Acta Orthop Scand 1988;59(6):748–752

Proceedings of the Scandinavian Foot Society

Århus, Denmark, June 8, 1988

Editor: Gert Walheim
Department of Orthopedics
Sabbatsberg's Hospital
S-113 82 Stockholm, Sweden

Diabetic osteopathy

Folke Lithner

Department of Internal Medicine, University Hospital, S-90 185 Umeå, Sweden

Diabetic osteopathy is an aseptic, osteolytic lesion, mainly of the small bones of the neuropathic foot and often with destructions. It is fundamentally a disease of the bone with a frequent and early involvement of the metaphyses rather than an arthropathy. Fever, leukocytosis, and pain are usually absent. An adequate blood supply is a definite prerequisite for osteolysis to occur. The clinical appearance of osteopathy in progress is therefore a warm, somewhat edematous and erythematous foot. Sometimes only the big toe is affected and can then be wrongly diagnosed as gouty arthritis. The osteopathy is closely connected with concomitant or previous occurrence of incipient or manifest cutaneous ulcerations of the diabetic foot; 15 percent of such patients have extensive and 15 percent have small skeletal lesions. Diabetics without history of incipient or manifest ulcerations on their feet seldom have osteopathy. Osteopathy is radiographically indistinguishable from osteomyelitis, the latter diagnosis can only be achieved by a needle biopsy and cultivation for bacteria. However, osteopathy is a common finding in diabetic feet, whereas bacterial osteomyelitis is rare. The treatment of osteopathy consists of immobilization of the foot

The diabetic gangrene: Clinical characteristics

Folke Lithner

Department of Internal Medicine, University Hospital, S-901 85 Umeå, Sweden

Gangrenous lesions localized in the lower limbs are not only the most common, but also generally the most invalidizing of the diabetic vascular complications. They are accompanied by a high mortality rate, a high frequency of subsequent major amputations, and a poor prognosis for social rehabilitation of the amputated patients. Mean age is 68 (21–92) years, and there is no sex difference. Gangrene is generally located in the feet: viz., toes 58 percent, interdigital spaces 6 percent, dorsa of the feet 10 percent, metatarsal heads 10 percent, and heels 16 percent. We found the frequency of lower leg or thigh amputations in different locations to be toes 22 percent, interdigital spaces 42 percent, dorsa of the feet 6 percent, metatarsal heads 10 percent, and heels 32 percent. Only a minor part of diabetics with peripheral gangrenous lesions have peripheral coldness and absence of peripheral pulses; they have a worse prognosis. More than 70 percent of the diabetics with peripheral gangrene have no pain in their lesions. Most diabetics with distal gangrene have a rather pronounced hyperglycemia when first admitted for medical care. Most often these patients also have other vascular disease, in particular heart failure with or without peripheral edema, but also venous thrombosis or nephrotic syndrome. The gangrene is often precipitated by these diseases.

The most severe risk factor for a subsequent major amputation in diabetics with distal gangrene is high age and after that, in sequence, smoking, local pain, hypertension, and male sex.

Vascular surgery and orthopedic care of foot ulcers and gangrenes: Report of 2 cases

Anders Starkhammar

Department of Orthopedics, Central Hospital, S-601 82 Norrköping, Sweden

Two case reports illustrate the need of close contact between vascular surgeons and foot-care units. Successful revascularization without strict postoperative foot care is incomplete. Protection of the ulcers or distal gangrenes, treatment of edema, early mobilization in a walking cast, walking bed, or orthopedic shoe are challenging tasks. When adequate nutritious blood flow is reestablished, the natural healing is sometimes amazing. Open-minded cooperation will save limbs.

Case 1. Male, aged 69 years. Smoker for last 55 years. Diabetes mellitus at aged 14. Peroral antidiabetics. Neuropathy. In 1985, foot exarticulation due to ischemic progressive gangrene of the left foot. Because no stump healing was noticed, vascular surgery (femurofibular bypass, v. saphena magna in situ) was performed. The postoperative stump care included a fenestrated weight bearing walking cast, Unna paste boots,

and local wound care. The stump healed; and 7 months from wound onset, the patient walked using a through-ankle prosthesis.

Case 2. Female, aged 77 years. Nonsmoker. Arteriosclerosis and neuropathy. Claudicatio and rest pain. Serious bilateral ischemia. In May 1986, vascular reconstruction of left leg (femurofibular bypass, v. saphena magna in situ). Two weeks later, treatment shoes. The heel was necrotic, and there were numerous small ulcers. By careful local treatment using fenestrated POP casts and Unna paste boots and treatment shoes, the ulcers healed, as the vascular reconstruction was successful. The fourth toe autoamputated. In July 1987, the patient used ordinary orthopedic shoes. The same month the patient sustained a left-sided trochanteric fracture. Postoperative, serious decubital ulcers developed on the right foot. In November 1987, vascular surgery of the right leg was performed (femurofibular bypass, v. saphena magna in situ) because of heel ulcers and more distal gangrenes. Successful reconstruction. In February 1988, the left leg and foot were painless and the right foot was healing.

Free vascularized flaps to the sole of the foot

A. Reigstad, K. R. Hetland, R. Sørensen and M. Røkkum

Kronprinsesse Märthas Institutt, Oslo, Norway

The sole of the foot is one of the most specialized areas of the body. For resurfacing the sole, a variety of techniques are available. These include split-skin grafting, local flap coverage, cross-leg flap coverage, and free microvascular transfer. However, some of these techniques suffer from the fact that there is no reinnervation: viz., the coverage may break down.

We have transferred five, free vascularized flaps to the sole of the foot in 4 male and 1 female patient in the period October 1985 to July 1987. The donor tissue, three scapular flaps and two lateral upper arm flaps, were transferred to an area with scar tissue in 2 cases, to a chronic ulcer in 1 case and to an acute laceration in 2 cases.

All the flaps revascularized and healed. Operative reduction of the flap was performed in 4 cases. In 1 case, minor skin problems were seen between the flap and the original skin. The two upper lateral arm flaps were performed as sensory flaps. They have both developed protective sensibility. The flap transfer had provided all 5 patients with stable skin coverage of the sole of the foot.

We find the upper lateral arm flap the most suitable flap for reconstructing the sole of the foot.

Total contact casting in diabetic foot ulcers: A study of predictive factors

Hannu Määttänen and Torsten Wredmark

Department of Orthopedics, Huddinge University Hospital, S-141 86 Huddinge, Sweden

The aim of this study was to identify prognostic factors for ulcer healing treated with a total contact plaster cast.

In a prospective study, 44 patients with 58 foot ulcers were treated with a plaster cast. Thirty-seven patients were insulin-dependent; they were younger (mean 53 years) and had a longer duration of their diabetes, 21 years, as compared with noninsulin-dependent patients, 73 and 14 years, respectively. The clinical parameters were correlated with the degree of healing by using a logistic regression analysis.

Thirty-two of the 58 wounds healed in 4 ± 3.5 months; 17 ulcers did not heal, and 9 patients were amputated. The following factors were correlated with healing: ulcer grade according to Wagner, ulcer area, and the calf-arm blood pressure index. Indices below 0.45 or above 1.40 were associated with low healing rates.

It is well known that a low blood pressure index is correlated with poor healing of diabetic foot ulcers. We found that also a *high* index is a negative prognostic factor: One possible explanation is the previously demonstrated anteriovenous shunting in diabetic patients with neuropathic foot ulcers. The study shows that it is possible to forecast the probability of wound healing in diabetic foot ulcers.

Immediate weight-bearing, total-contact walking casts in treatment of foot ulcers, distal gangrenes, or stumps after foot exarticulation

Anders Starkhammar

Department of Orthopedics, Central Hospital, S-601 82 Norrköping, Sweden

In the treatment of foot ulcers in diabetic, arteriosclerotic and/or neuropathic patients, the plaster of Paris cast provides excellent protection of soft tissues, control of edema, and support of the foot skeleton.

A total contact, full weight-bearing walking cast makes the patients mobile and active during the long healing time. Twenty-four hours unloading is recommended to avoid cast breakage. To minimize cast breakage and to allow immediate mobilization, the POP cast can be reinforced with laminating fiber glass tape – thus allowing full weight bearing after 30 minutes.

Fifty POP fiber-glass walking casts applied to foot ulcers, foot gangrenes, and stumps after foot exarticulation were evaluated; macroscopic cast deformation, new ulcers, and casting time were recorded.

There were no serious ulcers, no cast breakage, and no visible deformation due to immediate weight bearing. The need of ambulance transports or hospitalization was minimized.

In ambulant practice the reinforced cast is superior to the ordinary POP cast. The patient's comfort compensates for higher casting costs and more time-consuming cast removal.

Fibular mobility in patients with chronic lateral instability of the ankle

Richard Löfvenberg, Johan Kärrholm, Olof Ahlgren and Göran Selvik[1]

Department of Orthopedics, University Hospital, S-901 85 Umeå, and Department of Anatomy[1], University of Lund, S-221 85 Lund, Sweden

The fibular mobility in patients with chronic lateral instability of the ankle (CLI) has not previously been reported. We evaluated the movements of the fibula during adduction of the foot and during posterior loading of the tibia using the distal tibia as a fixed reference segment.

Twenty-nine patients with CLI of the ankle were investigated using roentgen stereophotogrammetric analysis. With the patients in the supine position, 54 ankles were examined during posterior loading of the tibia at 40 N and 160 N and during manual adduction of the foot. Ankles without symptoms (15), with unilateral (15), and bilateral symptoms were compared.

Small fibular rotations and translations were noted in all the groups. The mean internal rotation was 1.5° during posterior loading at 160 N. During the adduction test, a medial translation up to 1.1 mm was recorded in left ankles with bilateral symptoms. No significant difference was observed.

There is no significant difference in fibular mobility in ankles with or without CLI during the adduction and anterior drawer tests of the ankle.

The kinematics of the fibula during various movements of the foot

Ola K. Svensson[1], Arne Lundberg[2], Gert Walheim[3] and Göran Selvik[4]

Departments of Anatomy[1], Karolinska Institute, Stockholm, and University of Lund[4], Lund, and Departments of Orthopedics, Karolinska Hospital[2] and Sabbatsberg Hospital[3], Stockholm, Sweden

In 8 healthy volunteers the angular and translatory motions of the fibula in relation to the tibia were investigated by roentgen stereophotogrammetry. Tantalum markers (0.8 mm) were introduced into the tibia and fibula of the right leg. Examinations were performed with full body load in 10° increments of plantar flexion/dorsiflexion and pronation/supination of the foot. The reproducibility was tested on 1 subject and was found to be good.

From 30° of plantar flexion to 30° of dorsiflexion, the average widening of the ankle mortise was 1.04 mm. Totally, 72 percent of the width increase occurred in the plantar flexion part of the arc. The upwards/downwards displacement of the fibula in no case exceeded 0.1 mm. The outward/inward rotation of the fibula and movements resulting from input pronation/supination of the foot were small.

The present study supports the view that during fixation of the syndesmosis in ankle surgery, a plantar-flexed position of the foot should be avoided to decrease the risk of restriction of postoperative movement.

Proximal closing wedge osteotomy and adductor tenotomy for treatment of hallux valgus

Sylvia Resch, Anders Stenström and Niels Egund[1]

Lund University Hospital Departments of Orthopedics and Diagnostic Radiology[1], S-221 85 Lund, Sweden

Distal osteotomies of the first metatarsal are recommended primarily for moderate hallux valgus. For correction of larger intermetatarsal angles, proximal osteotomy might be needed, but there are few descriptions of such methods in the literature.

Twenty-five patients (27 feet) with moderate to severe hallux valgus and no arthrosis were reviewed 1–2 years postoperatively with a proximal closing wedge osteotomy of the first metatarsal combined with an adductor tenotomy. A clinical evaluation of appearance, mobility, and patient satisfaction with regard to pain was made. Preoperative and postoperative radiographs were compared, and changes in intermetatarsal and hallux valgus angles were recorded.

Twenty-three patients (25 of 27 feet) were satisfied with the operation. Radiographic measurements showed that the correction resulted in a narrowing of the forefoot rather than a large change in the intermetatarsal angle, which we expected. Radiographic measurements can be misleading, depending on how the axes are drawn. All the patients classed as dissatisfied or satisfied with reservation had metatarsalgia under the second metatarsal head due to dorsal shift in the osteotomy. Pin inflammation and incisional neuromas were also complications. The recovery period was long (11 weeks).

Correction of hallux valgus with metatarsus primus varus by use of a proximal osteotomy and a soft-tissue procedure gives very satisfactory results with regard to bunion pain in the large majority of patients. Nonetheless, a significant number of complications, of which metatarsalgia is the most important, occur. It is questionable whether the risk of these complications motivates the use of this procedure until it has been proven to be superior to more standard distal osteotomies.

Results of chevron osteotomy for hallux valgus

Håkan Dettmar, Björn M. Persson, Leif Stigsson and Hans Wingstrand

Department of Orthopedics and Radiology, S-251 87 Helsingborg, Sweden

The chevron type of osteotomy was first described by Austin in 1962. In 1978, Johnson described a modified chevron os-

teotomy without tenotomy of the conjoint tendon, but with a 30 days' walking cast.

A consecutive series of 68 patients (85 feet) were examined with weight-bearing forefoot radiographs preoperatively and 6–12 months postoperatively. At these visits, they were classified as satisfied, dissatisfied, and doubtful. The average age of the patients was 56 (18–81) years, and 91 percent were women. Local anesthesia and a medial plaster slab for 3 weeks were used in most cases.

The hallux valgus angle was corrected from a mean of 33 to 21° and the primus varus angle was corrected from 13 to 9°. The mean shortening of the first metatarsal was 0.4 cm, and the forefoot skeletal breadth decreased from 9.3 to 8.9 cm. The lateral displacement of the head was 0.3 cm. In 10/85 patients, such a displacement was not seen on the follow-up radiographs.

There was no statistical correlation between deformity, correction obtained, and patient satisfaction. In all, 72 percent were satisfied and 12 were dissatisfied. We suggest that the V-osteotomy be directed towards the MTP-V joint to stabilize the displacement by some shortening.

The subjective results of 443 surgical procedures for hallux valgus

V. Harju and J.-E. Michelsson

Division of Surgery and Traumatology, Surgical Hospital, Helsinki University Central Hospital, Helsinki, Finland

Among the wide variety of surgical procedures available for treatment of hallux valgus deformity, no one procedure stands out clearly above the rest as best for a specific age group. Our study reviewed the results of 443 surgical procedures performed at our hospital between 1976 and 1985. The mean age at the time of surgery was 52 (18–77) years. The average length of follow-up was 70 (24–127) months. The surgical procedures assessed were the Keller procedure, 190 feet; distal metatarsal osteotomy (Corless type), 154 feet; the McBride procedure, 38 feet; and simple bunionectomy, 61 feet. Orthopedic surgeons performed 344 of the procedures. Additionally, the survey included 99 procedures implemented by surgical residents.

All the patients responded through questionnaires. The questionnaires and the data obtained from the medical records were compared. The statistical analysis applied both the Kruskal-Wallis test and the Mann-Whitney test using two-tail approximation.

The percentages of patients under 50 years of age experiencing good or satisfactory results with the procedures used were as follows: Keller 92, distal metatarsal osteotomy 92, McBride 77, and simple bunionectomy 71. For patients between 50 and 60 years of age, the percentages were Keller 92, distal metatarsal osteotomy 87, McBride 77, and simple bunionectomy 77. The percentages of patients over 60 years of age who experienced good or satisfactory results were Keller 91, distal metatarsal osteotomy 90, McBride 100, and simple bunionectomy 100. The sample of patients over 60 years of age treated with the McBride and simple bunionectomy were too small to draw conclusions.

The survey showed that the patients operated on by orthopedic surgeons experienced better results ($P < 0.01$) than those who received treatment from surgical residents.

Our study indicated that the Keller procedure and distal metatarsal osteotomy both produced good results for all age groups; however, the responses suggest that neither the McBride procedure nor simple bunionectomy should be used on patients under the age of 60 years.

Failed Keller procedure treated by elongation arthrodesis of the first MP joint

A. Reigstad and M. Røkkum

Kronprinsesse Märthas Institutt, Oslo, Norway

Keller described the excisional arthroplasty as treatment for hallux valgus in 1904, and the procedure has become popular. Although some authors have had exceptional rates of success, a number of reports on the limitations and failures of this procedure have been published. The most frequent complications are metatarsalgia, excessive shortening of the hallux, floppy toe, claw toe, and reduced motion of the IP joint. Only a few authors have reported using an MP arthrodesis to salvage a failed Keller procedure.

We have operated on 3 patients bilaterally who had a failed Keller procedure. Their complaints were metatarsalgia and a short floppy toe. A conventional arthrodesis of the MP joint would result in an unacceptable shortening of the hallux. To reestablish the length of the hallux, a 2–2.5-cm corticocancellous graft from the iliac crest was interposed. Two Kirschner wires were used to stabilize the fusion and the graft.

All six arthrodeses healed within 12 weeks, retaining the length of the graft. The pain-relieving effect of the arthrodesis was good in all the cases. We believe that increasing the length of the hallux, combined with an arthrodesis of the MP joint, may increase the capacity of the hallux to bear weight, and, thus, reducing lateral metatarsalgia.

Long-term results of ankle arthrodesis

Emmo J. Schaap, Jaap Huy and Alfons J. Tonino

Department of Orthopedics, De Wever Hospital, Heerlen, The Netherlands

Between 1965 and 1984, 44 ankle arthrodeses were performed in 43 patients with posttraumatic arthrosis or poliomyelitis. Twenty-eight of these patients (20 posttraumatic and 8 poliomyelitis cases) were followed for an average period of 10 years.

Twenty-four patients were satisfied. Poliomyelitis patients did better than those with posttraumatic lesions.

We conclude that the preoperative condition of the other foot joints influences the results of the ankle arthrodesis, but

that the arthrodesis itself does not cause degenerative changes in these other joints.

The incidence of ankle sprains in soccer

Jan Ekstrand and Hans Tropp

Sports Clinic, Department of Orthopedics, University Hospital, S-581 85 Linköping, Sweden

The relationship between exposure time and ankle sprains in soccer was investigated. Forty-one teams (639 players) from four male, senior soccer divisions at different skill levels (Divisions I–IV) were followed prospectively for 1 year.

The exposure to soccer and the number of injuries per player were higher in higher divisions, but the injury incidence, percentage of ankle injuries, and incidence of ankle injuries were the same at different levels of skill. Totally, 20 percent of all the injuries were ankle sprains, and the incidence varied between 1.7 and 2.0 ankle injuries per 1,000 hours of exposure.

Because players with previous ankle problems ran an increased risk of reinjury, we recommend that these players receive preventive advice.

The incidence of ankle sprains in orienteering

Jan Ekstrand, Harald Roos and Hans Tropp

Sports Clinic, Department of Orthopedics, University Hospital, S-581 85 Linköping, Sweden

This study investigated the relationship between exposure time and ankle sprains in competitive orienteering.

Totally, 16,000 competitors performed 77,369 races over 5 consecutive days in the Swedish O-ring 5-day event in 1987. The average exposure for each runner was 1.01 hours. All the injuries requiring medical advice were analyzed.

Of the 658 injuries, 137 (24 percent) were ankle sprains. The total incidence of all the injuries was 8.4 per 1,000 hours, and the incidence of ankle sprains was 1.8 per 1,000 hours.