients had pain in the lumbosacral and sacroiliac region, 76% also in the gluteal region ; 53% complained about intense pain in the low back and the gluteal region. Pain in the sacroiliac and gluteal region could be elicited by SIJ compression in 88% of patients, but was absent in 12%. Eleven patients (65%) described constant or intermittent pain radiating down the lower extremity. Nine patients had pseudoradicular pain ; two had sciatic pain. Manual testing included the Mennell sign (33) which corresponds to the 2nd phase of the 3-step-hyperextension-test. This 2nd step was positive in 73% of patients, in 27% bilaterally.

Fifteen patients (88%) required analgesic drugs regularly. Sleep was disturbed owing to low back pain in 94% of patients. Sitting tolerance was limited in 77% of patients (less than 45 minutes) ; in 18% sitting was almost impossible (less than 10 minutes). Mobility in the lumbopelvic region was limited in two-thirds of the patients, with mobility in one or more directions less than 70% of normal. Flexion of the trunk was limited in 65% of patients, the mean finger-ground distance was 25.8 cm. Lateral flexion and extension were reduced or impossible in 75% and 65% of patients respectively.

Table I. — Demographic data

	Age (years)	Sex	BMI (kg/cm ²)	Pain Preop (a)	Preop LS/SIJ (n)	Prior operations on LS/SIJ	Success Preop.
1	47	F	20,58	2	0		
2	52	M	25,06	5	5	1 : 28a preop : L4/S1 (discopathy) 2 : 15a preop : L4/S1 (pseudarthrosis) 4 : 5a preop : resection spinous process L4 2 : 4a preop : SIJ bilateral 2 : 4a preop : L3/4 translaminar	Limited
3	46	M	25,73	5	0		
4	44	F	29,74	4	0		
5	40	F	18,59	10	10	1 : 8, 7, 6a preop : L4/5 and L5/S1 (5 OP) 4 : 5a preop : Impl. spinal cord stimulator 2 : 3a preop : L4-S1 (fix.int.) 4 : 2a preop : Reimpl. spinal cord stim. 2 : 1a preop : L4-S2 4 : 1a preop : spinal cord stimulator	Limited
6	44	M	28,52	20	1	1 : nucleotomia 2 : 1,5a preop : L4-S1	Limited
7	50	F	18,36	3	1	2 : L5/S1 translaminar	Limited
8	50	M	20,30	7	0		
9	76	M	20,76	20	1	1 : 30a preop : L5/S1	Yes
10	24	F	20,99	8	3	2 : 4a preop : L5/S1 ventral 4 : 3a preop : hemilaminectomy L5 2 : 2a preop : L4/5 dorsal	No
11	39	F	30,11	6	0		
12	37	F	20,98	1	1	2 : 2a preop : L5/S1 translaminar	Yes
13	22	F	21,67	6	4	2 : 6mon. Preop : L4/5 and L5/S1 3 : 3 mon. preop : L4-S1	No
14	53	F	18,82	7	3	1 : 5a preop 2 : 3a preop : L4-S1 3 : 7mon. preop : L4-S1	Limited
15	23	F	18,90	2	0		
16	49	F	23,94	2	0		
17	38	F	21,76	4	0		

LS : lumbar spine, SIJ : sacroiliac joint.

1 : intervertebral disc operation, 2 : arthrodesis, spondylodesis, 3 : hardware removal, 4 : other operation on lumbar spine or sacroiliac joint.

Fifty three percent of patients showed an unsteady gait ; four had an antalgic limp.

A peripheral neurologic deficit was present in 35% of patients. Two had radicular symptoms related to L4 and S1. Another two patients had paraesthesia without polyneuropathy. One patient has had a posttraumatic femoral nerve deficit prior to surgery.

Preoperative diagnostic workup included physical and radiological examination : radiographs using Barsony's

technique (100% of cases), computed tomography of SI joints (76.5% of cases). In 14 patients (82.0%) selective anaesthetic infiltration of the SIJ (5 ml scandicaine 1% for each SIJ) was done under fluoroscopy. Five patients (29.4%) had a technetium bone scan. For further differentiation of the lumbosacral and sacroiliac origin of pain, 4 patients (24%) had a trial selective immobilisation of the lumbar, lumbosacral and sacroiliac segments using a temporary external fixator (18, 46).

All 14 patients who had preoperative anaesthetic sacroiliac joint injection reported temporary reduction of their typical pain. Only one patient showed enhanced uptake over the affected SIJ in the bone scan ; in 80% the results of the preoperative bone scan were negative. Temporary preoperative selective immobilisation of the sacroiliac joint with an external fixator led to clear pain reduction in three of four patients. There were no complications due to the preoperative invasive diagnostic procedures.

The indication for SIJ fusion was considered definite if a patient with preoperative pain of more than one year duration in the SIJ region showed a positive Mennell sign, degenerative changes of the SIJ in conventional radiographs or CT-scan, a positive SIJ infiltration test, or a positive temporary external fixation testing, or a positive technetium bone scan. Isolated posttraumatic SIJ degeneration without secondary lumbar spine pathology was also considered an indication. The conditions for such a definite indication were met in 30% of the patients in this series.

The indication for SIJ fusion was considered less assured if, apart from the clinical symptoms and radiological signs, CT of the SIJ showed relevant degenerative signs and SIJ infiltration was positive. This was the case in 11 patients (65%). One female patient with pain in the lumbar spine and the SIJ insisted on having an operation, owing to her continued severe pain after multiple unsuccessful prior operations. (for further diagnostic procedure details, see table II).

The technique of SIJ fusion presented here, is derived from the dorsal bilateral interlocking technique described by Verral (50) and Pitkin (38). The patient was placed prone on the operating table. Bilateral incisions were made over the posterior iliac crests from the posterior inferior iliac spine, extending 10-15 cm anteriorly to the posterior superior iliac spine. The posterior iliac crest and posterosuperior iliac spine were exposed ; the muscles were subperiosteally detached on both sides of the ilium (gluteus medius and maximus laterally, iliocostalis medially) exposing both aspects of the iliac wing. The medial approach to the sacroiliac joint was then completed. Intraoperative testing of possible abnormal hypermobility of the sacroiliac joint was performed manually. The sacroiliac ligaments were divided distally, but were left intact on the upper third of the sacrum. The SIJ was identified and curetted to prepare the bed for autogenous bone graft. The ilium was then perforated from laterally with a 3.2 AO-drill bit with a specially designed drill guide. On the medial side, the drill exited the ilium immediately dorsal to the posterior surface of

the sacrum. A threaded rod was inserted and carefully advanced to the opposite side, keeping contact with the dorsal sacral surface. The opposite ilium was then perforated until the tip of the threaded rod appeared on the lateral side. Specially designed triangular buttress plates were put in place and a second rod was inserted parallel to the first rod. Through the remaining hole a cancellous bone screw (40-50 mm, short screw thread) was placed as a lag screw in an anterior-medial direction, fixing the sacrum between the two iliac bones. Bone graft from the iliac crest was then firmly impacted into the sacroiliac joint. With nuts on both sides, forceful compression of both sacroiliac joints was achieved (fig 2).

The mean postoperative follow-up duration was 39 months (range 12-66 months). Follow-up was done by questionnaire and clinical examination, rating pain reduction on a 10-point visual analogue scale, mobility, sleep disturbance, sitting, gait and neurological symptoms. Pain improvement was recorded if the value on the visual analogue scale was at least 3 points better after operation. During the follow-up, the pain improvement was classified as temporary (less than 6 months) or durable. Sitting and walking ability was also evaluated pre- and postoperatively, based on a report by the patient himself. Radiological examination was used to evaluate the status of fusion. Definite fusion of the SIJ was recorded if bone fusion of the sacroiliac joint could be shown on the CT. Postoperative CT was done in 9 patients (53.0%). If postoperative CT was not available (47.0%), assessment of fusion was done by using conventional radiographs with Barsony's technique. A postoperative bone scan was done in 5 cases (29.4%).

RESULTS

The mean operation time was 121.3 min. (range, 85-195 min.) and the mean intraoperative blood loss was 793.8 ml (range, 300-1500). Hospitalisation averaged 25.2 days (range, 9-55 days). Intraoperative complications occurred in one case, where the dorsal iliac crest fractured ; the fragment was reduced and healed uneventfully.

At the time of follow-up, one patient was free of pain, two had mild intermittent pain. Eight patients described their pain as marked and 6 reported severe, intolerable pain. Immediately after operation, 7 patients had no pain and 4 patients had mild pain. This shows that pain reduction was temporary in 8 patients (47%). In 8 patients there was no improvement after surgery. In one case, pain could

Table II. — Preoperative diagnostic procedures

<i>Pat. No.</i>	<i>Clinic : Mennell sign</i>	<i>Infiltration (result)</i>	<i>Bone scan (result)</i>	<i>Temporary external fixation (result)</i>	<i>Radiology : signs of arthrosis</i>	<i>Preop CT</i>	<i>Diagnostic result</i>
1	pos.	–	–	–	posttraumatic	No	sure
2	neg.	bilateral (pos.)	–	–	minor	No	nearly sure
3	pos.	–	–	–	posttraumatic	yes	sure
4	neg.	unilateral (pos.)	yes (neg.)	–	distinct	yes	nearly sure
5	pos.	–	–	ilium-ilium (pos.)	minor	yes	sure
6	pos.	bilateral (pos.)	–	–	minor	yes	nearly sure
7	pos.	bilateral (pos.)	–	–	minor	yes	nearly sure
8	pos.	unilateral (pos.)	–	L4-ilium (unclear)	distinct	yes	nearly sure
9	pos.	unilateral (pos.)	yes (neg.)	–	distinct	yes	nearly sure
10	neg.	bilateral (pos.)	–	ilium-ilium (pos.)	none	yes	nearly sure
11	pos.	unilateral (pos.)	–	–	minor	No	not sure
12	pos.	unilateral (pos.)	–	–	minor	yes	nearly sure
13	neg.	unilateral (pos.)	–	ilium-ilium (pos.)	distinct	No	sure
14	pos.	bilateral (pos.)	yes (neg.)	–	distinct	yes	nearly sure
15	pos.	unilateral (pos.)	–	–	minor	yes	nearly sure
16	pos.	–	yes (neg.)	–	None	yes	nearly sure
17	pos.	bilateral (pos.)	yes (pos.)	–	minor	yes	sure

Pos. : positive test result, neg. : negative test result.

* : local anaesthetics and/or corticosteroids.

be durably eliminated. For visual analogue scale see fig 3.

Fifty six percent of patients (9) reported undisturbed sleep after the incision had healed, 31% had mild and 12.5% severe sleep disturbance. But at the time of later follow-up examination, 82% of patients reported more or less sleep impairment due to recurrent pain. Walking ability improved permanently in one patient, temporarily in 10, and in 6 patients there was no improvement when compared to their preoperative walking ability.

In most patients mobility was also not improved. Trunk flexion was limited in 12 patients preoperatively, and in 13 after operation. The mean finger-ground distance did not change. Preoperative neurological deficits in 6 patients persisted unchanged after surgery. The Mennell sign was positive in 50% of patients at follow-up, compared to 76% preoperatively.

Radiological follow-up showed definite bony fusion in 6 patients (35.3%), questionable fusion in 4 patients (23.5%) and nonunion with instability in 7 patients (41.2%) (table V). Comparing only verified non-fusion and fusion, the independent samples t-test shows a significant influence of fusion on pain at time of follow-up ($p < 0.05$). Overall, 64.7% of patients (11) had further surgery. In 10 patients (59%) the hardware was removed to treat persistent local pain, within two years after the initial fusion operation. In 4 cases these procedures led to further pain relief ; in 6 patients there was no improvement. Three patients had excision of scar tissue. In 29.4% of the cases (5) a second fusion operation was performed on the SIJ, using a ventral technique in 4 patients and a dorsal approach in one. The time to fusion was 12, 18, 22 and 42 months from the time of the index operation. In one patient a ventral L4/5 fusion with insertion of a

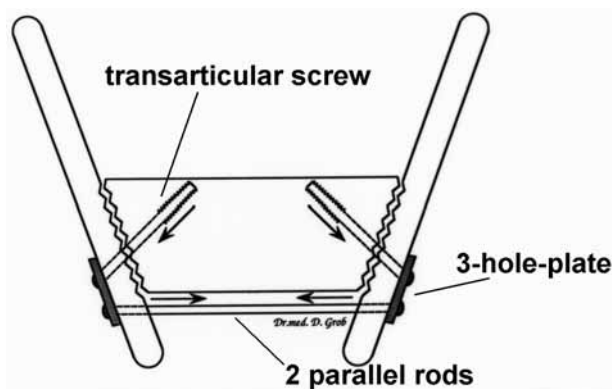


Fig. 2. — Bilateral fusion of the sacroiliac joint (scheme)

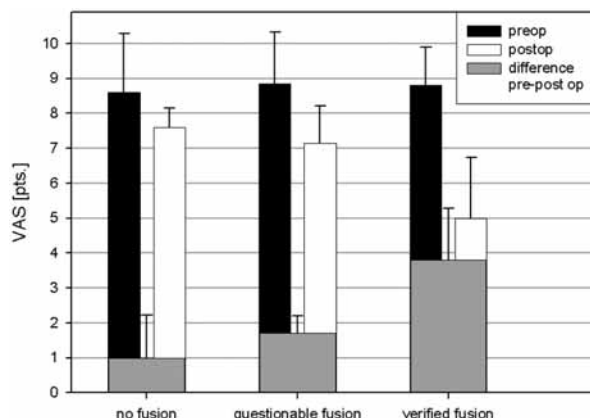


Fig. 3. — Radiological fusion and clinical outcome (mean, standard deviation).

Table III. — Reoperations

	Reop (n)	Reoperations	Indication for reoperation
1	1	1 : 22mon.p.o.	persisting local complaints
2	0	none	
3	0	none	
4	1	5 : tumour excision	osteoid osteoma r. iliac wing
5	2	1 : 3mon.p.o. : sacroiliac joint dorsal 1 : 5a p.o. : L4-S1 dorsal	persisting local complaints
6	0	none	
7	1	1 : 9mon.p.o.	persisting local complaints
8	1	1 : 5a p.o.	persisting local complaints
9	0	none	
10	2	1 : 4mon.p.o. : screw 1 : 1a p.o. : sacroiliac joint and L4/5	persisting local complaints
11	1	4 : 72mon.p.o. : L4/5 ventral (titan cage)	spondylosis and discopathy L4/5
12	3	1 : 5mon.p.o. 2 : 1a p.o. : revision soft tissue / cicatrice 3 : 1,5a p.o.	neuroma pseudarthrosis sacroiliac joint right
13	3	2 : 7mon.p.o. : implant changing 1 : 17mon.p.o. 3 : 42mon.p.o.	progressive local pain persisting pain pseudarthrosis sacroiliac joint right
14	1	1,3 : 22mon.p.o.	recurrentpain right sacroiliac joint, pseudarthrosis sacroiliac joint right
15	0	none	
16	1	1,4 : 7mon.p.o. : L5/S1 translaminär	Persisting complaints, discopathy L5/S1
17	3	3 : 1a p.o. : bilateral 1,2 : 20mon.p.o. 5 : decompression L4/5 (disc hernia)	pseudarthrosis sacroiliac joint

1 : hardware removal, 2 : local revision, 3 : ventral sacroiliac joint arthrodesis, 4 : spondylodesis lumbar spine, 5 : others.

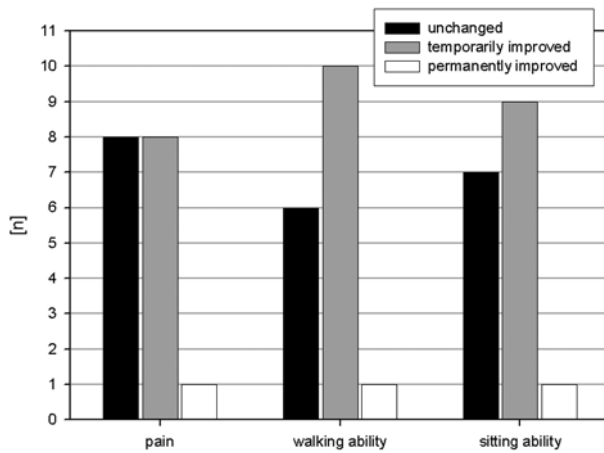


Fig. 4. — Development of subjective criteria

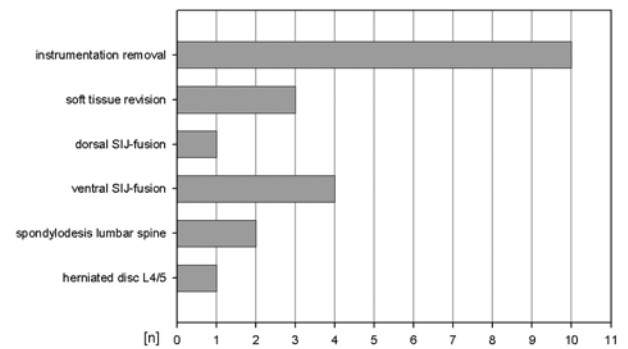


Fig. 5. — Reoperations

Table IV. — P.o. sacroiliac joint-fusion and clinical result

Pat. No.	Radiographs [months after operation]	Radiographs Barsony Tomography	CT [months after operation]	CT result	Fusion	Pain reduction
1	54	fusion	38	fusion	certain	permanent
2	12	fusion	45	fusion	certain	permanent
3	4	fusion	-	-	certain	permanent
4	35	not clear	30	fusion	certain	none
5	2	not clear	-	-	uncertain	none
6	17	not clear	-	-	uncertain	temporary
7	32	not clear	-	-	uncertain	temporary
8	47	fusion	48	fusion	certain	temporary
9	8	not clear	-	-	uncertain	none
10	61	no fusion	-	-	non union	none
11	66	no fusion	-	-	non union	temporary
12	18	no fusion	31	no fusion	non union	temporary unilateral
13	12	not clear	12	no fusion	non union	unilateral
14	5	not clear	27	no fusion	non union	temporary
15	4	fusion	-	-	certain	temporary
16	43	no fusion	43	no fusion	non union	none
17	7	not clear	7	no fusion	non union	temporary

titanium cage was carried out 72 month after operation (table III, fig 5).

Statistical analysis showed no relationship between long-term pain relief and the results of preoperative testing with temporary external fixation (independent-samples t-test: $p = 0.601$).

Similar observations were made for the preoperative SIJ infiltration test ($p = 0.867$) and for Mennell's sign ($p = 0.848$).

Overall, one case had an excellent result (permanent pain relief and improved sitting and walking ability) and two patients had a good result: one

patient with five prior operations on the lumbar spine had temporary pain reduction, he is satisfied with the result and would have the operation again ; in another female patient the result could be rated as good, because the operation relieved all pain in the sacroiliac joint area, but she now has symptoms due to lumbar stenosis. In all other patients (82%) there was no or temporary improvement in symptoms or activities of daily living (walking or sitting ability). The results were considered fair in 35% of cases (6) are and poor or unacceptable in 47% (8).

DISCUSSION

The unique morphology and biomechanical situation of the sacroiliac joint make the diagnosis and treatment of SIJ disorders difficult. The literature points out two main problems ; first, diagnostic problems in identifying these joints as the true origin of pain, and second the technical difficulties in obtaining solid fusion.

There is no specific clinical symptom pointing to the sacroiliac joint as the cause of pain. Low back pain in the lumbosacral and SI region, often accompanied by diffuse deep persisting pain, is thought to be typical for the SJI syndrome. Pseudoradicular pain radiating in the dorsal aspect of the thighs down to the knees is common. A possible explanation for this could be the innervation of the SIJ (19). Kellgren (22) surmised that the dorsal and ventral ligaments of the SIJ, due to their rich innervation, are the primary source of pain. The joint itself is supplied by branches from dorsal rami of spinal nerves S1 and S2. The extensive dorsal ligament is also innervated by dorsal rami from S3 and S4. The innervation of the origin of the gluteus maximus muscle by the same nerve pathways could explain the gluteal pain in the SIJ syndrome. Pseudoradicular radiation is considered "pain assigned" to segments S1 and S2.

There is no clinical test with a satisfying retest-consistency, particularly between several examiners (interobserver reliability). The SIJ is not directly accessible to palpation or functional examination. This considerably reduces the value of clinical testing. Other structures like muscles, the sciatic nerve, hip joints and the lumbar spine also make

the physical examination for sacroiliac joint pathology demanding. We performed several sacroiliac joint provocative tests, e.g. Patrick-test, Gaenslen-sign (16), but only the Mennell-sign was frequently positive. At time of follow-up, Mennell's sign was positive in 50% of cases, indicating the sacroiliac joint still was a important source of pain after operation. However, manual testing remains a small piece of evidence in the diagnostic process. Only pain provocative testing appears reasonably reliable (5, 9).

In the opinion of Waisbrod *et al* (51) surgery is not indicated unless clinical symptoms, radiology, bone scan and diagnostic tests all correlate. Selection for surgery should be strict and thorough. Six criteria have to be fulfilled : Presence of chronic low back or gluteal pain, possibly with radiation in the groin and/or lateral thigh without a radicular pattern. Radiological findings, preferably in CT-scan, should show a degenerative pathology. Bone scan should show SIJ enhancement. Pain provoking tests like the manual tests, infiltrations with physiological sodium chloride solution causing "memory pain" as well as pain reduction after controlled infiltrations using local anaesthetics should repeatedly lead to identical results. Finally psychosomatic disorders must be excluded. Waisbrod *et al* (51) used several psychometric tests to disclose any psychosomatic components in the patients' symptoms. Our history taking included inquiries into social, occupational and psychological factors. If there was any suspicion for a relevant psychosomatic source of pain, an operation was not performed. The discussion about which tests are suitable to answer this question is beyond the scope of this study.

In our opinion pain is the main relevant criterion to define if the operative intervention was successful or not. If there is no relevant pain reduction achieved, the operation has failed. Describing the main elements of activities of daily living (sitting, walking, sleep) is also an appropriate outcome measurement for any joint pathology. Orthopaedic operations for low back pain primarily intend to reduce pain and to improve activities of daily living. Positive changes of psycho-social/psychiatric conditions are mostly secondary effects from pain relief.

In Solonen's opinion (47), conventional radiology often provides deficient and/or deceptive information about the sacroiliac joint. Investigations of Rothschild *et al* (40) showed a high sensitivity in detecting erosions or fusions in sacroiliac joint arthrosis using projection angles of 15° or 30° and tomography. However high rates of false positives make their clinical application uncertain. We have not found the radiological pattern of Barsony (1) to be useful. While they may show distinctive radiological signs of joint degeneration, their significance remains doubtful, and they do not translate into specific symptoms. In our point of view, plain radiographs of the sacroiliac joint have little significance in defining a surgical indication or in assessing fusion during postoperative follow-up. Today, tomography has been replaced by high-quality CT scans. Transverse slices are most suitable to illustrate degenerative changes in the sacroiliac joint. The presence of sclerosis, osteophytes and vacuum phenomena may show progression of joint degeneration. However, their relationship to the clinical status remains uncertain. The findings of Elgafy *et al* (11) suggest limited diagnostic value of CT in SIJ disease because of its low sensitivity and specificity, also.

Kissling (23) performed anatomical examinations on pelvic specimens, looking for ways to penetrate the sacroiliac joint. In his point of view, the term "intraarticular SIJ injection" is not correct, because his examinations showed that the SIJ cannot be penetrated from a dorsal approach. He assumed that "SIJ injections" frequently referred to were mostly periarticular anaesthetics into the dorsal ligaments. Other authors describe fluoroscopy or CT-assisted injection as a less problematic and safer method, depending on the experience of the investigator (31, 3). Pain reduction following injection of the SIJ with local anaesthetics under fluoroscopy would seem to be a helpful predictor (51). Anyway, a placebo effect is also possible (28). In literature, an exact assessment of the validity and reliability of SIJ injection with local anaesthetics under fluoroscopy could not be given (42). We found no correlation between positive fluoroscopy-controlled preoperative injection of the SIJ with local anaesthetics and clinical outcome after dorsal SIJ fusion.

The reason for this may however be the unsuitable surgical fusion method, more than incorrect performance of sacroiliac joint infiltration.

Temporary external fixation was previously described as a valuable diagnostic tool to treat disorders of the lumbar spine (27, 36, 13). Investigations regarding transpedicular temporary external fixation of the lumbosacral spine showed a placebo effect of all invasive tests in this patient category (49). Transpedicular temporary external fixation (including a placebo trial) can however be a valuable test to select suitable candidates for spinal fusion. In our study, all patients with positive preoperative temporary external fixation of the SIJ showed poor and unacceptable results (table III and IV). There are unfortunately not enough data in the group with isolated dorsal sacroiliac joint fusion (17) to support the use of temporary external fixation for identifying the source of chronic low back pain (42, 11). Regarding the whole group of 27 patients treated with dorsal SIJ fusion and operation on the lower spine level at our hospital, the results of the patients who had diagnostic temporary external fixation and those without were compared. In the group with temporary external fixation, three had an excellent (33.3%), one a good (11.1%), two an acceptable (22.2%) and three (33.3%) a poor subjective rating. We could see no better results in patients with a temporary preoperative immobilisation of the SIJ compared to patients treated without this diagnostic tool. It is an invasive method, with possible complications. Consequently in our opinion, this diagnostic tool should only be used, when all other diagnostic methods have failed and the patient is decided to have an operative intervention if temporary external fixation is positive. False positive results have to be excluded by one or more consecutive sequences of immobilisation and destabilisation. If no pain reduction is achieved, SIJ fusion is not indicated.

The only patient with preoperative positive bone scan ended up with an unacceptable result. According to Snaith *et al* (45) bone scanning is not a useful diagnostic method with sufficient specificity and sensitivity, in most cases of low back pain. Chase *et al* (6) and Esdaile *et al* (12) concluded, that

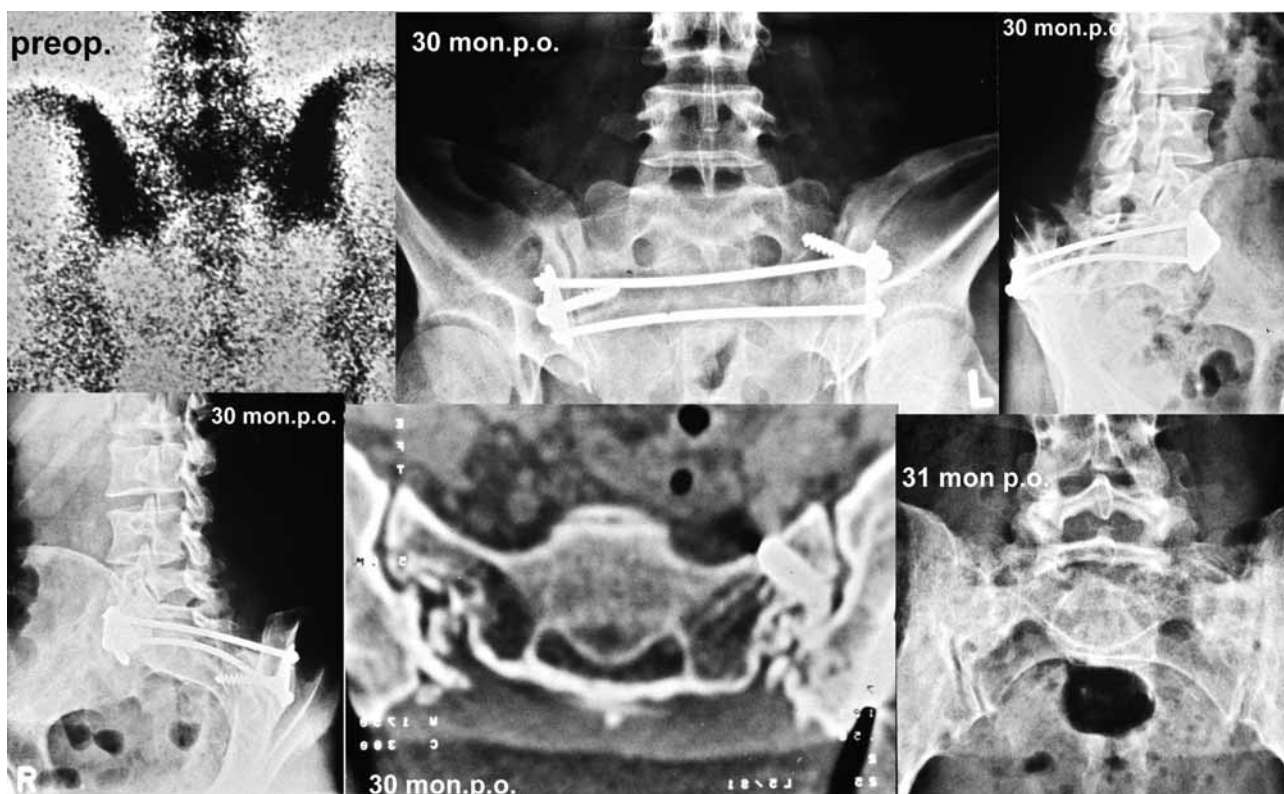


Fig. 6. — Female, 38 years old. (BMI 21.8 kg/m²). No prior operations, no injuries. 4 years of severe lumbosacral pain history, no neurological deficit. Indication based on scintigraphic enhancement in both sacroiliac joints, and positive SIJ infiltration test. No pain at time of discharge. During follow-up, exacerbation of pain similar to preop. CT-scan 6 month p.o. : no bony fusion. Reoperation 12 months p.o. : ventral bilateral SIJ fusion. 20 Month p.o. : hardware removal, revision. 39 months p.o. : persistence of lumbosacral, sacroiliac und gluteal pain. No further operative intervention is planned.

bone scan has no higher sensitivity and poor specificity when compared to radiographs. Similar results were shown by McKillop und Fogelman (32). The results of Slipman *et al* (43) demonstrated very low sensitivity and high specificity of nuclear imaging in the evaluation of SIJ syndrome. The authors do not recommend bone scan in the diagnostic algorithm for SIJ syndrome, because it is not a suitable method to differentiate low back pain from isolated SIJ syndrome. We found that even a positive bone scan alone does not indicate fusion in cases of degenerative SIJ syndrome (table II, fig 6). Bone scan should not be used as screening method with degenerative diseases, but can be useful in selected patients for evaluation of fractures, inflammatory processes or tumours related to the SIJ.

MRI, CT and bone scans of the SIJ cannot reliably determine whether the joint is the source of

the pain. We could not find any correlation between special diagnostic methods (SIJ infiltration, bone scan, temporary external fixation, Mennell-sign) used preoperatively, and outcome. Treatment modalities include medications, physical therapy, bracing, manual therapy, injections, radiofrequency denervation, and arthrodesis ; however, no published prospective data compare the efficacy of these modalities (8). Controlled analgesic injections of the SIJ are the most important tool in the diagnosis. We have used all the criteria of Waisbrod *et al* (51), and also temporary external fixation, to ensure correct and strong indication criteria. Considering all the lacks and pitfalls of SIJ symptoms and the possible diagnostic procedures, a really sure diagnostic method for indication finding is not available till now. Like many other authors (12, 23, 45, 6, 40, 51), we also stress the need for further

specific, sensitive and objective clinical methods in the diagnosis and follow-up examination of SIJ syndromes.

Although several types of SIJ shapes can be differentiated (41), the basic configuration is an ear- or C- shape with its opening in the ventrocaudal direction. The cross-section of the sacrum is conical with an increasing diameter ventrally. The range of motion of these true joints is very limited. Owing to its irregular surface and its strong ligamentous structures, the SIJ represents functionally more a syndesmosis than a real joint. Force transmission is primarily in a ventrocaudal direction, pushing the sacrum forward and downward. The sacroiliac ligaments tighten both iliac wings firmly against the sacrum and lock it into place. A biomechanically effective fusion of the SIJ should either stop this tendency of forward slipping from the ventral side or block it from the dorsal side. No single technique for operative fusion of the SIJ is commonly accepted as the gold standard. Many of the methods are described as adequate fusion techniques (2, 17) although they are only based on results achieved in less than 10 cases. Independently of their technique of dorsal SIJ fusion in degenerative cases, authors presenting larger case numbers describe their results far less euphorically (51). Even new approaches to the SIJ were created, but their benefit and results in clinical practice are still due (10).

Despite careful selection of patients with a long history of symptoms and multiple prior operations on the lumbar spine and the SIJ, our results after dorsal bilateral SIJ fusion with a new technical approach have been less than satisfactory. The aim of the operation was the fusion of the sacroiliac joint to reduce or eliminate pain. Unfortunately, we have carried out post-operative fusion control using CT as the method of choice only in 9 patients. When postoperative CT was not available, interpretation of fusion using conventional radiographs with Barsony's technique remains unclear. In the 9 patients who had postoperative CT-scan, only 4 however showed fusion of the SIJ. Besides the difficulties in defining the correct indications, in our opinion, a major reason for these disappointing results is the inappropriate operative fusion technique. Bone fusion did not occur in almost 30% of

cases, and was questionable in 42%. Bony fusion can be considered a prerequisite for pain reduction, although this has not been demonstrated so far. In our results, cases with verified fusion showed significantly better pain reduction than cases with non fusion (table V). One hundred percent of patients with radiological non union had poor results. Pain reduction was not achieved in most cases. Compared with the literature our results are still more disappointing than those of other studies in which similar or other fusion methods were used (17, 38, 2, 50, 51). Owing to failure to achieve pain relief and to the high rate of non union, the operative technique used can no longer be recommended. Why this method failed is difficult to say. Perhaps our method of SIJ is biomechanically inadequate and in spite of internal fixation the interfering forces result in persisting micromotion in the SIJ, inhibiting fusion.

CONCLUSIONS

The surgical technique used for bilateral dorsal SIJ fusion did not lead to acceptable results. The results in terms of pain relief were overall disappointing. Although these patients represent a negative selection, there is little hope for improvement after dorsal SIJ fusion. This study was not able to provide answers to questions about the diagnosis, therapy and pathophysiology of pain related to disorders of the sacroiliac joint. For a better understanding of SIJ disorders and related pain, further investigations are needed. Defining proper indications for SIJ fusion remains difficult (4, 9, 14, 26). If fusion is still considered necessary, it is difficult to achieve. Degenerative arthritis of the SIJ is common. It progresses with age, but is often self limited by spontaneous fusion of the articulating surfaces. Therefore SIJ fusion surgery should be carried out only as *ultima ratio*. The preferred treatment of low back pain due to degenerative SIJ disease remains conservative.

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