Anterior lumbar interbody fusion

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According to Webster's dictionary fusion is a union of different things by melding or blending. Arthrodesis is defined as a procedure to stiffen a joint. Because this definition of fusion clearly applies to dead material, strictly speaking the term arthrodesis should be preferred.

The first record of an attempted spinal arthrodesis was the publication of Hadra in 1891 (3). He described a technique of "wiring of the vertebra as a means of immobilisation in fracture and Pott's disease." He used silver wire.

In 1932 Capener (1) described the results of anterior lumbar interbody fusion in 34 patients with spondylolisthesis. Other well known orthopedic surgeons such as Mercer (8), Friberg (2) and Merle d'Aubigne (9) also described this technique for patients with spondylolisthesis. They all used the transperitoneal approach. From Lane and Moore (5) came the first report of the use of his technique for degeneration of the disc. Meanwhile in 1944, Iwahara in Japan had published in Japanese the extra peritoneal approach (4).

In this paper anterior lumbar interbody fusion via an extra peritoneal approach without instrumentation is described. The indication is restricted to patients with symptomatic degeneration of one segment, not operated before and without gross segmental hypermobility and to patients with symptomatic degeneration after a posterior decompression operation, in the majority of cases carried out for a herniated disc.

Diagnosis

Chronic low back pain with or without referred pain down the leg is a multicausal phenomenon: not only the condition of the spine, but also other variables are involved. These include aerobic fitness (7), strength and endurance of trunkmuscles (7) and psychological factors (7, 13): in particular somatisation, somatic fixation and operant conditioning are of significance. Aerobic fitness is assessed by bicycle ergometry and trunkmuscle performance is quantified in the ISO-station B200. Finally a psychological assessment is done, including a structured interview by a clinical psychologist, a paindrawing (10) and psychometrics (7, 13).

Patients with an insufficient physical condition and or with positive findings at psychological assessment such as signs of pain behaviour, somatisation and somatic fixation are not operated upon before these factors have been corrected by a cognitive behavioural training-program. A number of patients with degenerative changes will function normally after such a program. In only a small percentage of patients invasive radiological tests and subsequent fusion of the symptomatic segment is carried out.

Degenerative changes of the lumbar spine have been observed in people without symptoms: osteophyt formation occurred equally in people with symptoms as compared to people without. While a loss of disc heigth of 2 mm or more was significantly more present in people with symptoms, in particular in the younger age group (12). On MRI the incidence of degenerative changes in asymptomatic people is even higher (11). Lawrence (6) defined the sensitivity and specificity of plain radiography in patients regarding the relation of back pain and degenerative changes of the lumbar spine as 59%, respectively 55%, which is too low to be of practical value.

Because the radiologically observed degenerative changes of lumbar segments may or may not be the cause of the symptoms in the individual patient, the diagnostic dilemma of symptomatic versus asymptomatic degeneration has to be solved. Until now however, the available tests, such as provocative discography (Figure 1) and selective facetblocks (Figure 2) are still controversial. Because no other tests were available the author has used these tests since the late seventies.

Both tests are painstudies while the morphology is of little significance. Steindler's postulate of a symptomatic lesion is applied: a small amount of contrast is injected into the lesion (intradiscal or intraarticular) to provoke symptoms which have to be concordant and which have to be relieved by marcain for at least one hour. In that case the testresult is considered positive. The result is defined as true positive when the respons at an adjacent segment is negative. Because it is difficult for a patient in disstress to observe his own pain-pattern, the response at discography is in about 60%

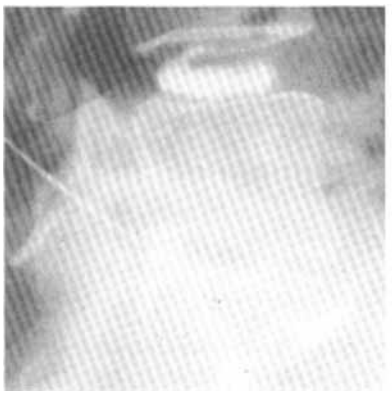

Figure 1. Discography in a 35-year-old woman; the disc at L4-5 is asymptomatic and normal. At L5–S1, symptoms were provoked by contrast leaking anteriorly and relieved for 2 hours by injection of 1.0 mL marcain: symtomatic degeneration.

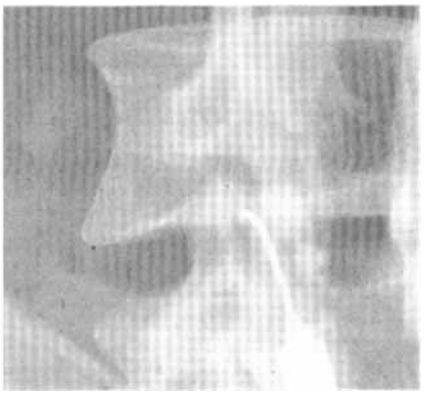

Figure 2. Facet block at L4–5: the symptoms were not relieved after injection of marcain intra-articularly. Normal asymptomatic facet joint.

equivocal; in about 20% a clear cut positive respons and in the other 20% a clear cut negative respons is obtained (14, 16).

Surgical technique

The approach is retroperitoneal via a lumbotomy. The patient is positioned on the operating table with his left side tilted about 60° to the table. The anesthesist is asked for a mild hypotension. The skin incision is different for the different lumbar segments (17). The muscles are dissected by diathermy in the line of the skin incision. The retroperitoneal space is dissected bluntly. An anatomical plane is present between the posterior peritoneum containing the ureter and the space in front of the spine containing the iliac vessels. To Steinmann pins are inserted in the vertebral body's to hold the disc free of bloodvessels and other tissue. One has to avoid strain on the iliac vessels. When this occurs a segmental vessel, in particular proximal, is clamped by vascular clips and cut. To this stage usually no bloodloss has occurred. The disc is excised, the endplate removed with osteotomes, into bleading bone. The antero-posterior depth is measured preoperatively on radiographs and marked by tape on the osteotomes, including a margin for safety.

Care is taken to perform a precise carpentry of the disc space and to ensure parallel planes in good bleeding bone after removal of the endplate, till a couple of mm. before the posterior margin of the vertebral body. Subsequently allograft is prepared and cancellous bone is taken from a small opening in the left iliac crest. As allograft a femoral ring is used which is stuffed with cancellous bone. The remaining cancellous bone is placed in the disc-space around the femoral ring. This technique has been used by the author since three years with no more pseudarthroses as compared with convential techniques. A vacuum drain is placed in front of the spine and the wound is closed continuously with vicryl 0 en the skin intracutaneously. Postoperatively AP- and lateral radiograms are made and the patient is mobilised in a couple of days leaving the hospital between 5 and 10 days without any external support. He is instructed to do as soon as possible after the operation isometric abdominal and backmuscle excercises, gradually extended into dynamic training.

The operative morbidity was in the late seventies characterized by an average bloodloss of 210 mL and an average operating time of 2 hours 50 minutes. The average hospital stay was 19 days. In the early eighties patients were faster mobilised resulting in an earlier discharge at 12 days. In those days the reconstruction of the iliac crest with a bone graft taken from the depth of the ilium after removal of the graft took considerable time. Since allografts have been used the patient is on average discharged after 8 days, the bloodloss is on average 110 mL and the operating time 1 hour 45 minutes (14, 16).

Results

From 1979 till 1989 two prospective longitudinal studies have been performed: one on patients with symptomatic degeneration of one lumbar segment (14) and one on patients with a laminectomy or discectomy in their history (16).

At discography 34% of 131 injected degenerative levels were symptomatic, while 48% of 44 injected discs with segmental hypermobility were. Complica-

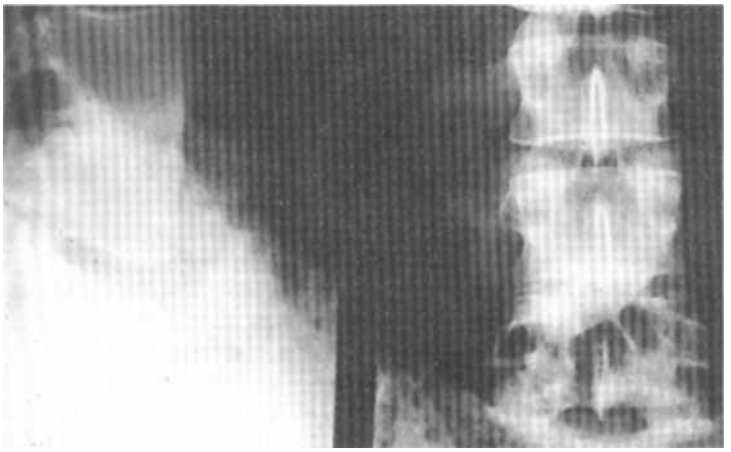

Figure 3. A-P and lateral view 9 years after anterior fusion for symptomatic degeneration. Note the bony ankylosis and the normal adjacent discs.

tions: of 86 patients operated by using large bone-grafts from their iliac crest 18 patients had symptoms related to the donor area. In the majority only mild, such as loss of sensation in the area of the lateral femoral cutaneous nerve, in 5 however necessitating re-operation. One patient had a deep wound infection, one a low grade infect leading to a pseudarthrosis. One patient had a lymph fistula. A pseudarthrosis was observed in 14/86 patients, in 6 symptomatic requiring an intertransverse fusion. This was succesful in 4.

Outcome was assessed by an independent observer, being a resident of a different department, the radiographs by an independant radiologist not having assessed the patients in the diagnostic phase. Patients were asked in a dichotomous way whether they were satisfied with the operation or not: 82% were satisfied. The outcome was objectively assessed by applying five criteria, each of them on a five point scale: 68% of patients had a good result, 12% fair and 20% poor of which 5% worse. The adjacent discs proved to be normal at long term follow up (Figure 3) when these discs were normal at discography pre-operatively (15). The majority of poor results were due to not recognized pain behaviour and somatisation. These patients suffered a deconditioning syndrome as described by Mayer et al. (7).

Conclusion and recommendations

Degenerative changes of the lumbar spine as an indication for fusion is still controversial. Results as described above may well be the result of a placebo effect. However, by following up these patients during many years, the author has the impression that patients can be selected which will benefit from such an operation. Unfortunately an effective selection process is still lacking. As Alf Nachemson has stated repeatedly, well designed outcome studies are needed. Outcome criteria related to function are now available. Function in daily life, including sports and work are among the most significant.

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