Joint surgery in severe ankylosing spondylitis

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Twenty-three patients with ankylosing spondylitis with severe deformities of hips, knees, and ankles were treated by a variety of surgical procedures followed by a comprehensive rehabilitation program. The surgery included 35 total hip replacements, six knee arthroplasties, and seven femoral osteotomies. Elongation of the Achilles tendon (eight procedures) was done on 6 patients. Shortening of the femur was performed in patients with long-standing flexion contractures when straightening of the limb during the operation caused traction on the vessels and the nerves. When there was both hip and knee involvement, hip arthroplasty was performed first. Preoperative planning aimed at obtaining plantigrade position of the feet and lower limb-length equality.

Availability of custom-made and miniaturized components was essential. Positioning of patients on the operating table necessitated special supports. Six patients were completely bedridden before surgery and 17 were severely disabled or deformed. All the patients but 2 improved markedly, became mobile, independent, and self-supporting. Revision arthroplasty was performed in 4 patients; 3 others deteriorated functionally, but refused further treatment. Heterotopic bone formation was observed after operation in 6 patients.

Surgery for severe ankylosing spondyloarthritis requires highly specialized and well-equipped centers.

In ankylosing spondylitis the loss of motion is the most disturbing feature. Improvement after surgery in this condition is poorly reflected by the usual objective evaluation tests, because even relatively small improvement in motion can be functionally appreciated by a patient with a stiff back. The development of new instrumentation, precise surgical techniques, and safer anesthetics present new reconstructive surgical options for severely crippled patients. We have reviewed our clinical approach and results in 23 patients with multiple joint involvements necessitating special surgical strategy and unconventional operative techniques.

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Patients and methods

During the period 1977–1982, 22 males and 1 female suffering from ankylosing spondylitis with involvement of joints of the lower limbs underwent a variety of procedures in our hospital. Severe locomotor disability was the main indication for joint arthroplasties. Six patients were bedridden due to bilateral hip ankylosis in a nonfunctional position. Seven had severe locomotor difficulties: 2 with bilateral hip ankylosis in extended positions were able to walk by knee and ankle motion, and 5 had unilateral hip ankylosis and restricted hip motion on the other side. Ten other patients were restricted in their walking abilities to a lesser degree because of various degrees of joint contracture.

Twenty-one patients had not had any previous physical or surgical treatment; 2 patients had previously undergone Girdlestone procedures.

The main indications for hip arthroplasty were flexion contracture above 60° or flexion-extension motion less than 45° causing marked functional

impairment. Knee flexion contracture of 35°, bilateral flexion contractures above 20°, or knee motion less than 45° were functionally disabling and necessitated surgery. Ankle plantar flexion contracture greater than 30° caused leg-length discrepancy and need for special shoeware. Surgery was indicated in bilateral cases, and in unilateral cases when the leg length was equal or the affected side was longer primarily because of fixed pelvic obliquity. Pain was the prime indication for surgery in only 4 of the 23 patients whose disease was still active. These patients also had hip and other joint contractures.

Twelve patients had replacement of both hip joints, and in 11 one hip joint was replaced. Of those patients with unilateral hip replacement, 2 had a prior Girdlestone procedure of the contralateral hip joint. Twelve patients (10 with bilateral hip replacement and 2 with unilateral hip replacement) underwent additional surgery: six knee arthroplasties (6 patients), seven femoral shortenings – three proximal and four distal in combination with wedging osteotomies – and eight elongations of the Achilles tendon with posterior ankle capsulotomy. The youngest patient undergoing hip arthroplasty was 21 years old at the time of surgery and the oldest was 44 years old. The age of disease onset divided the patients into two groups: juvenile onset, less than 15 years of age (4 patients), and adult onset, with first signs of the disease appearing after 15 years of age (19 patients).

The age of onset of the juvenile type was 9, 11, 11, and 14 years, respectively. All 4 patients underwent bilateral hip replacement, and 3 knee arthroplasties as well. In this group, peripheral joint involvement preceded axial involvement. The mean age at onset in the adult group was 23 years. The axial onset preceded the peripheral involvement in 15 of the 19 patients; in the other 4 patients, peripheral and axial involvements were simultaneously noted.

Before admission to the hospital, each patient was carefully examined and functional abilities recorded. The results were analyzed according to a special scoring system based on functional abilities (Table 1). Walking difficulties and functional disability were the major indications for surgery in 19 of 23 patients. Only in 4 patients was joint pain the main complaint. According to these data the proportional scoring values of the findings were walking capability 40 percent, function (including daily activities) 40 percent, and pain 20 percent of the total score. Patients were referred for evaluation of respiratory, hematologic, and urologic functions, and finally to anesthetic presurgical screening. The anesthetist paid particular attention to the possibility of cricoarytenoid arthritis, vocal cord fixation, and tempromandibular motion. Cervical spine movements were checked. Prior to induction of anesthesia the patient was positioned and supported firmly by specially prepared vacuum-setting bags. Special care was taken for protection of the neck area during intubation and operation to avoid subluxation of the atlantoaxial joint.

Table 1. Scoring system for patients with ankylosing spondylitis and joint involvement

	Score
Walking	
Bedridden	0
Wheelchair, transfer activities with walker	10
External support, limited walking distance	20
Fully ambulant (with or without limp)	40
Function	
Completely dependent or confined	0
Partially dependent needing human help and supporting aids	10
Most housework, shop, desk-type work	20
Independent, can work on feet with or without supporting aids	40
Pain	
Pain at rest, continuous medication	0
Pain with activities, occasional medication	10
No pain	20

Prophylactic antibiotic therapy with cloxacillin for 24 hours starting with premedication was usually employed. Heparin, 5,000 units every 8 hours subcutaneously, was administered postoperatively for 1 week or until the patient was mobile.

Total hip arthroplasty

The patients were positioned on their side. The skin incision was lateral and curved according to the hip flexion contracture. Trochanteric osteotomy was performed in 14 of the 35 hips to facilitate femoral canal exposure and to determine the appropriate anteversion of the femoral component. In cases with marked femoral neck anteversion, shortening of the neck and a more lateral reattachment of the trochanter were done. In 3

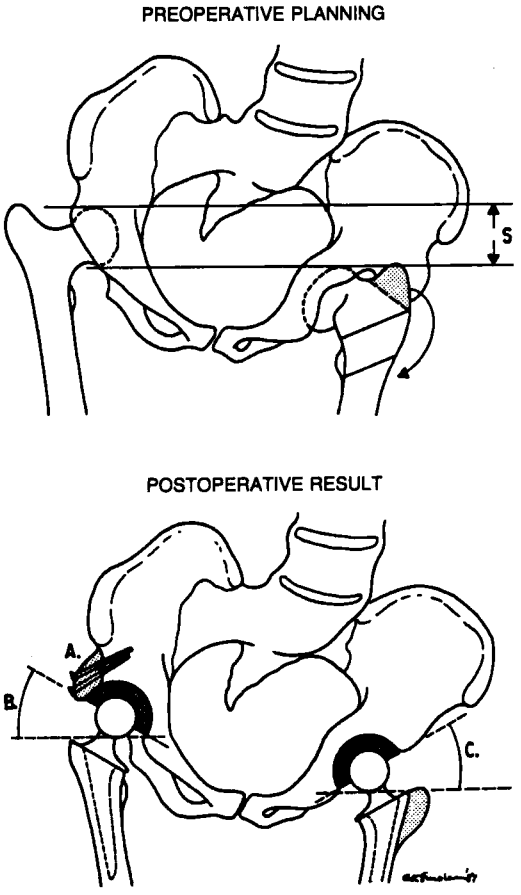

Figure 1. Preoperative planning in a patient with ankylosing spondylitis and bilateral hip arthroplasty. Note the relative shortening (S) resulting from the pelvic obliquity, shortening of the femur, and transfer of the greater trochanter.

Postoperative result. Equal positioning of the cups (B - C) resulted in relative varus position on one side necessitating a bone-graft coverage and relative valgus position on the opposite side.

cases a complete capsulotomy and a psoas tenotomy were performed. In 3 cases full hip extension was not achieved following these procedures. Additional detachment of the muscles from the inferior pubic ramus and shortening of the femoral neck had to be performed. Reaming of the acetabulum and the location of the acetabular cup was done according to the pelvic position. When fixed pelvic obliquity and forward pelvic tilt was present, the acetabular cup was inserted so as to achieve the best femoral head coverage while the patient was erect. In 5 cases, bone grafting using the femoral head was required to achieve full coverage of the acetabular component (Figure 1). Vitallium mesh and bone grafts were used in 3 other patients with severe acetabular protrusion.

In 16 hips special reamers and femoral components, used for congenital hip dislocation, were required. The femur was reamed initially with an intramedullary reamer used for femoral nailing followed by manual curetting of the proximal femur to achieve fitting of the femoral components in the correct anteversion angle. The trial prosthesis was used to find the range of motion that was achievable. During this test the lower limb was held in an extended position for a few minutes, and the peripheral pulses were checked. If the pulses were diminished or the skin became paler or colder, the trial was removed, the stump shortened, and the procedure repeated.

Knee surgery

Knee arthroplasty was performed in patients whose knees were ankylosed both in extended and in flexed positions. When the knee was ankylosed in extension, soft-tissue releases were performed as needed to achieve knee motion, and quadriceps lengthening was done when knee flexion was less than 60° after the capsular release. When the knee was ankylosed in flexion, an attempt to straighten the knee caused traction on popliteal vessels and nerves. In those cases, anterior wedge resection of the femur and shortening of the bone were done, followed by the knee arthroplasty or fusion (unilateral cases). When knee arthroplasty was indicated, the procedure was postponed until bone fusion was achieved after the osteotomy or shortening combination.

Ankle surgery

Chronic bedridden patients with severe equinus deformities in the ankles were treated by lengthening of the Achilles tendon. Additional talocalcaneal capsular release was necessary in the majority of these cases to achieve a plantigrade foot. A plaster cast was then applied from the toes to the knee for 6 weeks.

Postoperative management

Patients began to perform isometric exercises within a day of the operation. They progressed to active assisted exercises as soon as tolerated. Weight bearing was not attempted before the

surgery of the second limb was completed. Patients who were nonambulatory before the operation, regained an erect position gradually in a tilting bed. Weight bearing was assisted by hydrotherapy, the patient being supported by parallel bars. The prone position in bed was recommended for a few hours daily to maintain hip extension; all could not endure this position because of the spinal deformities. If residual knee flexion contracture was present, a long leg cast was applied under anesthesia for a period of 1 week, followed by a long night splinting in extension.

The average follow-up period of the patients was 8 (4–9) years.

Results

Complications

The acetabular cup was incorrectly placed in five hips; these patients had severe, fixed pelvic obliquity and forward pelvic tilt. In three hips the acetabular cup only partially covered the prosthetic head and was found to be unstable. In the other two hips the cup was placed too horizontally, restricting abduction. The cup was removed, the acetabulum osteotomized, and bone grafted to obtain better coverage of the femoral components (Figure 1). This readjustment markedly prolonged the operation.

In 3 cases longitudinal fractures of the proximal femur occurred during femoral reaming. One supracondylar femoral fracture occurred on attempting to straighten the knee. All the fractures healed uneventfully without severe delay of the rehabilitation program.

In 2 cases, vasospasm in the leg and foot developed a few hours postoperatively requiring urgent femoral shortening. Two hips dislocated after extensive soft-tissue release was done to overcome severe flexion contractures. There were 2 cases of infections around the hip that responded well to antibiotics; a spica cast was applied for 2 weeks. Skin sloughing with superficial infection around the knee occurred in 3 cases and was treated successfully by local debridement and antibiotics.

Six patients with ankylosed hips and knees, and without pain before surgery, experienced pain when walking after surgery. Heterotopic bone formation and decreased range of hip motion compromised the results in 4 other patients (six hips).

Four patients underwent revision arthroplasty due to acetabular loosening (3 patients) and acetabular protrusion (1 patient). One patient sustained an oblique fracture of the femur just below the femoral stem, and this was revised with a long straight stem. In 3 patients, fixation wires were disrupted over the trochanteric area causing moderate discomfort; one of these wires was removed.

Joint motion – walking ability

The mean hip flexion-extension of the ankylosed joints after surgery was 86° (60°–120°), measured during the first year following surgery. Functional abduction was regained in all the cases, but rotational movements remained restricted in most hips. All the patients had a dramatic improvement in walking ability. This was also reflected in the patients' score (mean of 10 out of 40 before surgery to 23 points after the surgery). At follow-up, 8 patients had developed hip contractures. Because of their spinal deformities, those patients could not maintain the prone position recommended as a preventive measure, and they had stopped active physiotherapy. Four of them had heterotopic ossification around their hip joint. Flexion-extension deteriorated to an average of 48°, but the patients maintained walking ability with the support of external aids, mainly a cane.

Daily activities – function

A direct correlation was found between walking ability achieved by surgery and capacity of patients to help themselves in daily activities and to support themselves financially. The mean score before and after treatment was 15 and 30 points out of 40, respectively.

Two patients with hip ankylosis in extension were bedridden most of the time before the surgery. The patients' lifestyles and working abilities improved dramatically after surgery owing to sitting ability. In these 2 patients, regression in their hip flexion was noted 3 and 4 years after surgery. Oblique rubber-foam cushions were enough to improve their sitting comfort and to maintain their working ability.

Table 2. The average score of 23 patients before and after surgery

	Score before surgery	During the 1st year after surgery	Last follow-up[a]	Maximal score
Walking	10	32	26	40
Function	15	30	26	40
Pain	10	13	10	20
Total score	35	75	62	100

[a] Average 7.5 years, range 4–9 years.

Pain

Pain was the primary indication for hip arthroplasty in only 4 of our 23 patients. All 4 patients suffered incapacitating pain that was substantially relieved; 2 were without pain and the other 2 had some pain on physical activity. Six patients whose hips were ankylosed and were without pain before surgery experienced pain necessitating medication while walking after surgery. In 3 of these patients, loosening of the prosthesis was found; and they underwent revision arthroplasties 3, 5, and 8 years after the initial surgery (Table 2).

Discussion

The small number of patients whose main complaint was pain, as compared with those with functional disabilities, made us elaborate a special scoring system emphasizing functional elements. The maximal improvement in joint motion was during the first 2 years following the surgery. In 8 patients the range of motion deteriorated gradually after the second year; 4 of them developed heterotopic ossification. Deterioration in joint mobility could also be explained by cessation of intensive physiotherapy practiced after the surgery and pain experienced during activity in previously painless ankylosed joints. In 3 patients additional improvement of motion was later recorded.

The routine of preoperative examination by the anesthetist, the use of indirect larynogoscopy, the positioning of the patients, and careful monitoring markedly reduces the anesthetic risks and justify fully the surgery (Wittmann and Ring 1986); we did not have any serious anesthetic complication in our patients. Special preparations and instrumentation were necessary in the surgical treatment of these patients. Each patient had to be individually positioned and supported on the operating table and in the bed by specially molded supports.

Identification of the structures, especially blood vessels and nerves, was mandatory for appreciation of the tension applied during the attempts to correct joint position and increase range of motion. The leg was held in the correct position for at least 10 minutes and pulses, skin color, and temperature were checked. In spite of this, 2 patients developed later ischemic changes and parasthesias in the legs, and repeated shortening of the femur had to be performed; thus, further recording of the limb vascular status for 24 hours is advocated.

Correct positioning of the acetabular cup in the presence of fixed pelvic obliquity or pelvic tilt was difficult. Three-dimensional analysis of the femoral head in relation to the acetabulum, as described by Sartoris et al. (1986) and Vannier et al. (1985), could be helpful in the preoperative planning. Reaming of the femur turned out to be problematic after shortening of the femoral neck because of the narrow intramedullary canal and brittle bone. Following longitudinal splitting of the proximal femur in 3 cases, we used intramedullary flexible reamers to widen the canal; using this technique, no further bone splints were noted.

Special custom-made prosthetic devices were designed for hip arthroplasty in 16 cases. Preoperative planning using radiographs and the use of templates were misleading in most cases, mainly because the final leg lengths were adjusted and reshaped during the operation. A wide range of available prosthetic components is essential during each procedure. When hip and knee arthroplasty were both indicated in the same patient, total hip replacement was performed first to enable exercise of the hip joint and the tight muscles in the presence of a stiff knee (Scott et al. 1984). In patients with bilateral hip and knee involvement, multistage surgery was performed on one side starting with hip replacement, followed by knee surgery. When the knee motion was partially preserved (45° or more) and the knee not painful, a supracondylar wedge osteotomy with or without shortening of the femur was very beneficial. In cases with bilateral knee involvement, the joint motion should be preserved under all cir-

cumstances at least on one side to enable sitting and standing. Bilateral one-stage total arthroplasty, advocated by Kaukonen and Sjöström (1983), was not performed because in many of our cases mutiple time-consuming procedures were done on one limb, and we found such ipsilateral interventions more beneficial for the patient.

Progressive restriction of joint movement was noted in 8 of 23 patients; 4 of them had heterotopic ossification. The incidence of this phenomenon was close to the one reported by Taylor et al. (1976) and Williams et al. (1977), and was lower than that of Ritter and Vaughan (1977) and Sundaram and Murphy (1986). The relatively low incidence of heterotopic ossification around the hip in our series was probably due to surgical procedure done in all our cases when the disease was not in an active stage and because trochanteric detachment was not performed routinely.

Joint surgery in ankylosing spondylitis fully justifies expectations of both patients and surgeons. Because of the risk for complications, surgery should be performed in highly skilled and equipped medical centers (Taylor et al. 1976, Sundaram and Murphy 1986).

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