both freely in the deeper bursal stroma, and in the vicinity of blood vessels. Morphologically, they were thick, coarse and nonvaricose nerves, whereas synaptophysin immunoreactive nerves, observed adjacent to cells in the superficial zone, had a punctate appearance, possibly indicating axon varicosities or nerve terminals. Substance P and CGRP immunoreactive nerves were also varicose, and sparsely distributed. Such neuropeptide nerves were, similarly to the PGP 9.5 immunoreactive nerves, present adjacent to blood vessels and were also seen to course freely through the bursal stromal tissue. Compared with normal bursal tissue, the immunoreactive nerves were more sparse in the inflammatory bursal tissue in patients with chronic shoulder pain. The observed nerves may be important in bursal physiology and pathophysiology.

Foot

250. Hallux valgus correction using a modified Hohmann technique

Poul Hedevang Christensen and Torben Baek Hansen

Department of Orthopedic Surgery, Holstebro Central Hospital, Holstebro, Denmark

We have used a modified Hohmann technique with Kirschner wire fixation as routine treatment for hallux valgus in our department. The aim of this study is to investigate the results of this technique.

Material and methods: A total of 246 toes in 181 patients were operated on in 1984–1990. Twenty-two patients had died or their radiograms were missing, leaving 217 operated toes in 159 patients.

All patients were followed with roentgen examinations until the osteotomy had healed. Follow-up was by a questionnaire.

Results: The questionnaire was returned by 91%. The average observation time was 52 (25–97) months. The correction of the valgus angle was 10° (31°–22°). 55% of the patients were completely satisfied, and only 12% were dissatisfied with the outcome. There was a significant correlation between the correction of the valgus angle, the lateral displacdment and patient satisfaction but not to plantar displacement or preoperative intermetatarsal angle.

Conclusion: The modified Hohman procedure is a safe and reliable procedure in treating hallux valgus patients.

251. Free vascularized flaps for reconstruction of the foot

Karl R. Hetland, Astor Reigstad, Kjell Bye and Magne Rökkum

Kronprinsesse Märthas Institutt, Oslo, Norway

Soft tissue defects and bone loss in the foot may lead to Syme or below knee amputation. Microvascular free tissue transfer can be a salvage procedure in many cases. The sole of the foot is one of the most specialized areas of the body. Some of the traditional techniques for resurfacing the foot sole suffer from the fact that there is no innervation and the coverage may break down. This may be overcome with transfer of sensory free flaps.

Material and methods: In the period 1985–1991 we have transferred 24 free flaps to the foot. The series consists of 11 lateral arm flaps and 13 scapular flaps, involving 3 women and 21 men, age 32 (4–69). The flaps covered partly the weight-bearing area of the foot sole in 10 cases, the heel in 5 cases and lateral, medial or dorsal aspect of the foot and ankle in 9 cases. In 3 cases the lateral arm flap was raised as a sensory flap using the posterior nerve of the arm and forearm. A compound osteocutan flap was raised in 2 cases.

Results: One flap was lost because of thrombosis of the flap vein. Successful revision of the anastomoses was carried out in 5 cases. 23/24 flaps revascularized and healed, and then provided the recipient area for full thickness skin coverage. In 7 cases the flap was later reduced. Secondary procedures (arthrodesis, osteotomy, bone resection) for which the flap was a prerequisite, were carried out in 7 cases. In one case a secondary below knee amputation was carried out because of nonunion. In 6 cases of weight-bearing flaps minor skin problems between the flap and the original skin occurred.

Conclusion: Free flap transfer to the foot may reduce the amputation rate in foot surgery and provide the patient with satisfactory skin coverage.

252. Avascular necrosis of the first metatarsal head after Chevron osteotomy shown by ^{99m}TC-MDP scintigraphy

Sylvia Resch, Anders Stenström and Torbjörn Gustafson

Department of Orthopedics, University Hospital, Lund, Sweden

Introduction: Distal osteotomies of the first metatarsal such as Chevron osteotomies are often used for the correction of metatarsus primus varus. It has been suggested that there is increased risk for avascular necrosis (4–40%) of the distal fragment due to capsular stripping and to the transection of the circulatory apparatus of the neck, especially when combined with adductortenotomy. In a prospective, randomized study, early TCM scintigraphy was used to investigate the frequency of avascular necrosis.

Patients and methods: 41 patients (44 feet) scheduled for hallux valgus surgery where early postoperative TCM scans could be obtained were preoperatively randomized to Chevron osteotomy with or without adductortenotomy. 36 patients (39 feet) are included in the follow-up. They were reviewed with radiographs and clinical evaluation at 6-8 weeks and at a minimum of 1 year (average 19 months); a TCM scan was obtained 2–12 days postoperatively and if there was a defect after about 3 weeks.

Results: An early cold scan was found in 4 feet: in 3 of the 18 operated on by Chevron osteotomy only, and in 1 of 21 operated on with Chevron osteotomy and adductortenotomy. The difference is not statistically significant. No defect was seen in the second scan at about 3 weeks. Only one patient was dissatisfied with the operation. No complaints in the series could be directly attributed to avascular necrosis. Radiography could not confirm the diagnosis of avascular necrosis made by early cold scan. Late radiographs show uneventful healing in all cases.

Conclusion: The rate of avascular necrosis of the first metatarsal head after distal osteotomy is not negligeable, although it appears that the adductortenotomy does not increase the risk. Patients whose scans indicate vascular impairment initially appear to be asymptomatic. Radiographic evaluation is not reliable in diagnosing limited circulatory impairment.

Hand

253. Proximal thumb metacarpal fractures treated by Iselin's operation technique

Denis A. Dartée, Peter R. G. Brink
and Hendrik P. van Houtte

Department of General Surgery and Traumatology,
De Wever Ziekenhuis, Heerlen, The Netherlands

Thumb proximal metacarpal fractures can be divided into extra- and intra-articular fractures; the latter including the Bennett's and Rolando's fractures (Green and O'Brien 1972). The literature mentions many different ways of treating the thumb proximal metacarpal fracture.

Between 1980 and 1989 thirty-three patients with a thumb proximal metacarpal fracture were treated according to the method introduced by Iselin (1956).

At 58 (16–124) months follow-up all patients were free of pain. All operated hands had a stable carpo-metacarpal joint. All but two had a full range of motion. At follow-up some arthrosis, grade one to two, (Eaton 1973) was seen in five cases.

When we compare Iselin's method to nonoperative treatment by closed reduction and plaster of Paris immobilization the main disadvantages of nonoperative therapy are skin problems at the pressure site under the plaster at the base of the thumb metacarpal and the possible secondary loss of reduction. The open reduction, however, has also its disadvantages; like loss of function due to local damage during preparation and fixation of the bony fragments. The method by Mark Iselin leaves the joint and fracture site untouched, restores the webspace between the thumb and index metacarpal, which is necessary for good hand function and keeps the fracture well reduced. The operation technique is simple and the operating time is short. The main objective is a good pain free functional result.

254. Fractures of the scaphoid—a long-term follow-up study

Henrik Düppe[1], Olof Johnell[1], Göran Lundborg[2]
and Inga Redlund- Johnell[3]

Departments of [1]Orthopedics, [2]Hand Surgery and
[3]Diagnostic Radiology, Malmö General Hospital, S-214 01
Malmö, Sweden

Method: Radiograms of fractures of the scaphoid, that all had occurred in the city of Malmö 1950–1959, were examined and 75 patients still living in the city 1990 were invited to a follow-up study after on an average of 36 years. Sixty were interviewed and 56 were re-examined, including radiograms of both hands. Their average age at the time of fracture was 28 (15–48). All patients were treated with a scaphoid plaster not extending over the elbow joint.

Results: Four of the re-examined patients had radiological signs of nonunion already in their first radiograms taken in the 1950's without a history of previous trauma. The nonunion rate at follow-up of the 52 patients with a fresh fracture in the 1950's was 10%. Degenerative arthrosis is uncommon if the fracture is united. Only one (2%) of the patients with a united fracture had a radiocarpal arthrosis with a reduced joint space. In the group with a pseudarthrosis this was far more common. Five (55%) of the nine patients with a pseudarthrosis had a reduced radiocarpal joint space. There was a manifest radiocarpal arthrosis only in 6% of those who did not have any complaints at re-examination compared with 43% in those who had complaints. Overall, of those with a united fracture only 6% had complaints compared with 44% in the group with a pseudarthrosis.

Conclusion: The long-term prognosis of healed fractures of the scaphoid is good. A pseudarthrosis though, often results in a radiocarpal arthrosis and future complaints.

255. Closed pulleotomy—a new surgical technique for the treatment of trigger finger

Shaw-Ruey Lyu

Division of Orthopedics, Chiayi Christian Hospital, Chiayi, Taiwan

In the orthopedic clinic, stenosing tenosynovitis of the thumb or finger flexors is a common cause of hand pain and disability. Surgical treatment by releasing the Al pulley has long been proven as an effective cure of chronic relapsing cases. The conventional surgical method, though very simple, can still cause the patients to suffer from some complications. Moreover, most patients feel uncomfortable during the application of a pneumatic tourniquet which is sometimes needed to control bleeding and ensure the safety of this procedure. In order to solve these problems, special instruments and a new technique have been developed to release the Al pulley.

Material and methods: The patients: From April 1988 to November 1990, 54 consecutive patients with 63 fingers or thumbs were treated by this method. The involved fingers were: s16 thumbs, 12 index, 11 long, 21 ring, and 3 little fingers. The surgical indications were either one or more of the following: 1. patients with symptoms for more than 3 months, 2. patients with multiple digit involvement, 3. patients with recurrence after conservative treatment, and/or 4. patients who were willing to receive this procedure as a primary treatment when explained of its simplicity and effectiveness. The instruments: The instruments used to perform closed pulleotomy consisted of a pulley hook and a curved knife. The pulley hook is a small sized ligature needle, which is bent to the appropriate curve needed. The width of the hook is about 2 millimeters, and a gutter is located along the concave surface of it. The curved knife can be easily contoured from a No. 12 surgical blade with an electric grindstone. The curve of the knife should be carefully contoured to coincide with the curve of the pulley hook. The knife then can be coupled snugly with the hook when it is slide down along the gutter over the concave surface of the hook.

The surgical procedure: The precise location of the incision is the key determinant of the success of the procedure. It is located just over the proximal edge of the first annular pulley of each flexor tendon, and by careful palpation can be well localized prior to the infiltration of a local anesthetic. About 0.5 c.c. of 1% Lidocaine is infiltrated into the skin and the tissue around the tendon sheath. A 2 to 3 mm transverse incision is made by a No. 11 scalpel blade just over the needle hole. The tip of the pulley hook is then penetrated bluntly into the small wound to touch the surface of the flexor tendon sheath. The location of the proximal edge of the first annular pulley can be well determined by a step sensation when the tip of the pulley hook is slided back and forth gently on the tendon sheath. When the location of the proximal edge of the annular pulley is determined, the tip of the hook is carefully inserted from this point horizontally and distally with some force to slide in between the pulley and the flexor tendon and loop the Al pulley. With the hook held firmly in place, the distal skin edge of the wound is retracted with a skin hook. The curved knife is slided all the way down along the gutter of the concave side of the pulley hook to release the Al pulley. Complete release of the Al pulley can be felt by a giving sensation. A pneumatic tourniquet is not used during this procedure and no sutures are needed for the wound.

Results: All of the patients were followed up weekly for at least one month postopertively. Most of them can resume daily work immediately after this procedure with only mild wound pain for a few days. Three patients suffered from persistent wound pain and local swelling due to repeated unsuccessful loopings, but within three weeks their pain subsided. No other immediate complications were noted.

At the time of this report, a telephone questionnaire was successfully obtained from 48 of the 54 patients. The average follow-up period was eleven months (range, 6 months to 24 months). All of the patients were satisfied with their results and their treated digits no longer clicked or locked and were pain free. One female patient did complain of mild discomfort over the tiny hypertrophied scar left in her palm, but was still satisfied with the results.

256. Ring finger avulsion injury

Karl R. Hetland, Astor Reigstad and Svein Waage

Kronprinsesse Märthas Institutt, Oslo, Norway

In ring finger avulsion injuries with intact arterial circulation but disrupted venous supply, there is universal agreement that microvenous reconstruction is the only way to salvage the finger.

Methods and results: From 1984 to 1992 we have treated 5 patients with this type of injury—4 men and 1 woman with an average age of 40 (23–58)—all with injuries of their right ring finger. None of the patients needed repair of the volar neurovascular bundle or reconstruction of tendon or joints. In four patients a microvenous reconstruction was carried out. In one case a direct end to end venous repair without vein graft interposition was undertaken—this patient developed venous thrombosis; the finger went on to necrosis and had to be amputated. In three patients the venous repair was done with vein grafting. One of these showed signs of impaired venous return one day postoperatively. He was treated successfully with leeches for 7 days. One patient had no microvascular operative intervention. In the referring hospital the finger was initially considered to have adequate venous drainage, but after 2 days it became congested. It was successfully treated with leeches for 9 days.

Conclusion: This type of ring finger avulsion injuries should be treated by a microvenous repair with vein graft to restore the venous drainage. In cases with failure of the micro-venous repair the use of leeches may salvage the finger.

257. Tennis elbow/radial epicondylalgia—measurement of range of motion of the elbow and the wrist including a reliability study

Sven-A. Sölveborn

Department of Orthopedics, Academic Hospital, Uppsala, Sweden

This very common ailment (prevalence 1–3%) "tennis elbow" is a misnomer since a small minority are tennis players (<5% in the present study one individual). Even the term "lateral epicondylitis" is misleading because of the absence of evidence of inflammation in biopsies. For this affliction, most appropriately named radial epicondylalgia, there is rarely any data or reports on the range-of-motion (ROM) and if so, often in rather imprecise terms, mostly stating that all movements are complete on superficial examination. Apparently no accurate study has previously been performed to establish the typical ROM features of this condition, which is the aim of this study.

Material and method: First a study of the reliability of measurements of the elbow and the wrist with a simple goniometric device was performed on 16 healthy individuals (mean age 46 years, all but two right handed, matching the clinical material with respect to age and profession). All were measured by the same investigator with the same goniometer and one single measurement for each ROM, both active and passive, repeated once a week for 4 weeks at the same time of the day, without earlier values being available ("blind"). Then 123 patients with unilateral radial epicondylalgia were examined, 75 men and 48 women, mean age 43 (19-63). The pain duration was on average 11 months (median 6), with a mean for the last week of 50 on a 100 mm pain visual analogue scale. They were right-handed in 91%, left-handed in 9%, but the symptom side was in 75% the right (92 patients) and 25% (31) the left.

Results: The precision/accuracy in the reliability study had a minimal variation, expressed as $\sqrt{\sigma_\varepsilon^2}$ from one to six degrees for the different angles (best for elbow extension, flexion and palmar flexion of the wrist, while the greatest variation was found for pronation and supination).

In patients the affected side was compared with the healthy side. For the 92 patients with right-sided symptoms all measured ROM:s were restricted on the involved side (except passive supination), i.e. palmar flexion (difference 7° active, 8° passive) and dorsal extension (11° and 8°, respectively) of the wrist, supination (3° active) and pronation (7° and 12°, respectively), radial deviation (4°, only measured active) and ulnar deviation (4° active) of the wrist, flexion (3°) and extension (4°) of the elbow, low probability value ($<10^{-5}$) for all except supination ($p< 0.05$). The 31 patients with left-sided symptoms had significantly restricted ROM only for palmar flexion (5° active, 4° passive), supination (9° active, 8° passive) and extension of the elbow (4°).

Conclusion: Despite statements in several descriptions of "tennis elbow" the flexibility is limited in practically all ROM:s in patients with right-sided symptoms of unilateral radial epicondylalgia whereas for those with left-sided symptoms the restricted ROM was significant only for palmar flexion of the wrist, supination and extension of the elbow.

258. Surgical treatment of post-traumatic arthritis of the wrist, and/or painful non-union of the carpal scaphoid, and aseptic necrosis of the lunate by a wedge osteotomy or a simple, with or without displacement, osteotomy of the lower end of the radius

Emmanouel Fragiadakis and George Papachristou

Athens Greece

The purpose of this paper is to report on a simple surgical method for treating a group of diseases resulting in traumatic conditions of the wrist, and mainly osteoarthritis of the joint.

A total of 127 cases were treated surgically during the last 17 years. They were divided mainly into three groups: cases treated for a painful pseudarthrosis of the navicular bone alone, or in association with osteoarthritis of the wrist; cases treated for aseptic necrosis of the lunate bone, with or without osteoarthritis of the joint; cases treated directly for the secondary osteoarthritis, regardless of the initital cause.

The surgical method included either a wedge osteotomy, kept in place with one or two kirschner wires, or a complete osteotomy without displacement, or a much simpler incomplete osteotomy performed in the lower end of the radius.

The results from a follow-up ranging from 1–17 years are encouraging, and the authors are convinced that this relatively simple surgical method leads to solution of the major problems which result from the above mentioned diseases.

259. Histological changes of the flexor tendon synovium in idiopathic carpal tunnel syndrome

Panayotis Kinnas, Constantinos L. Yiotis, John Zogos, Vassilios Psichoyios, John Tinios and Christos Koutouzos

Athens Greece

In this study, the histological lesions in the flexor tendon synovium were studied in 40 patients with idiopathic carpal tunnel syndrome. Tenosynovial biopsy specimens from 50 wrists (10 patients had both wrists involved) were obtained from the patients at carpal tunnel release and a control group of 14 specimens was also tested. Ages ranged from 32 to 60 years with a mean of 40.

Inflammation was present in only 20% of the patient specimens and was correlated with only one of the clinical and histological factors studied, i.e. nerve conduction impairment. Edema was observed frequently (90%) and was not correlated with inflammation. Vascular sclerosis was found consistently (96%) and was correlated with the patient's age and the degree of edema. Edema and vascular sclerosis occurred with significantly greater frequency and severity in the specimens from the patients than in the control group. Fibrosis and synovial hyperplasia were uncommon findings.

We concluded that tenosynovitis is uncommon in patients undergoing surgery for treatment of idiopathic carpal tunnel syndrome and does not represent the usual cause of this syndrome.