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Isolated avulsion of the lesser tuberculum of the humerus

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Introduction: Fractures of the lesser tuberculum of the humerus as a rule occur in combination with fractures of the head of the humerus, which may be (multi)segmental, or as a fracture in posterior dislocation of the shoulder. Only 34 cases of isolated avulsion of the lesser tuberculum of the humerus have been reported in the literature, in as far as we have been able to ascertain.

Material and method: The diagnosis of 'isolated avulsion of the lesser tuberculum' was made in the Reinier de Graaf Gasthuis, Delft, six times in a relatively brief period (4 years). This suggests that this fracture occurs much more frequently than hitherto assumed.

All our six patients complained of moderate to severe plain. Physical examination in all cases revealed limited function of the shoulder joint. The diagnosis in all cases could be made on the basis of radiography, although it was found that fracture of the lesser tuberculum is easily missed in the AP projection. In such cases an axillary radiograph was a condition of making the correct diagnosis. In our experience, CT scanning was diagnostically useful, especially for determination of the size and the degree of dislocation of the fragment.

Results: One patient had a non-dislocated avulsion fracture and was treated conservatively with good results. In five patients, the fragment of the lesser tuberculum was dislocated to such an extent that surgical treatment was decided upon; in one of them, a disloation of the biceps tendon was found as well. In all five cases, the lesser tuberculum was reattached and the rotator cuff was repaired. Six months after the operation, four of the five operated patients were free of pain. One patient still complained of pain and had restricted shoulder joint function.

Our results of surgical treatment are comparable with those reported in the literature.

Conclusion: In case of dislocation of an isolated fracture of the lesser tuberculum of the humerus, surgical treatment is advisable, with re-attachment of the fracture fragment and repair of the rotator cuff.

Stability in the absence of the lateral malleolus

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Complete absence of the lateral malleolus was observed in a patient with an ankle injury. Nevertheless, functional stability of the ankle was good after wound healing. This post-traumatic stability is to be attributed to the nature of the direct injury, which knocked away only the lateral complex, leaving intact the other ligaments which stabilize the talus in respect to the tibia. This in contradistinction to supination-inversion injuries, in which these ligaments, also, are damaged. Our observation is not in agreement with the general view in the literature according to which the lateral malleolus together with the syndesmosis is regarded as a very important factor in the stability of the ankle joint.

Experience with arthroscopically assisted treatment of tibial plateau fractures

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Introduction: Tibial plateau fractures have been treated surgically in the Alkmaar Medical Center since July 1992 under arthroscopic control.

Material and method: Tibial plateau fractures were classified according to the AO system and the results of treatment were followed up prospectively in a comparative study with a group of patients treated by conventional means.

Surgical treatment begins with an arthroscopic inventory, following which the fracture is repositioned under arthroscopic control. Fixation of the fracture and spongiosaplasty were done in the usual way. At follow-up, attention was given to function, stability, leg axis and residual symptoms. Sixteen patients have so far been included in this study. The fracture type distribution was as follows: A1 once, B1 once, B2 three times, B3 eight times and C3 three times. Arthroscopic inspection revealed anterior cruciale ligament damage twice and a meniscus lesion three times; meniscopexy was performed in one case.

A dynamic splint was used for the after-treatment; in five cases, restriction of the extension of 20° was allowed. All patients were mobilized without weight-bearing for at least two months; six times in a hinged brace, without protection in the other cases. Complete weight-bearing was permitted after an average of 12 weeks.

Results: No immediate postoperative complications were observed. Fourteen patients could be subjected to follow-up examination after an average of 11 (4–24) months. Knee function in five cases showed a limitation of extension ranging from 3 to 10°; three of these patients had also received aftertreatment with restricted extension. No relation existed between the fracture type and the restriction of the extension. It was only in one case that the flexion was restricted to less than 130°, namely in a patient with an A1 (eminentia) fracture who one year postoperatively had a flexion of 100°.

Three patients had complaints such as starting stiffness or sensitivity during effort. Mild lateral laxity was observed in three other patients. Although the follow-up period in our study is still too short and the series too small for a comparison of the results with those of conventional methods of treatment, the preliminary results, in any case, are favorable.

Conclusion: The arthroscopic technique which offers the advantage of a better view of the intra-articular damage and renders superfluous the surgical repair of that damage and (extensive) arthrotomies, is to be recommended.

Results of the treatment of unstable tibial shaft fractures with the undrilled AO tibial pin

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Introduction: Unstable as well as IInd and IIIrd degree opoen tibial shaft fractures require surgical treatment. Recently, the AO undrilled intramedullary tibial pin became available. A study was made of the results in 32 cases of tibial shaft fractures treated with this intramedullary pin.

Material and method: The fractures were classified using the AO system and the Gustilo classification for open fractures. The primary choice in 27 cases was intramedullary fixation with an undrilled AO tibial pin. In five patients, after initial plaster cast treatment, this medullary pin fixation was carried out later. Mean follow-up was 12 months.

Results: The postoperative situation in all cases was an exercise-stable osteosynthesis with good position of the fracture fragments. Complete weight-bearing of the fractures was allowed after an average of 6.4 (0–15) weeks. The following complications were seen: broken screw, transient loss of peroneal nerve function, pain at the site of the distal screws, consolidation in 13 antecurvation and one deep infection, treated conservatively with good results. Delayed consolidation was encountered in one patient, another developed a severe compartmental syndrome, treated with amputation of the lower leg.

Conclusion: We conclude from our results and from the data in the recent literature that fractures of the tibial shaft can be treated effectively with the undrilled AO intramedullary pin. We recommend this treatment for tibial shaft fractures that require surgical stabilization as well as for severe open fractures (Gustilo degrees II, IIIa and IIIb).

Results of conservative treatment of crural fractures

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Introduction: A protocol for the treatment of crural fractures was introduced in January 1992 according to which the management in the first instance is conservative. After initial treatment in a thigh cast, patients received after-treatment with a brace, which allowed a rapid start of quadriceps and knee flexion exercises.

Surgical treatment was reserved for open fractures of the lower leg and fractures which could not be adequately repositioned even under general anesthesia. A study was made of the results of this method of treatment as administered during 1992 and 1993.

Material and method: A retrospective examination was made of the records of the outpatient department and of the radiographic; in addition, enquires were made by telephone regarding the current functional level.

Results: Of the 29 crural fractures treated conservatively, 20 consolidated with a good, six with a fair and three with a poor axial direction. Eighteen of the 20 patients reached by telephone had ultimately regained their former level of function. The following complications were recorded: peroneal nerve damage once, hypertrophic pseudarthrosis once and Sudeck dystrophy, once.

Conclusion: We conclude that conservative treatment is still the management of first choice in crural fractures.

Postponement of ankle arthrodesis owing to Ilizarov articular distraction?

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Pain and restriction of movement in a worn-out articulation may cripple the patient to such an extent that surgical arthrodesis or implantation of an articular prosthesis is indicated. Neither method of treatment is attractive to the (usually young) patient with posttraumatic osteoarthrosis of the ankle. A recently introduced method for the treatment of posttraumatic osteoarthrosis of the ankle is articular distraction. With the aid of an Ilizarov external fixation system, 5 mm distraction is induced in the affected joint. Weight-bearing walking is allowed for three months, following which the external fixation is removed. The principle of this unique treatment is the combination of mechanical relief and intermittent intra-articular hydrostatic pressure. The pressure measured intra-articularly during distraction (3.0+0.5 kPa without weight-bearing and 10.3+0.6 kPa with weight-bearing, with a weight-bearing frequency during walking of 0.5 Hz, n=3) in vitro exerts a significant reconstructive effect on arthrotic human articular cartilage. Retrospective examination of 11 patients subjected to this ankle distraction for three months revealed such good clinical improvement that arthrodesis of the ankle could be avoided for a long period (20±6 months). Pain was significantly relieved in all cases, five patients were even completely free of pain. The mobility of the ankle improved in 55% of the cases and deteriorated in only one patient. Widening of the talocrural articular cleft could be observed radiographically in 50% of the patients.

Prospective findings confirm these observations, which suggest that intraarticular intermittent hydrostatic pressure in the absence of mechanical weight-bearing may induce repair of cartilage.

Conclusion: Ilizarov distraction of an arthrotic ankle can postpone the necessity of ankle arthrodesis for a long period.

Posttraumatic problems and the Ilizarov method

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Fracture healing with shortening, defect pseudarthrosis, osteomyelitis and articular contractures are redoubtable complications in traumatology, because they require highly complex treatment.

The Ilizarov method offers new possibilities. The Russian Ilizarov developed an external fixation system consisting of rings and Kirschner wires. These wires are drilled straight through the skin, soft tissues and bone and subsequently attached to external rings under tension. This renders external manipulation of even small bone fragments very well possible. Ilizarov also detected the principle of 'distraction histogenesis': the capacity of bone and soft tissues to proliferate under distraction. Distraction osteogenesis allows lengthening of a leg with correction of axial deviations without requiring osteoplasty. Complety closed filling of bone defects is also possible with the scalled 'lift procedure'. In addition, this technique also makes it possible to correct several abnormalities in one and the same long bone, although this is not a simple matter. For instance, compression of a nonunion in the proximal femur may be applied simultaneously with distraction of an osteotomy in the distal femur to correct a difference in leg length. Moreover, simultaneous correction of several axial deviations can be brought about, for instance of a varus position in the proximal femur and a valgus position in the distal femur.

This creates new therapeutic possibilities for various problems. An osteomyelitis may be so violent that after débridement acute leg shortening with subsequent lengthening is to be preferred to a 'lift procedure'. Gradual distraction of a joint can improve a contracture position. Mobility can even be restored by distraction in a completely stiffened joint. Distraction also appears promising for the treatment of painful posttraumatic osteoarthritis of the ankle.

Treatment of metacarpal fractures with a functional three-point brace

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Introduction: A prospective, randomized study was carried out to compare the treatment of metacarpal fractures by means of a conventional plaster splint for three weeks with an equally long treatment in a three-point brace made of plastic. The principle of the functional brace is believed to be based on a stable threepoint fixation, allowing virtually unlimited exercising of all the articulations of the hand.

Method: Out of 81 patients with metacarpal fractures, 41 were treated with a brace and 40 with plaster; the groups were of similar composition. Nine of the 41 brace patients did not finish the treatment. In two cases, making a brace to measure was impossible, in four patients, the brace was replaced by plaster because of pain, three patients failed to appear for the follow-up examination. Of the 40 patients treated with plaster, two did not finish the treatment.

Results: The patients who had completed the brace treatment had better clinical and radiographic results than the patients treated with plaster.

The mean change in angulation between the start (if necessary, after reduction) and the end of the treatment amounted to –0.25 degrees (improvement) in the brace group as compared to +6.6 degrees (deterioration) in the plaster group.

This difference increases further when fractures of the base of the metacarpal bones, which in our opinion are usually stable, are not taken into account. The differences in angulation were then –0.5 degrees in the brace group and +9.8 degrees in the plaster group.

Conclusion: The dynamic three-point brace constitutes an excellent alternative to the conventional plaster splint in the treatment of metacarpal fractures, but demands much of the patient's compliance. In view of the large proportion of dropouts (21%) during treatment with the brace, it is doubtful whether this treatment is suitable for use in everyday surgical practice.

Treatment of 100 cases of osteomyelitis with gentamicin-PMMA beads—survival analysis of the results

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Introduction: Out of a group of patients treated for orthopedic infections, those with osteomyelitis who had been treated at least once with gentamicin beads were subjected to a follow-up study with a minimum of one year.

Material and method: Treatment consisted of local implantation of gentamicin beads during a period of two weeks, which might or might not be combined with systemic antibiotic treatment. If necessary, this treatment was repeated every two weeks. Reconstructions were carried out when the infection appeared to have cleared up. Data were collected prospectively, and the follow-up was done during the regular outpatient control examinations or by telephone. Recurrences and recurrence-free intervals were established. Survival analyses were carried out and Kaplan Meijer curves constructed.

Results: 100 of osteomyelitis (39 acute, 61 chronic) were treated in 98 patients. The duration of the infection ranged from 0 to 48 years (mean 50 months). The osteomyelitis was complicated 18 times by an adjoining sepotic arthritis and three times, by an infected pseudarthrosis. Most frequent localizations were: the tibia 29 times, the femur 16 times and the hip 11 times. The causative agents most frequently isolated were *Staph. aureus* in 37 cases and *Staph. epidermidis* in 10 cases, while in 21 cases a mixed flora was involved.

A total of 144 operations were carried out: during 141 operations 10–360 large and/or mini-gentamicin beads were implanted while gentamicin-collagen membranes were used during four operations. Systemic antibiotics were administered at 89 operations and not administered at 65 operations; 21 times, the wound was closed with Epigard® artificial skin.

After a follow-up of 1-20 years (mean 64 months), 79 of the 100 osteomyelitis infections were found to have healed without recurrence. There were 16 recurrence infections, of which 13 were cured by repeated treatment. Of four infections, the degree of cure remained uncertain. Four osteomyelitis infections did not clear up; this necessitatated two amputations.

Recurrences were observed in 5% of the acute and in 23% of the chronic cases. The principal risk factors, as also demonstrated in survival curves, proved to be a duration of the infection of more than 6 years and referral by another orthopedic surgeon.

Conclusion: The osteomyelitic infections in this group of patients were ultimately cured in 92% of the cases by step-by-step débridement and treatment with local antibiotics, which might or might not be combined with systemtic administration. The literature reports similar results with this treatment, which indicates an improvement in comparison with the results of 20 to 30 years ago.

The recurrent infections appear mostly during the first two years after the treatment; several risk factors, which are strongly interconnected, are involved.

Treatment of medial fractures of the femoral neck with a head-neck prosthesis

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Introduction: In the University Hospital of Nijmegen, patients with a traumatic fracture of the neck of the femur have been treated since 1987 with a head-neck prosthesis. A retrospective study was carried out to evaluate our therapeutic protocol.

Material and method: The study included 84 consecutive cases of patients aged 70 years or older with a traumatic medial fracture of the femoral neck treated with a head-neck prosthesis during the period from January 1987 to December 1991. The bipolar (Charnley-Hastings) prosthesis was implanted via a dorsolateral approach in 39 vigorous patients. A unipolar (Thomposon) prosthesis was preferred for 45 less mobile patients and for all patients over 85 years of age. Data were available of 58 patients, with a minimum follow-up of three months.

Results: During the period up to three months postoperatively four patients died, two developed a deep infection and dislocations occurred in five patients. Six patients had little pain; three patients had crippling pains, in one case dure to inoperable heterotopical ossifications, in one case to a Girdlestone situation and in one case due to unknown causes. The radius of action was limited by the prosthesis only in patients with complications, in the others, the general physical condition was the limiting factor. Apart from two patients with Parkinson's disease, the flexion in the hip amounted to 90° or over in all patients examined.

No acetabular protrusion was observed, possibly due to

the limited follow-up (up to 5 years). Reoperation was carried out in six patients: because of a dislocation in three cases, because of a deep infection in one case, because of trochanteric bursitis in one case and because of heterotopic ossifications in one case.

Conclusion: Comparing our results with the results of osteosynthesis reported in the literature, we have to conclude that in patients over 70 years with a traumatic medial fracture of the femoral neck, implantation of a head-neck prostheis is the treatment of first choice.

Clinical and radiological evaluation of the treatment of acetabular dysplasia by means of Tönnis' triple osteotomy

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Introduction: The technique described by Tönnis for the treatment of acetabular dysplasia is based on osteotomy of the three bony ridges of the acetabulum and tilting of the acetabular roof over the head of the femur.

Material and method: Thirty-seven acetabula of 33 patients were operated on by means of this triple osteotomy; a retrospective study was made of the results. The mean follow-up was 34 months; 19 hips had been operated on previously. Mean age was 23 (8–43) years.

The Harris hip score (HHS) and the Visual Analogue Score (VAS) were used for the evaluation. In the roentgenological study, the center edge angle (CE) and the acetabular angle (AA) were measured. The mean duration of the operation was 3 hours; four complications occurred, all of which responded well to conservative management.

Results: After the operation, the HHS increased from 74 to 86, the VAS decreased from 50 to 28, the CE angle increased from 7 to 32 degrees and the AA angle decreased from 49 to 34 degrees. The mobility of the patients subjected to this operation improved substantially. Only three patients in retrospect were of the opinion that this operation was not to be recommended.

Conclusion: Triple osteotomy according to Tönnis is a safe and effective operation; 88% of the patients considers the treatment recommendable. This operation can be a good treatment for the young patient (8-45 years) with dysplasia of the hip joint.

Results of rotation osteotomy in the treatment of non-traumatic avascular necrosis of the head of the femur

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Introduction: One possibility of treating necrosis of the head of the femur is to correct the position of the head, tilting its affected part away from the weight-bearing surface.

Material and method: The results were studied of 28 rotation osteotomy operations in the treatment of avascular necrosis of the femoral head. Mean duration of follow-up was 5.3 (1.5–10) years.

A total of 18 intertrochanteric and nine transtrochanteric osteotomies according to Sugioka were carried out. The patients' mean age was 32 (15–51) years.

Results: The clinical result was good in 19 of the 28 hips. Nine patients were subjected to implantation of a total hip prosthesis, 4.3 years after the osteotomy. The operation was significantly more successful in patients younger than 35 years and in cases of Ficat stage II or III necrosis of the femoral head.

Conclusion: The results of this study corroborate the view that in young patients with necrosis of the femoral head there exists and indication for a conservative operation, in the form of a rotation osteotomy.

Experiences with the Mallory head porous-coated uncemented primary total hip arthroplasty: a prospective study in 70 patients

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Introduction: The Mallory head porous-coated uncemented total hip arthroplasty was introduced in the Netherlands in 1988. An 'intermediate inventory' was made as a part of a prospective study, after 5 years' use of this prosthesis.

Material and method: Between 1988 and 1990, a total of 76 prostheses were implanted in 70 patients with a mean age of 57 years. Use was made in all cases of titanium femoral heads and Hexloc acetabular components. The follow-up examination was done after an average of 46 (34–60) months. The Harris Hip Score (HHS) was determined preoperatively and at the follow-up, as was the visual analogue score (VHS, 0–10) concerning pain and function. Radiographs in two projections were made routinely.

Results: The mean HHS before operation amounted to 55, that at follow-up to 95. Fiftynine hips (78%) scored excellent, 15 (19%) scored well and two (3%) scored fair. The VAS scores for pain and function were both 8.8. Pain during or after thigh exercise was recorded in 12 cases (16%); in all these cases the pain was mild. Roentgenological examination yielded no indications of loosening of the femoral component, but did show the possibility of loosening of the acetabular component, which involved slight protrusion.

Periarticular calcifications and cortical thickening round the middle segment of the stem of the prosthesis were ob-

served radiographically in 18 cases (24%), and indications of polyethylene erosion (>2mm) in 11 cases (15%). No statistical correlations were found between the HHS on the one hand and age, sex, the indication for operation or surgical approach on the other, nor between HHS on the one hand and cortical hypertrophy or polyethylene erosion on the other. Since this study was done, two cups were revised.

Conclusion: The clinical and radiographic findings indicate good to very good results of the uncemented Mallory head total hip arthroplasty. However, a relatively large proportion of cases with polyethylene erosion should not go unnoticed.

Chevron osteotomy in hallux valgus

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Introduction: The results of the chevron osteotomy in hallux valgus are described in a prospective study.

Material and method: The indications for operation were: 1) pain and problems with shoes; 2) metatarsus primus varus of 10–15, without osteoarthrosis in the MTP-I articulation.

Thirty patients were operated: 28 females and two males. Five patients underwent bilateral operations. Mean age was 51 years, mean duration of follow-up four years.

Results: 28 patients were satisfied and seven were dissatisfied with the results of the operation. The mean intermetatarsal angle decreased from 12.4 to 9.2. The mean hallux valgus angle decreased from 27.5 to 18.3. Postoperatively, there were four cases of metatarsalgia, one of a superficial skin infection and one of irritation of the scar. Evaluation according to the Bonney and McNab score gave the following results: excellent in 19 patients; good in 11 patients; poor in four patients.

Conclusion: The distal chevron osteotomy of the first metatarsal bone is a good operation which allows immediate mobilization with weight-bearing of the patient. It is important that patients are informed adequately about the correction to be expected.

CD loop instrumentation for cranio-cervical osteosynthesis in patients with rheumatoid arthritis

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Introduction: Seven patients, all women, were fitted with a CD loop instrumentation with a view to cranio-cervical spondylodesis in rheumatoid arthritis. The purpose of this operation was to prevent sudden death or tetraplegia and to achieve immediate stability with the possibility to immobilize the patient postoperatively with a collar and to bring about neurological recovery. This CD instrumentarium consists of a rod bent into a flat lopp, with an 80-degree kink that fits the curve of the occipito-cervical transition. The loop is fixed to the occiput with screws and the two rods pointing down are fixed dorsally on both sides of the cervical vertebral arches using hooks or cerclages.

Material and method: The operations were performed between November 1991 and May 1994. The indications were C1–C2 (atlanto-axial) instability, (pseudo)basilar impression and/or symptoms of loss of nerve function in which conservative treatment no longer had any results. In six cases, the fixation system was applied between the occiput and C7 or Th1, in one case between the occiput and C4. One patient 7 years previously had been subjected to a Gallie spondylodesis C1–C2; at the subsequent operation the spondylodesis was extended from the occiput to Th1. Two patients had tetraparesis, two had paraparesis of the arms while two patients only displayed loss of sensory nerve function. Mean age at operation was 61 (47–77) years.

Results: No peroperative complications occurred. One patient immediately postoperatively required an emergency tracheostomy because of an upper airway obstruction. Two months later, the tube could be removed without further problems. All operated patients received after-treatment with halo traction for an average of 2.5 months. The mean follow-up period was 1.5 years (6-34 months). No late postoperative complications were encountered. The spondylodesis consolidated in all patients, no secondary instability below the fusion was seen. One patient died 2 years and 10 months after the operation of the effects of a cerebral infarction. Six patients became completely and one only partially free of pain. Improvement of the neurological symptoms of functional loss was seen in four patients (Ranawat classiviation), while in three patients these symptoms remained unchanged. It was interesting to note that the patients were inconvenienced relatively little by the occipito-cervical spondylodesis. All regarded the operation as highly successful and would opt for this treatment again.

Conclusion: Cranio-cervical spondylodesis using the CD loop instrumentation was succesful in all seven patients. With this technique, symptoms of loss of nerve function were improved or stabilized.