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Rheumatoid arthritis

Metatarsal head resection in the rheumatic foot

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Rheumatic deformations of the anterior part of the foot are often painful. Decapitation of the metatarsals is a salvage procedure to alleviate pain and improve the shape of the foot. Few long-term results are on record.

During the period 1975-1985, decapitations were performed (usually via a dorsal approach) on 69 feet of 41 patients in the Nijmegen University Hospital and on 83 feet of 49 patients (via a plantar approach) in the Malberg Hospital, Arnhem.

Long-term results were assessed in a retrospective study. All the patients were asked to complete a questionnaire (20 patients had died and 5 could not be traced).

The results of 67 operations via the plantar approach were compared with those of 41 operations via the dorsal approach. The mean follow-up was 7.5 years.

A wound complication developed in 1 case of the plantar and in 8 cases of the dorsal group. No thromboembolic complications were seen.

In the dorsal group, patients were satisfied or highly satisfied about 35 feet and dissatisfied about 6 feet. The corresponding figures in the plantar group were 63 and 4.

Improvement of the shape of the foot was reported in 12 cases in the dorsal and in 44 cases in the plantar group. Reoperation was required in two instances in the dorsal and in 11 instances in the plantar group, usually for further shortening of metatarsals due to poor alignment or for correction of a hammer toe.

The results of these corrections are comparable with large series reported in the literature; the long-term results can be described as satisfactory.

Hallux arthrodesis as part of correction of the rheumatoid foot

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The typical rheumatic destruction of the forefoot comprises a hallux valgus and luxation of the remaining MTP joints. In many cases resection arthroplasty of MTP II-V is combined with a Brandes or Keller procedure. A disadvantage of this treatment is that a high hallux valgus relapse rate is entailed.

From January 1984 through February 1987, 33 forefoot corrections were performed on 25 rheumatic patients. In 26 feet of 22 patients, resection arthroplasty of MTP II-V via a plantar incision was combined with arthrodesis of MTP. Of these feet, 25 were available for a retrospective clinical and radiographic study. The mean follow-up was 17 (5-35) months. Postoperative management: immobilization of the forefoot in a plaster cast for 5-6 weeks.

The patients were usually mobilized on the third postoperative day. Delayed wound healing occurred in 4 instances. The position of a consolidated arthrodesis had to be corrected in 1 case.

At follow-up, all the arthrodeses showed clinical and radiographic consolidation. The subjective results of the total procedure were good to very good. Radiographically, the varus position of MT I (expressed in the MT I-II angle) was found reduced in half of the cases. This reduction was not related to the original valgus position of the hallux or to the hallux correction.

Conclusion: Most patients can be mobilized early. Arthrodesis of the MTP I as part of a total procedure to correct a forefoot is an adequate procedure without recurrence of the valgus position.

Arthroplasty of the forefoot

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Resection arthroplasty of the MTP joints of a rheumatically destroyed foot can be combined with arthrodesis of the MTP I joint. In Leiden this combined operation has been in use for years. A retrospective study was performed on 15 patients with a follow-up in excess of 5 years. Even after a mean follow-up of 12 years, half of the patients had no pain at rest or when walking. In a number of cases the walking distance was still longer than that before the operation. Four feet showed no improvement.

Conclusion: Resection arthroplasty of the forefoot combined with arthrodesis of the hallux gives good long-term results.

A 9-year follow-up of Clayton's foot operation

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Of 68 patients (127 forefoot operations) considered for a follow-up, 26 had died and 2 could not be traced. The remaining patients completed a detailed questionnaire concerning pain, walking, and subjective results. The follow-up of these patients averaged 9 years. The technique used has been a combination of a Brandes resection of MTP I and total resection of MTP II-V.

Reoperation in 5 cases was required to shorten too long metatarsals and/or to smoothen the metatarsal ends.

Pain was effectively controlled in a large percentage of the cases. Special orthopedic footwear was worn by some patients after the operation. After an average of 9 years, the walking distance decreased owing to exacerbation of the rheumatic inflammation in other joints. Three fourths of the patients were satisfied with the subjective results of the operation.

Results of the Kates, Kessel, and Kay operation of the rheumatoid forefoot

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During the period 1974 through 1985, 42 patients with severe deformation of the forefoot as a result of rheumatoid arthritis were submitted to a Kates, Kessel, and Kay operation: decapitation of all the metatarsals via a plantar incision, with an oval-shaped skin excision.

A retrospective study of 41 of these patients (74 feet) was carried out after a mean follow-up of 6 (1.5-12) years. One patient could not be traced. The mean age was 60 years. The mean period of complaints about the forefoot before the operation was 9 (1-36) years.

At follow-up, four fifths of the patients had less pain, fewer pressure points, and shoe problems and a better walking pattern. The mean walking distance had doubled (from 750 to 1,500 meters). Subjective results were described as satisfactory by 38 of the 41 patients (69 of the 74 feet). Few complications developed: a hematoma in five feet and delayed wound healing in 4 cases. The good results observed during the first few postoperative years gradually deteriorated with time.

Talonavicular arthrodesis in rheumatoid arthritis

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Arthritis of the talonavicular joint is frequently seen in rheumatoid arthritis. Talonavicular arthrodesis to control the pain is usually rejected because the talonavicular joint forms a functional unit with the subtalar and the calcaneocuboidal joint. A triple arthrodesis is believed to be more appropriate. Nevertheless, a talonavicular arthrodesis was performed on 12 feet in 11 patients, including 9 with rheumatoid arthritis. The latter were asked to report for a follow-up after an average of 7 years; their mean age was 50 years.

All of these patients expressed satisfaction with the subjective results. Radiographic examination, however, revealed a pseudarthrosis of the talonavicular joint in 9 cases. Rearthrodesis was performed in 1 case; superficial wound infection developed in 1. In 3 cases in this series, a naviculocuneiform arthrodesis had been inadvertently performed previously.

In view of the good effect on the pain, arthrodesis of the talonavicular joint would appear to be a valuable procedure, regardless of radiographic consolidation.

Synovectomy of the elbow in rheumatoid arthritis

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In 1987, a retrospective study was performed on 72 patients with 90 elbow synovectomies carried out during the period 1976-1983. Of this group, 15 patients had died and 6 could not be traced; this left 51 patients with 62 synovectomies, and with a mean follow-up of 7 years. The results were good in 44 elbows.

The group included a subgroup of 33 patients with 43 synovectomies, performed between 1976 and 1980, and who had been the subjects of an earlier retrospective study in 1981. Results at that time had been good in 23 patients. Six years later, 11 patients had died. The remaining 22 patients with 27 synovectomies and a mean follow-up of 8 years showed the result satisfactory in 17 synovectomies.

On the basis of these figures, no distinct exacerbation in the course of is demonstrable.

Total elbow replacement according to Cavendish (Liverpool)

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Fifteen patients were treated by total elbow replacement in the Sint Franciscus Hospital and the Dr Daniel den Hoed Hospital between November 1984 and August 1986. Characteristics of the Cavendish procedure used are replacement of articular surfaces in accordance with anatomic principles, limited bone resection, and a semiconstraint prosthesis. The group included 14 patients with rheumatoid arthritis and 1 with posttraumatic arthrosis. In a retrospective study, all were clinically and radiographically evaluated. The mean age was 55 (24-72) years, and the mean follow-up was 19 (9-36) months.

The principal indication for operation had in all the cases been severe pain due to destruction of the humero-ulnar joint. Seven patients immediately received functional treatment with a removable plaster splint. The remaining patients wore a circular plaster cast for 3 weeks.

The results were good to very good in 13 patients. Two elbows were classified as poor because of dislocation.

Conclusion: Total elbow replacement according to Cavendish gives good short-term results. The two problem cases were due to wrong indications and an imperfect operative technique.

Early results of total elbow replacement according to Souter-Strathclyde in patients with rheumatoid arthritis

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During the period 1982-1986, 19 Souter-Strathclyde total elbow replacements were performed on 18 patients with severe rheumatoid arthritis. A retrospective study of this group was carried out after a minimum follow-up of 1 year. Two patients meanwhile died. Dislocation of the joint occurred fairly soon after the operation in 3 cases; revision followed in 2. After a mean follow-up of 3 years, 13 patients with 14 total elbow replacements were entirely satisfied with the result obtained: pain was markedly reduced or totally absent. The function of the arm was markedly improved and elbow motion increased. Mean preoperative/postoperative values were flexion 115°/140°, extension 50°/35°, pronation 60°/80°, and supination 50°/60°. No deep-seated infection and no clinical loosening were seen. Incomplete radiolucent lines around the cement were frequently observed.

Although problems attending total elbow replacement have not yet been entirely solved (particularly fixation and dislocation), there is an indication for total elbow replacement according to Souter-Strathclyde, even though for the time being this procedure has to be reserved for patients with rheumatoid arthritis.

Elbow replacement in rheumatoid arthritis

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Twenty elbow replacements were carried out in 18 patients with rheumatoid arthritis during the period 1982-1986. A nonconstrained Wadsworth prosthesis was used in all the cases. The follow-up averaged 31 (14-67) months. Two patients were operated on bilaterally.

The preoperative clinical features in 17 cases were pain with severe limitation of movement; the radiographic features were cartilage destruction with osteoporosis and joint deformity. The remaining 3 cases had ankylosis.

The principal preoperative complication in 7 cases was a (usually medial) condyle fracture resulting from severe periarticular osteoporosis. Immediate preoperative fixation of these fractures caused no subsequent problems except in 1 patient. One patient (rheumatoid

spondylitis) developed an infection that necessitated removal of the prosthesis. Partial loosening was observed in 1 case: a stemless humeral component loosened, necessitating revision 1 year after the operation.

Despite the development of a number of complications, most of which could be effectively treated, the results are encouraging: a good effect on preoperative pain and restoration to useful mobility.

Uncemented Neer hemiarthroplasty of the shoulder in rheumatoid arthritis

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Thirty patients with severe rheumatoid arthritis were reviewed after a Neer I hemiarthroplasty of the shoulder, using an uncemented prosthesis. The mean age was 65 (38-83) years, and the mean follow-up was 4 years. Moderate improvement of motion was achieved in all the cases. Results were remarkably good in 6 cases (elevation more than 120°). Preoperative pain was severe in 29 patients; after the operation, 21 patients had no or only slight pain, and 4 experienced pain after unusual activities. The pain relief had a very positive effect on the functional results.

A high position of the humeral head before the operation predicted a similar situation after the operation due to absorption of the posterior facet of the glenoid and the prolonged internal rotation contracture. In view of this, a sliding tenotomy of the tendon of the subscapular muscle is advisable. Appropriate alignment instruments for the head and the glenoid are being studied.

An uncemented Neer I prosthesis can relieve pain. Good postoperative function can be achieved if the soft tissue structure is good. Early surgery is advisable.

Synovectomy of the wrist

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From 1982 through 1986, 44 synectomies of the wrists were performed on 38 patients (including 31 with rheumatoid arthritis). The mean follow-up was 3 years. The indication for this operation was painful synovial swelling in 33 cases and rupture of one or more extensor

tendons in 7. The synovitis affected the joint as well as the tendons in 26 cases; in 13 cases only the tendons were affected and in 5 cases only the joint. Procedures, in addition to the synovectomy, were resection of the ulnar head (9 cases); decompression of the median nerve (8); and suture, transposition, or reconstruction of a tendon (7).

Two patients required reoperation due to recurrence of synovial swelling and rupture of the extensor pollicis tendon. Subjective results were described as moderate in 8 cases; the remaining patients were satisfied with the results.

Conclusion: Few tendon ruptures occurred following synovectomy of the wrist. One patient required reoperation due to recurrence of synovial swelling. The subjective results were satisfactory in 36 of the 44 wrists.

Experience with Swanson's silastic wrist in rheumatoid arthritis

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Between January 1981 and April 1986, 28 silastic wrist prostheses were implanted in 24 patients with rheumatoid arthritis (radiographic stages III and IV according to Steinbrocker). There were 19 men and 5 women, with a mean age of 57 (32-82) years. After a mean follow-up of 28 (12-73) months, 21 patients with 25 prostheses were examined.

The principal indication for operation was pain (19) and subluxation/dislocation (6). The radiocarpal prosthesis was combined with an ulnar head prosthesis in 24 instances, and with resection of the ulnar head in one. Standard postoperative management was plaster cast immobilization (4-6 weeks) followed by rest, splint, and ergotherapy.

Early complications were delayed wound healing (4), subluxation of the wrist due to insufficient reefing (2), ulnar dislocation (1), faulty positioning (1). Late complications were dislocation of the ulnar head prosthesis (14), broken ulnar head prosthesis (5), broken radiocarpal prosthesis (1), fistulization of the ulnar head prosthesis (1), and stress fracture of MC II (1).

Results: Subjective results were described as good in 18 instances. All the patients reported alleviation of pain. Functional gain (12) and improved strength (15) were reported. Examination revealed no change in wrist function as compared with the preoperative situation. Postoperative passive and active mobility measured radiographically were identical. The daily activities score (Davis' 6-point scale) was moderate. Grip strength averaged 27 N, versus 43 N on the contralateral un-

treated side (Preston dynamometer). Radiographic findings were subsidence of the prosthesis in the radius (average of 4.3 mm), marked resorption of ulnar bone (14), and volar radiocarpal subluxation (2).

Conclusion: The silastic wrist prosthesis can be effectively used in treating severe rheumatoid wrist lesions in terms of pain alleviation and positional correction. Results with the ulnar head prosthesis are poor. Distal ulnar head resection (e.g., Darrach procedure) is probably to be preferred.

Long-term results of dorsal synovectomy of the rheumatoid wrist

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Between 1965 and 1987, 69 dorsal synovectomies of the wrist were performed on 51 patients with rheumatoid arthritis; 13 patients (14 synovectomies) had died and 4 (five synovectomies) were not available for other reasons. One patient had undergone a forearm amputation due to unrelated pathology. The 33 remaining patients had undergone 48 dorsal synovectomies (15 bilateral and 18 unilateral operations).

The follow-up was 9 (1-22) years. The synovectomy had been combined with resection of the ulnar head in 15 instances, and 10 patients had had an additional suturing of an extensor tendon; arthrodesis had been performed in addition on six wrists. Radiographic examination revealed that the carpal index was not significantly changed, but increased ulnar drift and radial deviation were marked. One patient sustained a rupture of the extensor pollicis longus tendon immediately after the operation and 1 patient required resynovectomy due to a recurrence.

The results were described as satisfactory by 22 patients, as moderately satisfactory by 6 patients, and as unsatisfactory by 5 patients.

Arthrodesis of the rheumatoid wrist

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Twenty-one patients with a mean age of 63 years and a mean history of rheumatoid arthritis of more than 17

years underwent 26 arthrodeses of the wrist between 1979 and 1986; the indication was disabling pain resulting from destruction of the wrist joint. The operative technique was the same in all the cases, with a Steinmann pin for intramedullary fixation. This technique is simple and quick, and requires but brief postoperative immobilization in a plaster cast.

Radiographic examination revealed osseous consolidation in 23 cases and pseudarthrosis in 3. Complications were superficial wound infection (2), radius shaft fracture (1), and distal migration of the pin (10 cases, necessitating removal in 9).

A clinical follow-up on 16 patients (19 arthrodeses) after an average of 3 years showed that all the patients were free from pain except 3 with pseudarthrosis.

Subjective results were good in terms of improved grip and strength. Evaluation of improved function in daily activities showed that no significant functional gain can be expected in patients with destruction of adjacent joints.

The silastic MCP prosthesis in the rheumatoid hand: 15 years' experience

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In the past 15 years, more than 200 silastic prostheses were implanted in hands of rheumatoid patients. Silastic MCP prostheses were used in 36 patients, 30 of whom were available for a follow-up. Functional gain, corrected position, and alleviation of pain were evaluated after a mean follow-up of 7 years. Totally, 118 MCP prostheses were implanted.

Results: The average deviation improved from 36° before to 13° after the operation. Flexion-extension excursion showed no gain except in the direction of extension. As to pain and cosmetic results, all the patients were satisfied.

Postoperative complications: Infection (3 cases), broken prosthesis (1 case), faulty position of the prosthesis (3 cases), and excessive residual ulnar deviation (9 cases).

Conclusions: The Swanson prosthesis contributes to cosmetic improvement and pain alleviation in treating rheumatic hands. The functional gain is disappointing, especially if deformed adjacent joints are not corrected in advance or simultaneously. Another important factor is the patient's motivation to perform active exercises after the operation.

Rupture of the extensor pollicis longus tendon in the rheumatic hand

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Rupture of the extensor pollicis longus tendon unrelated to trauma was seen in 17 hands. In most of the cases, there was no active synovitis at the time of rupture. All the cases were treated surgically: reconstruction with the aid of the extensor indicis proprius in 13 cases, with the aid of the extensor carpi radialis in 1 case, bridge graft in 1 case, free tendon graft in 1 case, and tendon suture in 1 case.

The 13 ruptures treated by reconstruction using the extensor indicis proprius were studied in retrospect.

After a mean follow-up of 7 years, all the hands showed adequate extension of the thumb. There was no loss of function of the index finger. No recurrence of the rupture was recorded.

In the case of an isolated rupture of the extensor pollicis longus in the rheumatic hand, reconstruction with the aid of the extensor indicis proprius gives good functional results even in the long term.

Preliminary experience with isoelastic finger-joint prostheses in the rheumatoid hand

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Isoelastic finger-joint prostheses are hinged prostheses made of plastic material. The proximal part is made of polyacetate resin and the distal part of polyester. Fixation of the two parts in the shaft is achieved with the aid of a tap-bolt system, using no cement. The prostheses are implanted only in patients with painful, deformed joints minimizing hand function.

Since 1983, 44 prostheses have been implanted in 18 patients (in 2 patients bilaterally) in one or more deformed joints. In a few patients, moreover, Swanson prostheses were removed and replaced with isoelastic prostheses.

A follow-up study revealed that PIP arthroplasties were less successful. Infection necessitated removal of the prostheses in 2 patients with posttraumatic deformities and in 1 whose broken Swanson prosthesis had been replaced. The results in the other cases were moderate, although some improvement occurred. In 10 of the 13 patients treated by MCP arthroplasties, hand function showed subjective and objective improvements.

Swanson prostheses in surgery of rheumatic hands: Experience with MCP arthroplasty

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Since 1971, 73 MCP implants have been inserted in 24 operations. One implant was revised after 13 months in view of insufficient correction of ulnar drift in the primary operation; superficial wound infection without further consequences developed in one instance.

A clinical and radiographic study of 17 patients after a mean follow-up period of 7 (1-15) years led to the conclusion that the favorable effect on the pain and improved cosmetic features are more important to the patient than functional gain.

A review of operations performed on patients with rheumatoid arthritis during the period 1957-1986

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During the period 1957-1986, the annual number of operations averaged 923, including 80 (8 percent) operations performed on patients with rheumatoid arthritis. Operations performed on the knee showed a striking decrease in synovectomies in the 1970s (mean number in 1967-1970 was 32 annually versus five annually in 1983-1986) and an increased number of implantations of prostheses toward the end of the 1970s: the current preference is for implantation of a prosthesis whenever the cartilage is affected (4 cases annually in 1972-1976 versus 24 annually in 1982-1986). The number of hip operations in patients with rheumatoid arthritis has greatly increased since the late 1960s, with the introduction of total hip replacement. Operations on the wrist and hand were unchanged in frequency (six per year during the time period studied). To replace finger joints that are no longer functioning, Swanson's silastic prosthesis was widely used. Synovectomy of the elbow joint was performed relatively seldom. The number of operations on the elbow in rheumatoid arthritis had increased with the introduction of the Souter prosthesis from two annually in 1977-1981 to six annually in 1982-1986. Operations to improve humeroscapular function were not frequently performed. Excellent shoe-wear facilities have reduced indications for operations on the rheumatic (fore) foot.

With the development of prostheses for various joints, indications for operative treatment in rheumatoid arthritis have increased.

Synovectomy of the knee in rheumatoid arthritis: A curative or a palliative procedure?

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A retrospective study was performed of data collected on 90 synovectomies in 70 patients with adult rheumatoid arthritis. The follow-up ranged from 3 to 11 years.

A reoperation was performed in 31 cases: in 29 a prosthesis was implanted after an average of 4 years, and double osteotomy was performed in 2. Implantation of a prosthesis is indicated for seven knees. Most of the 52 knees for which a reoperation is not indicated showed a good clinical result, although gradual progression of the secondary arthrosis was seen. In comparison with the literature, there were more reoperations, and the interval was shorter.

Conclusion: Synovectomy of the knee in rheumatoid arthritis is a palliative procedure with a relatively great risk of reoperation after only a few years.

Clinical and radiographic aspects of 12 cases of juvenile ankylosing spondylitis

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Juvenile Bechterew's disease, or juvenile ankylosing spondylitis (JAS), is one of several types of juvenile rheumatoid arthritis. JAS develops mostly in boys, the symptoms usually occurring at the age of about 10 years. This pauci-articular arthropathy mostly involves the lower extremities. Anomalies in the SI joint are extremely rare in the initial stages of JAS.

Laboratory studies usually reveal an increased ESR and thrombocytosis. Rheumatoid factors and ANF are negative. The HLA-B27 antigen is demonstrable in virtually all the patients.

Characteristic radiographic changes in the course of the disease are erosive changes in the joints, spontaneous ankylosis, premature fusion of growth plates, and periosteal reactive changes (e.g., a calcaneal spur), but they are not diagnostic for JAS.

Because the arthropathies are often asymmetric, there may be growth disorders with length differences.

The clinical features in children with psoriasis, inflammatory enteropathies, and arthritis may closely resemble those of JAS.

Treatment of JAS includes dietary measures, physiotherapy, and NSAID medication. If properly treated, JAS generally has a favorable prognosis.

The surgical contribution to the treatment of juvenile rheumatoid arthritis

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In a group of 200 patients (aged 0-18 years) with juvenile rheumatoid arthritis ranging in severity from monoarticular to systemic arthritis, 82 operations were performed during a 3-year period; 58 arthroscopies (48 knees, 6 hips, 6 shoulders, and 6 elbows) were performed to establish the diagnosis and to determine the damage to the joints. A synovectomy was performed in 10 instances (8 knees, 1 wrist, and 1 ankle); other operations were six release procedures (2 halluces, 3 knees, and 1 hip) and two osteotomies (1 upper and 1 lower leg).

Three patients (aged 14, 14, and 15 years) showed bilateral damage to the hip joints necessitating six total hip replacements.

The surgical treatment of this group of patients generally causes more complications than in other patient groups; the influence of nonorthopedic factors on the results is so marked that treatment of these patients can only be provided by teams.

Synovectomy of the knee under arthroscopic control in juvenile rheumatoid arthritis

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In children with juvenile rheumatoid arthritis, synovectomy of the knee often causes postoperative loss of function. In the past 2 years, eight synovectomies of the knee were performed under arthroscopic control in 6 patients with juvenile rheumatoid arthritis (aged 8-16 years, follow-up 0.5-2 years). The indication was mostly found in the pauci-articular form. Several different shavers or resectoscopes were used in the operations. Hemarthrosis and consequences of prolonged ischemia were observed immediately after the operation, but in all the cases disappeared quickly. Loss of function was not observed, and the hospitalization could be considerably shortened (9 days). One patient developed a recurrence after 7 months.

Conclusion: Synovectomy under arthroscopic control has significant advantages over the traditional technique in patients with juvenile rheumatoid arthritis.

Radiographic changes of the wrist in juvenile rheumatoid arthritis

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Synovitis of the wrist is a common finding in juvenile rheumatoid arthritis. This contributes significantly to loss of hand function. The consequences of this abnormality are visible on anteroposterior and lateral radiographs of the carpus. They may be divided into several types not previously described as such. A retrospective study of radiographic changes of the wrist was carried out in 20 patients with juvenile rheumatoid arthritis. Apart from the classical "adult" type in which erosions, diminished intraarticular space, and/or ankylosis are the predominant features, some patients may show a type in which growth disorders determine the picture, and overgrowth of the radius with slanting of the distal epiphysis leads to volar and ulnar subluxation of the carpus. These changes often develop early in the course of growth and cause severe, permanent loss of hand function.

The pathologic anatomy of the cervical spine in rheumatoid arthritis

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Rheumatoid arthritis often causes changes in the atlantoaxial region, including potentially lethal dislocations. In postmortem examinations of patients with rheumatoid arthritis, it is therefore advisable to resect the cervical spine en bloc with part of the base of the skull. In total, 50 specimens of this type have been obtained since 1968; some of the patients had undergone an operation for cervical dislocation.

Many changes were found in these cervical spines: inflammation with destruction of intervertebral articular cartilage or disc tissue and erosion (sometimes leading to fracture) of the odontoid bone, dislocations in the atlantoaxial region (horizontal, as well as vertical) and lower in the cervical spine, syndesmosis, synchondrosis, and ankylosis (sometimes in a dislocated position). In comparison with control specimens obtained from patients without rheumatoid arthritis, the specimens studied showed more dislocation, ankylosis of discal or intervertebral joints, and syndesmosis and synchondrosis of intervertebral joints.

Nuclear magnetic resonance (NMR) imaging of the cervical spine in rheumatoid arthritis

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NMR was performed on 19 patients with rheumatoid arthritis in whom spinal cord compression due to subluxation of cervical vertebrae was suspected on the basis of conventional radiography of the cervical spine.

Eleven patients had only symptoms compatible with a cervical myelopathy; in 8 patients physical examination revealed several neurologic changes suggestive in this direction. Atlantoaxial subluxations (in 16 patients) and subluxations below C2 (5 patients) could be visualized as readily by NMR as by radiography.

NMR revealed a closed subarachnoid space and cord deformation in 7 patients (6 with and 1 without demonstrable neurologic changes). There was no correlation between the extent of dislocation (in mm) measured at radiography and the presence of cord deformation at NMR. Myelography was performed in 5 patients with neurologic changes and revealed blockage of the contrast medium passage at the same level as the cord deformation at NMR.

Conclusion: NMR makes it possible to locate cord compression without using intravenous contrast medium. Cord deformation at NMR correlates with the presence of neurologic dysfunctions. NMR is a diagnostic asset for a selected group of patients with rheumatoid arthritis suspected of having cervical cord compression.

Posterior atlantoaxial spondylolysis in rheumatoid arthritis

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Twelve patients with atlantoaxial subluxation were treated surgically between February 1979 and February 1985; the mean follow-up period was 4 years.

Indications for operation were progressive neurologic changes in 4 patients, persistent severe pain in 2 patients, pain and neurologic changes in 5 patients, and symptomatic "instability" in 1 patient. The maximum preoperative subluxation averaged 10 (7-13) mm.

Preoperative treatment: When necessary halo traction or a halo cuirass with the halo spring-loaded posteriorly.

Operative techniques: McGraw and Rusch procedure (5 cases), Brooks and Jenkins procedure (2 cases), and modified posterior wiring with autograft (5 cases).

Postoperative immobilization: Collar (1 case), halo shoulder brace (5 cases), and halo cuirass (6 cases).

Results: Improvement was observed in all the cases, although 1 of the patients with pain and neurologic changes continued to have intermittent pain in the neck. Fusion occurred in 9 patients. Stable asymptomatic fibrous union was achieved in 3 cases. One patient required two reoperations. The postoperative resubluxation averaged 1.7 mm with the cuirass versus 3 mm with the brace. The ultimate subluxation averaged 4.7 (0-9) mm. The cuirass caused two transient pressure sores.

Conclusions: Posterior atlantoaxial fusion is a safe and reliable technique in the treatment of atlantoaxial subluxation. The modified surgical technique combined with a spring-loaded halo cuirass has advantages; however, because partial resubluxation may occur, a more effective method of internal fixation is desirable.

Cervical spondylodesis in rheumatoid arthritis with cord compression

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During the period 1961 through 1986, spondylodesis was performed on 49 patients with rheumatoid arthritis showing alarming symptoms and neurologic changes due to destructive lesions of the cervical spine. The radiographic lesions were at C1-C2 in 29 cases, caudal to C2 in 8, and at both levels in 12 cases. Preoperative treatment often consisted of skull traction for a few days to 3 weeks. The operation consisted of occipitocervical spondylodesis with steel-wire fixation and laminectomy when required.

Postoperative management consisted of skull traction either on a circular bed or in a halo cuirass for 2.5-3 months. All the patients showed neurologic improvement.

At follow-up at least 9 patients again had neurologic complaints and changes, which in 4 cases resulted from a slip at a lower level. Twenty-six patients died, 3 of whom shortly after the operation of a pulmonary embolism, infection in the operation area, and mesenteric hemorrhage associated with vasculitis. Twenty-two patients died within an average of 5 years after the operation. Causes of death were unrelated to the cervical spinal lesions except in 2 patients, in whom a bone graft had not been properly fixated. The remaining patients were alive after a mean follow-up of 5 years.

Columnotomy for hyperkyphosis in rheumatoid spondylitis: A comparative study of the effects of various methods of fixation

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One or more wedge osteotomies of the lumbar spine were performed on 43 patients with hyperkyphosis due to rheumatoid spondylitis. Internal fixation was used in only some of the 22 patients in the first group, treated between 1957 and 1983. The wedge osteotomies caused an average of 44° (30-60°) correction; the mean loss until consolidation was 9° without and 1° with internal fixation (although patients in the latter group were mobilized earlier in a plaster cast).

Transient complications were slight peripheral neurologic disturbances, general medical problems, and psychologic problems. Permanent complications were retrograde ejaculations in 2 cases.

In a second group of 21 patients (including 1 with severe low cervical kyphosis), treated from 1983 through 1986, 12 fixations were carried out by the Wisconsin system at one level with ossified discs, and eight fixations were carried out by Zielke's dorsal pedicle system with malleable discs and wedge osteotomies at several (usually three) levels because a) it is often impossible to fracture at a nonossified disc (insufficient correction) and b) single-level fixation by the Zielke system gives insufficient correction. The primary corrections with these techniques did not differ much: they averaged 47° with Zielke fixation and 44° with Wisconsin fixation (final correction 35°).

Complications after Zielke fixation: in 1 case, severe motor dysfunction due to an anterior spinal nerve syndrome possibly caused by a hematoma (only partial recovery); in 1 case, transient peroneal paresis; and in 1 case, paresthesia of the thigh; in 1 case, infection.

Complications after Wisconsin fixation: slight scoliosis in 2 cases, slight paresis of the thigh in 1 case, faulty plaster cast in 1 case, and faulty assembly in 2 cases.

Conclusion: The Zielke technique, which ensures superior fixation, can be safely used only if the discs are still malleable, and are preferably below the conus; at least two levels must be fixated to achieve adequate correction. The Wisconsin technique gives fair fixation, but it is not sufficient without a perfect plaster-cast corset. It may be used for sharp correction at a single level after rupture of an ossified disc.

Correction and fixation should preferably take place while the discs are still malleable, and at several levels. This makes it possible to achieve physiologic lordosis or hyperlordosis along the entire length of the lumbar spine.

Hip arthroplasty

A geometric study of the primary fixation of Lord prostheses

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In an effort to gain some insight into the primary fixation of uncemented total hip replacements, Lord prostheses were implanted postmortem in both hips and cut into sections in a reproducible manner. The contact areas between prosthesis and bone, in the femoral as well as in the acetabular component, were studied and measured.

Primary fixation of the femoral component proved to be based mainly on incarceration of the stem of the prosthesis in the diaphysis resulting from narrowing and antecurvature of the femur. The cortical bone/prosthesis contact was limited here: at best 25 percent of the stem circumference in a few sections, but at most levels considerably less.

The contact configuration of the screwed acetabular component showed that a major part of the thread had no or only marginal contact with the acetabulum. The two acetabular rings were incarcerated between the anterior/cranial and posterior/caudal aspects of the acetabulum.

Although only two total hip replacements were studied, the results are important in view of the lack of geometric studies of uncemented fixation in the literature and in view of the emphasis placed on postoperative bone/prosthesis contact with uncemented hip replacements. In addition, the results obtained may serve as a basis of tension analyses using the finite elements method. The method of investigation used may also be employed in studying other uncemented prostheses.

Radiographic interpretation of cement-bone interlock in the femur

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Recent modifications of the technique of cementing arthroplasties – bone lavage, use of low-viscosity cement, retrograde cement injection, and pressurization – aim at improving primary fixation of the implant. Available knowledge about the cement-bone interface is still insufficient, as is the knowledge required for proper interpretation of the interface on standard radiographs. The value of conventional diagnostic radiography for assessment of the actual cement-bone interface

was studied. For this purpose, seven femurs cemented in vitro and two cemented in vivo were cut into sections of 1.5-mm thickness. The cement-bone interface as depicted radiographically was compared with the macroscopic features in cross section.

Findings: 1) Due to superimposition of cancellous structures, the proximal view of the cement-bone interface on radiographs was often obscured. 2) On the radiographs, discrimination between air, blood, soft-tissue debris, and intact cancellous bone was impossible. 3) Fractured interposed trabeculae and intact cancellous bone with adequate cement contact produced similar radiographic features. 4) Porosity and coarse lamellation of the cement were not radiographically visible. All of these phenomena, which were difficult to differentiate radiographically, were quite distinct macroscopically.

Conclusion: Immediate postoperative radiographs supply virtually no information on the quality of cement-bone interlock and on important structural properties of the cement. The practical consequence is that assessment of any interface development and loosening is possible only by comparing timed series of radiographs.

A modular femur prosthesis

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Malignant tumors of the distal femur often necessitate an operation. In a joint project of the Groningen University Hospital and Twente University, work is in progress to develop a modular prosthesis system to replace the resected bone. Because the unaffected contralateral leg continues to grow, the prosthesis system should comprise a component that can be adjusted for length. The system also comprises a hip and a knee component and bone-prosthesis joints to be connected to a universal joint.

The lengthening component was first designed. The major criterion was that it should permit noninvasive phaseless lengthening up to a maximum of 72 mm. This was achieved by using an external magnetic field, which causes an internal magnet to rotate; via a screw transmission, this magnet can move two telescope parts apart.

Animal experiments have shown that the prosthesis functioned well, although moisture entered the telescope part and the prosthesis was prematurely overgrown with bone.

The next design concerned a universal joint derived from a dovetail joint.

Varia

The influence of NSAIDs on healthy human cartilage cells in vitro

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Both in vivo and in vitro NSAIDs have a positive effect on the synovitis accompanying hydrarthrosis; most NSAIDs, however, interfere with the cartilage metabolism of the joint in question, although the total effect remains positive. Hardly any research has focused on the simultaneous effect of NSAIDs prescribed for hydrarthrosis, on the remaining healthy joints.

The effect of a number of NSAIDs on healthy cartilage was studied in an in vitro model that we developed for cultivation of isolated human chondrocytes. The NSAIDs were administered in a serial dilution around the concentrations attained in vivo to a healthy human cartilage aggregate formed in vitro. Matrix production and rate of mitosis proved to be highly dose-dependent and was influenced negatively by NSAIDs. The concentrations producing a negative effect are around the values found in vivo following a normal dosage of NSAIDs.

The positive effect of NSAIDs on hydrarthrosis, both in rheumatoid arthritis and in arthrosis, seems to be beyond doubt. It seems advisable, however, to be aware of possible negative effects on remaining healthy joints when administering NSAIDs.

The influence of skin tissue on the growth and calcification of mouse embryo metatarsals

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The role of tissue interactions in osteogenesis is not yet entirely clear. A recent hypothesis suggests that delayed fracture healing in the presence of major soft-tissue damage is due to competition of certain factors released from these soft tissues. The influence of skin and muscle tissue on osteogenesis was studied.

In an in vitro study, metatarsals of 18-day-old mouse embryos were cultured with fetal skin and muscle tissue interspersed at certain intervals. The effect of these two

tissues was studied by measuring the longitudinal growth and the progression of the calcification of the growing metatarsals. Skin fragments proved to have an inhibitory effect, whereas muscle fragments did not.

The results suggest that skin tissue produces a factor that is responsible for inhibition of the longitudinal growth and calcification of skeletal parts largely consisting of chondrocytes.

Reconstruction of experimental meniscus lesions

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In dogs, 40 T-shaped lesions were made in the lateral meniscus and repaired with the aid of implants consisting of polylactic acid (PLLA) and polyurethane (PU), in 14 instances reinforced with carbon fibers. Some implant characteristics were as follows: pore size 35-150 μ ; pore volume (percent) 84 (dry); Young's module (MPa) 42 (dry) and 42.5 (wet); elasticity module at (kPa) 2 percent compression 2.5 (dry) and 11 (wet). The horizontal leg of the T-shaped lesion represented a central longitudinal rupture outside the vascularized zone, whereas the vertical leg formed the connection with the capsule. The horizontal leg covered 30 percent of the length of the meniscus. A pedicled synovial flap was sutured onto the implant. The period of observation ranged from 10 to 52 weeks.

Results: In the carbon-PU-PLLA group, 12 implants showed a fair degree of ingrowth. Two implants were dislocated. Histologic examination revealed ingrowth of vessels and fibrous tissue over a large distance; in addition, there was unmistakable evidence of synovitis, probably caused by loose carbon-fiber particles. In the PU-PLLA group, 25 implants were found to function well. Histologic examination revealed a fibrous pannus along the peripheral margin of the meniscus. Vascularization and ingrowth of chondroblasts in the pores of the implant were evident. There were unmistakable signs of fibrocartilaginous reconstruction without inflammatory changes. This reconstruction is probably induced from the synovial lining; fibrochondrocytes undergo metaplasia to fibrocartilaginous tissue in response to certain blood serum factors and mechanical stimulation. Preliminary compression experiments disclosed that in many instances the elasticity module of the reconstructed meniscus was close to that of the original meniscus tissue.

Shock absorption by the human foot

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Insufficient shock absorption by the foot during locomotion may lead to such conditions as arthritis, arthrosis, and periostitis. Medical interventions, such as arthrodeses in the tarsus, have as yet an unknown effect on shock absorption by the foot. Shock absorption may take place through storage of energy in the heel cushion, ligaments, and muscles. Estimates of transfer functions with the aid of the linear system theory give no satisfactory results because the characteristics of the tissue involved are fundamentally nonlinear. It is difficult to design a model because complex geometries, characteristics of ligaments and muscles, and muscle control have to be taken into account.

Synchronized acceleration measurements with miniature sensors at different levels on the foot and lower leg can in principle demonstrate the effectiveness of shock absorption. Fixation of the sensors to the skin, however, interferes with the signal. This was demonstrated by performing a synchronized measurement on the skin and the skeleton. Shock absorption during a walk was studied by acceleration measurements in axial and in the anteroposterior direction in the heel of the shoe and on the tibia. Fourier analysis of the signals revealed that frequencies in excess of 60 Hz are not transmitted by the foot. The reduction of the acceleration proved to be more effective in the axial than in the anteroposterior direction. During a walk on a hard surface, the distal tibia may accelerate by 12 g.

The conclusion is that research into shock absorption, while highly desirable clinically, is very difficult in theoretical and experimental terms.

Relationship between force and EMG of intrinsic lumbar muscles

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Two experiments were performed in order to determine the role of the intrinsic lumbar muscles (ILM) in stabilizing the vertebral column.

In the first experiment the test subjects (15) were asked to extend the back against resistance while standing upright. At different levels of static force the level of electromyographic activity was measured (the relationship was approximated with the equation $RA - EMG = aF + b$, in which F is the level of force and $RA - EMG$ is the mean absolute value, both as percentage of the maximum; a , q , and b are constants.

The $RA - EMG$ of the medial column of the ILM increased almost linearly with force ($q = 1.3$). The $RA - EMG$ of the intermediate and the lateral column did not increase until higher force levels were attained ($q = 2.1$ and $q = 2.9$, respectively); their relative contribution in the external force is large only at these higher levels.

In the next experiment this difference between the columns was confirmed. An artificial leg length difference resulted in a pelvic tilt that was corrected by the ILM. Not until a certain leg length difference (mean 34 mm) was exceeded did the $RA - EMG$ increase, especially in the medial column. This is probably due to the fact that this column includes muscles that extend obliquely from the pelvis to the vertebrae (e.g., the multifidus muscles).