BRITISH ORTHOPAEDIC FOOT SURGERY SOCIETY

Enfield, England - November 11, 1994

President: Mr D. Grace

The abstracts were prepared by Mr N.P.J. Geary. Correspondence should be addressed to him at BUPA Murrayfield Hospital, Holmwood Drive, Thingwall, Wirral, Merseyside, L61 1AU, England.

THE FUNCTION OF ARTIFICIAL FEET: A COMPARATIVE STUDY OF SACH SEATTLE AND JAIPUR FOOT

A.P. Ayra, A. Lees, L. Klenerman
(Department of Orthopaedics and Trauma Surgery, Royal Infirmary, Barrack Road, Dundee DD1 9ND, Scotland)

The prosthetic foot plays an important part in the performance of the artificial leg. There are many prosthetic feet available in the market. The Jaipur prosthetic foot, which is made of rubber and wood is widely used in India and several other developing countries. It was developed in India in response to specific socio-cultural needs of the Indian amputees. Its claim of a cheaper and satisfactory alternative to other prosthetic feet has not been investigated. The present study was undertaken to compare its biomechanical properties with that of SACH and Seattle foot, as reflected in the ground reaction forces.

Three trans-tibial (below knee) amputees participated in the experiment. They walked on a Kistler force plate which measured the ground reaction forces generated with each prosthesis. Data from the normal foot were used as a control. Six variables of ground reaction forces were quantified. They included impact peak, impact load rate, vertical impulse and drive off peak from the vertical component; braking impulse and drive off impulse from antero-posterior component of ground reaction forces. The true impact force peak identified here has not been measured before.

Statistical analysis of data showed that normal gait in an unilateral amputee is an asymmetrical one having below normal acceleration and deceleration on prosthetic side. The SACH foot was found to have better shock absorption capacity as compared to Seattle and Jaipur foot. There was no significant difference in the drive off capabilities of three feet. It was also revealed that the Jaipur foot has a more natural and nearer to normal performance leading to a more secure and confident walking style, as compared to SACH and Seattle foot.

THE APPLIED USE OF BIOMECHANICS AND REHABILITATION IN FOOT ASSESSMENT

R.J. Abboud, D.I. Rowley
(Orthopaedic & Trauma Surgery, Dundee Royal Infirmary, University Department, Dundee DD1 9ND, Scotland, UK)

Over the last six years, we have managed to establish a successful biomechanical foot assessment laboratory to measure pressure distribution beneath the plantar surface of the foot in relationship to muscle activity. This helped us in a better understanding of the foot and its related problems which either complemented or corrected clinicians' findings.

A portable electromyographic measurement system (EMG) has been synchronised with a sixteen channel piezo-electric inshoe pressure measurement system called Gaitscan. The resulting system provides six channels of EMG and sixteen channels of foot pressure. This system has been used to study relationships between the activity of five muscles of the lower limb (gastrocnemius, soleus, anterior tibialis, peroneus longus and brevis) and foot pressure beneath the eight loading points of the plantar surface of the foot. Barefoot contact pressures have also been assessed using a Dynamic Pedobarograph, for comparison with the inshoe measurements. Inshoe pressure was found to be higher than barefoot pressures by 2 $Kg/cm^2 \pm 0.5\ Kg/cm^2$.

The resulting system is being used in three different applications firstly in clinical research, secondly in conservative clinical treatments, i.e. insole (orthosis) design and finally in rehabilitation of all sort of foot pathologies in clinics as well as pre-operative and post-operative cases.

Normal subjects have been assessed to build up a control reference group with which to assess and compare results obtained from pathological studies. One important group has been considered which is diabetes with and without peripheral neuropathy. In some diabetics the period of peak contact pressure was greater than in normal. In those dorsiflexor muscles normally contracting eccentrically at heel strike, there is a measurable delay in contraction in clinically overt neuropathies when compared to a normal population. The delay was related to the degree of neuropathy and ranges from 50 to 200 milliseconds. An insole design is under investigation to control such a delay which is hoping to produce a better pressure distribution and avoid plantar ulceration.

A new matrix shoe pressure measurement consisting of thirty-two transducers per individual insole has been designed and is to be used in conjuction with the above system.

In this paper, we would like to present our novel measurement system and the usefulness of such measurements in clinical applications.

Future work is concentrating on a new 3-D goniometry system (funded by the Scottish and Health Department) which we hope to integrate to the above system as well as a foot project for improvement of insole design (funded by Scholl Plc, UK branch).

PRESSURE TRANSDUCER POSITION UNDER THE WEIGHT-BEARING FOOT

P. Laing, M. Patterson, L. Klenerman
(University Department of Orthopaedics, Royal Liverpool Hospital, Liverpool L69 3BX. UK)

Many studies have attempted to identify pressures under the metatarsal heads by placing transducers or markers on the plantar surface of the foot and then walking the subject. Such studies have often produced widely differing results and sometimes unexpected ones. Papers infrequently describe exactly how the position of the metatarsal heads was determined or, if they do, usually state that the heads were palpated and the transducers/markers taped in place. What is evident, although rarely stated, is that the palpation is done with the foot in a non weight-bearing position. However, it is known that the foot elongates in a weight-bearing position and that the site of maximum pressure may be distal to the expected position. In order to determine the accuracy of this standard method, and improve upon it, we constructed a standing platform with a perspex top and an oval hole cut in it to allow palpation of each metatarsal head in a weight-bearing position. 5 male and 5 female adult volunteers with normal feet were studied by marking the position of the metatarsal heads of one foot in the non weight-bearing position, and the position of the metatarsal heads of the other foot using the weight-bearing platform. Metal washers were then attached to the feet in the marked positions and weight-bearing x-rays taken in a standard repetitive manner. Statistically significant results showed that the metatarsal heads consistenly moved distally and laterally (up to 2 cm) on weight-bearing, with the greatest movement occurring in the 2nd-4th metatarsal heads. Transducers applied to the foot by palpating the metatarsal heads in a non weight-bearing position would rarely be measuring near their intended site. Consistent accurate placement of a transducer can, however, be obtained by palpating the foot in a weight-bearing position. In conclusion, we recommend using a weight-bearing platform if accurate transducer replacement is required.

THE CONTROL OF THE WEIGHT-BEARING FOOT BY ITS MULTI-SEGMENTAL TIE-BAR SYSTEM

G.D. Stainsby, J.S.G. Miller, C.E. Harkness
(9 Meadow Court, Darras Hall, Ponteland, Newcastle upon Tyne NE20 9RA. UK)

The biomechanics of the foot and the control of foot posture during the weight-bearing phase of walking have been studied.

The foot skeleton rests on a multi-segmental tie-bar system. The transverse tie-bar is formed by the plantar plates and deep transverse metatarsal ligaments. The plantar fascia forms the longitudinal tie-bars.

Anatomical, radiological and clinical investigations have confirmed that when full weight with full foot contact the foot skeleton acts as a 'beam mechanism' but is also supported by the plantar fascia as an 'arch mechanism' as described by Hicks in 1955.

It has been found that when fully weight-bearing and there is full foot contact, the mid-foot pronates and also angles inwards. When the mid-foot supinates during push-off, lateral angulation occurs at the talo-navicular and calcaneo-cuboid joints. Lateral angulation at the calcaneo-cuboid joint causes a tongue projection on the medial side of the cuboid to 'lock' into a groove on the distal articular surface of the calcaneum. This allows the joint to remain stable in late push-off when the 4th and 5th metatarsals are no longer on the ground.

When the mid-foot supinates and angles laterally the talus rotates outwards so that its axis comes to lie between the 1st and 2nd metatarsals.

During push-off tibialis posterior helps to support the talus and supinate the mid-foot. Peroneus longus can keep the forefoot pronated and assist inversion of the heel when the foot moves into equinus as it loops around the lateral border of the os calcis and pushes it medially.

It can therefore be suggested that during the weight-bearing period the posture is controlled as follows:

a) Full Foot Contact. As a result of weight-bearing the arch flattens until the plantar fascia tightens as the toes flex down against the ground (the 'reversed' windlass mechanism). The hind-foot and mid-foot pronate and the talo-navicular and calcaneo-cuboid joints angle inwards until the 'spring' ligament tightens beneath the head of the talus.

The talus rotates medially. The long and short plantar ligaments tighten and the saddle shaped calcaneo-cuboid joint locks with compression. Weight-bearing is through the heel and forefoot and the foot is supported by both 'beam' and 'arch' mechanisms.

b) Early Push-off. All weight is now transferred to the forefoot and the foot is supported by the 'arch' mechanism. Until the heel is approximately 2 to 3 cm off the ground the posture of the foot is unchanged and the talus remains medially rotated.

c) Late Push-off. The plantar fascia effectively shortens as the toes dorsiflex and the medial arch rises. The hind-foot and mid-foot supinate and the heel inverts, the mid-foot angulates laterally and the tongue mechanism of the calcaneo-cuboid joint stabilises the mid-foot. The talus rotates laterally and weight-transference is now directly down the medial border of the foot to the medial three metatarsals. Activity of tibialis posterior and peroneus longus helps stabilise the mid-foot by keeping it supinated and laterally angulated.

It is therefore suggested that normal function of the windlass mechanism of the plantar fascia and the tie-bar system is an essential part of the control mechanism of the weight-bearing foot.

RETROSPECTIVE STUDY OF COMPARISON BETWEEN DORSAL AND PLANTAR APPROACH FOR MORTON' S NEUROMA

M. Nashi, B. Muddu
(Orthopaedic Department, Tameside General Hospital, Ashton-Under-Lyne. OL6 9YZ. UK)

5 Morton' s neuromas in 52 patients were studied in 2 groups, 26 in the dorsal approach and 26 in the plantar approach between 1986 and 1993 with an average follow up period of 3.1 years after surgical excision of neuroma.

All the excised neuromas were carried out under general anaesthesia with a tourniquet by standard procedure.

All the excised neuromas were sent for histology. 51 were confirmed as Morton' s neuroma, 1 as adipose tissue and 3 as normal digital nerve. Each group was compared with regard to age, sex, duration of symptoms and follow up period. Associated deformities were mainly flat foot (13%), hammer/curly toes (12%) and hallux valgus (10%). The results were assessed according to hospital stay time taken to start full weight-bearing, time taken to return to work, and activity, complications and the patient' s own assessment.

The results show that the dorsal group patients bear weight early (mean of 16 days in the dorsal group and 23 days in the plantar group), return to work and sporting activities early (mean of 22 days in the dorsal group and 37 days in the plantar group), duration of stay in hospital is less (mean of 3 days for the dorsal group and 3.5 for the plantar). There were 5 painful scars in the plantar group and 2 in the dorsal group. Recurrence of neuroma was 1 in each group.

With regard to the patient' s satisfaction, 80% of patients were rated as good/satisfied in the dorsal group compared to 65% in the plantar group.

Our conclusion is in favour of the dorsal approach because of shorter inpatient period, earlier weight-bearing, shorter time taken to return to work, less painful scars and more patient satisfaction.

CORRECTION OF HALLUX ABDUCTUS VALGUS BY MITCHELL' S METATARSAL OSTEOTOMY COMPARING STANDARD FIXATION METHODS WITH ABSORBABLE POLDIOXANONE PINS

T.D. Prior, D.L. Grace, P.W. Allen, J. Maclean, P.G. Chapman, A. Day
(Department of Chiropody and Podiatric Medicine, St Leonards Primary Care Centre, Nuttall Street, London N1 5LZ)

Thirty-nine Mitchell' s first metatarsal osteotomies were performed in twenty-eight individuals with Hallux Abductus Valgus at two centres. Following informed patient consent each foot was randomised at time of surgery to one of two fixation methods. Seventeen osteotomies were stabilised with standard fixation (Vicryl bone suture or K-wire) and twenty-two were fixated with absorbable poldioxanone pins (Johnson & Johnson, Bracknell, UK). Patients were assessed pre-operatively and at 3, 6 and 12 months post-operatively. Clnical evaluation was undertaken by an independent assessor unaware of the fixation method with radiographic assessment performed by the consultant. On review, one patient (one foot) that received absorbable fixation was lost to follow up and another was last seen four months post-operatively. Average follow up was 10.7 months (4-24 months). There was no statistical difference between the two groups in terms of age or weight. Statistical analysis by Mann-Whitney U test revealed no significant difference between the treatment and control groups for 1st metatarso-phalangeal joint (MTPJ) range of motion, hallux valgus angle, intermetatarsal angle, hallux rotation and first to second metatarsal length ratio both pre-operatively and post-operatively. Analysis of the patients combined by signed rank test revealed no significant change in the 1st MTPJ range of motion but there was a significant reduction in the hallux valgus angle, inter-metatarsal angle, hallux rotation and 1st:2nd metatarsal ratio following surgery. There was no evidence of foreign body reaction, persistent or increased pin tract lucency or sinus formation in any patients receiving absorbable fixation. One foot required removal of the K-wire fixation. In conclusion, absorbable poldioxanone pins present no additional complications to those associated with standard fixation methods and avoids the possible need for a second procedure to remove metalwork.

COMPARISON STUDY OF TWO METHODS OF FUSION OF THE FIRST METATARSO-PHALANGEAL JOINT

M. Hatton, G. Zafiropoulos, A.P.J. Henry
(Derbyshire Royal Infirmary, London Road, Derby. DE1 2QY. UK)

In this paper the clinical and radiological results of two methods of arthrodesis of the first metatarso-phalangeal (MTP) joint are compared in the treatment of hallux rigidus.

A retrospective review was made of 121 patients who underwent fusion of the 1st MTP joint in 164 feet, for hallux rigidus. Two methods were used for fixation: the Ross-Smith crossed wire loops and the cancellous compression screw. 95 feet underwent fixation of their fusion with cancellous screw inserted across the joint (Group A). 69 had crossed wire loops by the Ross-Smith technique (Group B).

Assessment was made of pain, comfort of footwear and ability to walk and if necessary would they undergo the same procedure. Radiographs assessed completion of union and the angle of fusion.

Of the 95 feet in Group A, 74 were pain free after the initial operation, 20 had residual pain and underwent a further procedure. As secondary procedures re-arthrodeses were carried out in 11 feet, because of mal-alignment of 5 feet and non-union in 5 feet. 9 feet had to have the painful screw removed.

Of the 69 feet in Group B, 66 were pain free after the initial operation and 3 had pain. All 3 patients underwent a further fusion. Re-arthrodeses were undertaken because of unsatisfactory position in 1 foot and non-union in 2 feet. After the 2nd operation, all 3 feet were pain free. None of the groups with wire fixation had problems with metalwork.

In conclusion, screw fusion gave a 10% re-operation rate due to prominence of the screw head. Crossed wire loops had a lower rate of re-operation, and lower rate of mal-union. Crossed wire loops provide a useful alternative to screw fusion, especially if there is malposition or fracture into the screw hole.

THE HELAL INTERPOSITIONAL ARTHROPLASTY - 4.5 YEAR REVIEW

A.P. Phillipson, F.P. Monsell, B.G. Bolton-Maggs
(Whiston Hospital, Prescot, Merseyside. UK)

The use of a silicone elastomer prosthesis for interpositional arthroplasty in the treatment of first metatarso-phalangeal joint osteoarthrosis has a number of theoretical advantages and has been widely reported. This study reports the results of a group of 13 patients (18 implants) who underwent the procedure described by Helal and Chen and were assessed sequentially at a mean time of 1.5 and 4.5 years following surgery.

Pain, stiffness and cosmetic acceptability were all assessed. Power, range of movement, and orientation of the great toe were also measured. Pain, which was the indication for surgery, was considered to be the most important factor in judging success. The patients subjective opinions were also noted.

Initial follow up was performed at a mean of 1.5 years post-operatively, and 62% (13/21) of cases had no or mild pain. This was considered comparable to other treatment options. However, when reviewed at 4.5 years, the proportion of patients with no or mild pain had fallen to 39% (7/18). Furthermore, 28% (5/18) had moderate or severe pain and were judged as poor results. More significantly, 33% (6/18) had had the implants removed for pain. This gives an overall failure rate of 61% (11/18). The cosmetic appearance was acceptable to most subjects, as was the function of the first ray as estimated by the movement of the first metatarso-phalangeal joint and the power of the flexors and extensor of the great toe.

In conclusion, this significant failure rate leads us to question the use of silicone implants in this situation and the initial optimism associated with the early results has not been sustained. Despite the retrospective nature of the study and small numbers we suggest that other more predictable and well established procedures may be more appropriate in the management of this condition.

SWANSON DOUBLE STEMMED SILASTIC ARTHROPLASTY OF THE FIRST MTPJ

R.R. Shah, D.L. Grace
(Highlands Hospital, Winchmore Hill, London. UK)

49 patients who have undergone this procedure since May 1988 on one orthopaedic firm at Chase Farm and Highlands Hospitals were retrospectively reviewed as part of this study. Of these 8 patients were not available for follow up due to various reasons. Of the remaining 14 patients had bilateral procedures, giving a total of 41 patients with 55 procedures for evaluation. There were 37 females, 4 males in this study. The age range was from 25 to 74 years with a mean of 57.5 years. The duration of follow up was from 12 to 66 months, with a mean of 35.3 months. There were 16 patients - 23 with hallux valgus, 18 patients - 20 feet with hallux rigidus, 4 patients - 8 feet with rheumatoid arthritis, and 4 patients - 4 feet with revision procedures.

All the patients were evaluated using a specially designed form which measured the functional, clinical and radiological outcome. The hallux valgus group showed 87% excellent and good result, 3.5% fair and 9.5% poor result. The hallux rigidus group showed 95% excellent to good result, and 5% poor result. Overall in the study there were only 4 failures, one due to silastic synovitis which needed removal 24 months after surgery, one patient developed reflex sympathetic dystrophy on both feet after simultaneous surgery, and one patient remained generally unhappy with the outcome. There were no deep infections. Interestingly, 15 feet in the hallux valgus group had recurrence of rotational deformity, though it did not affect the final outcome.

From the initial results this procedure in the medium term provides excellent pain relief, improves walking distance and has a high patient satisfaction. Also, importantly, it has a high degree of predictability in view of the fact that the surgery was performed by seven different surgeons of various ranks. It remains to be seen whether the recurrence of rotation will compromise the long term outcome.

FOOTBALLERS ANKLE: THE ROLE OF POSTERIOR IMPINGEMENT

N.J. Donnachie, M.E. Lovell, P.K.M. Rostron
(69 Beech View Road, Kingsley, Nr Frodsham, Cheshire WA6 8DG)

A review of 447 separate injuries or clinical conditions affecting 147 professional rugby players over a six year period was performed.

Fifty concerned the foot and ankle with a significant number of ankle lesions affecting the talus.

Six players attended with increasing pain in their foot and ankle after training or play. They had evidence of footballers ankle. A further four players had evidence of anterior impingement but this was not their major reason

for referral. All ten players had anterior tibial osteophytes or beaking. Four players had large anterior talar osteophytes, six had large posterior osteophytes, another player had fractured a large posterior osteophyte. Often the talar appearances looked more significant than the anterior tibial osteophyte. There was calcification present at six medial malleoli and four lateral. There was no gross loss of joint space. A review of the literature would suggest that our series is atypical because of the associated abnormalities. This may be due to the rigors of the particular sport. We feel posterior impingement is also of importance.

Other problems in our group included one case of talar osteochondritis dissecans. Fourteen fractures were present. There were fifteen severe lateral ligamentous injuries, two resulted in instability with demonstrable talar tilts.

There was no excess of any injuries in any particular player position.

We feel many of these injuries could be prevented by strapping and this should be encouraged.

DELTOID LIGAMENT FORCES FOLLOWING TIBIALIS POSTERIOR TENDON RUPTURE: THE EFFECTS OF TRIPLE ARTHRODESIS AND CALCANEAL DISPLACEMENT OSTEOTOMIES

R.B. Resnick, M.H. Jahss, J. Choueka, F. Kummer, J.C. Hersch
(38 East 85th Street, New York, N.Y. 10028. USA)

Progressive peritalar subluxation following triple arthrodesis for advanced ruptures of the tibialis posterior tendon (TP) prompted our investigation of the forces on the deltoid ligament.

Using a rosette strain gauge at the origin of the deltoid, six fresh frozen below knee amputation specimens were progressively axially loaded simulating the following clinical conditions: (1) controls: using a tensioned TP simulating a normal tendon; (2) untensioning the TP: simulating rupture of the TP; this doubled the deltoid forces; (3) unloaded TP, plus triple arthrodesis with fixation: this brought the deltoid forces back to normal; (4) unloaded TP plus triple arthrodesis plus a 0.5cm lateral displacement calcaneal osteotomy: this clinically simulated a late stage valgus foot with peritalar subluxation. The deltoid forces were now 97% greater than with the intact TP tendon; (5) the calcaneus was then shifted 0.5cm medially: the deltoid forces were now 61% less than with the ruptured tendon.

The experiment suggests that while a triple arthrodesis for rupture of the TP is effective in non displaced subtalar joints, it may aggravate a laterally displaced foot. Conversely, a triple arthrodesis with medial displacement calcaneal osteotomy stabilises any subtalar subluxation and restores the normal integrity of the deltoid forces.

ANKLE JOINT DESTRUCTION IN R.A.: PROBLEMS - NEW ASPECTS

K. Tillmann
(Postfach 1448, 24572 Bad Bramstedt, FRG)

Ankle joint arthrodesis is considered to be the method of choice for the treatment of inflammatory destructions. Nevertheless, it may cause considerable problems, e.g. in case of bilateral involvement and of simultaneous functional disorders, especially instability of the knee joint. Moreover, the post-operative treatment is burdened by the need of longstanding external fixation, even using screws and staple.

In 1976 we started with endoprosthetic replacement. Precondition is an acceptable position of the hindfoot and a sufficient bone stock.

Having tried different designs, we ended up with the T.P.R. endoprosthesis consisting from a metal talus and a tibial polyethylene component, both cemented.

The mid-term results of 35 prostheses gave satisfying results regarding pain relief. The ROM was reduced from 45° pre-op to 25° post-op clinically.

The rate of radiolucency of various degree amounted to 51%, but the revision rate of 67 cemented ankle-endoprostheses after 9.1 years was 12%.

In spite of a very positive assessment of the patients we changed our concept in favour of two different uncemented endoprostheses, both of the following the GOODFELLOW-knee-principle at the ankle: the 'New Jersey' , and the 'S.T.A.R.' prosthesis. In the last three years we inserted 55 uncemented implants (32 'New Jersey', 23 'S.T.A.R.'). Two of them in one patient subsided, the others function very well. In an early follow up of our first 19 implantations pain relief was also excellent. Post-operative mobility seems to be somewhat better compared to cemented prosthesis (ROM 40° pre-op., 30° post-op).

In three joints an exchange of a loosened cemented T.P.R. prosthesis against a special uncemented New Jersey implant has been performed successfully.

A REVIEW OF PODAL COMPLICATIONS IN HAEMOPHILIA

M. Heim, H. Horoszowski, S. Shulman, D. Varon, U. Martinowitz
(Israel National Haemophilia Centre)

Almost 97% of bleeding incidences in the haemophiliac occur within the musculo-skeletal system. About 80% of these bleed occur within the joints. The major articulations affected are the knees, elbows and ankles respectively. A great paradox with this coagulation disorder is that despite the fact that the hands and feet are in constant motion and recurrently traumatized, the incidence of haemorrhage are indeed very low. How then are the feet involved in haemophilia? Recurrent haemarthroses in the ankle joint causes synovial hypertrophy and a chronic synovitis of the joint develops. The hyperaemic, hyperplastic synovium secretes proteolytic enzymes which eventually destroy the articular cartilage and at a very early age haemophiliacs may suffer from the most severe arthritis of the ankle joint. Subchondral cyst formation may damage the bones and growth plates and their evacuation and irradication is described. A number of cases of post-traumatic haemorrhage are demonstrated; subungual haematomas and oozing haematoma collections post lacerations highlight the mechanisms whereby the fibrinolytic system is stimulated and persistent clot lysis takes place. Haemorrhage within the fascial envelopes of the shin may result in raised intercompartmental pressure and result in neural as well as possible vascular catastrophies. Pseudotumours are a rare complication of haemophilia and a case study is presented wherein total foot destruction is demonstrated in addition to a second lesion in the proximal tibia. A transfemoral amputation was carried out and the difficulties of prosthetic fitting and gait training described.

Although the natural pathogenesis of the disorder affects 2 of the 3 major articulations of the lower limb, and hence disturbs the normal gait pattern, the foot tends to remain anatomically and physiologically intact.

INCISIONS AROUND THE HALLUX

D.A. Campbell
(Department of Orthopaedic Surgery, St James' University Hospital, Beckett Street, Leeds, UK)

A previous retrospective study of 51 patients (75 feet) undergoing surgery on the hallux has shown that sensory nerve damage occurred in 34 feet (45%). The mean follow up of this group was four years (Range 1 to 8 years).

A reliable surface marking and incision to avoid the superficial sensory nerves was described following cadaveric dissection.

If a line is drawn along the long axis of the hallux, beginning at the medial corner of the nail and ending over the metatarso-phalangeal joint, then the terminal sensory branch of the medial division of the superficial peroneal nerve lies, on average, 5 mm (S.D. ± 1 mm) on the lateral side of this marking. It is recommended that the incision should be no more lateral than this marking, but should preferably lie on the medial aspect of the marking.

This present study has been designed to test the recommended incision prospectively.

34 patients (50 feet) underwent surgery employing the modified incision. The mean follow up was 3.2 months (Range 2 to 8 months). Ten feet (20%) showed evidence of sensory nerve damage after testing sensation to pinprick.

Statistical analysis has shown that this is a significant reduction in the incidence of nerve damage. ($p = < 0.005$).

The shorter follow up period (mean 3.2 months) may actually over estimate the incidence of nerve injury, since it is possible that there were some recovering neuropraxias in this group.

It is concluded that the described incision can reduce nerve damage by half, although accurate per-operative visualisation and preservation of the nerve may help to reduce the incidence of nerve injury still further.

This is an easily learnt and cost effective way to further improve the results of hallux surgery.

CLINICAL APPLICATION OF ANKLE AND HINDFOOT MAGNETIC RESONANCE IMAGING

A.M. Wainwright, A.J. Kelly, D. Glew, A.E. Mitchelmore, I.G. Winson
(Avon Orthopaedic Centre and Bristol MRI Centre)

Introduction: Magnetic Resonance Imaging (M.R.I.) of the ankle and hindfoot has been described for the assessment of many conditions, but the usefulness of this investigation in clinical practice has not been shown.

Methods: We reviewed the first cohort of patients who had been investigated with ankle and hindfoot M.R.I. In a year of clinical practice there were 39 patients, with an average age of 32 years (range 9 - 79), half were male.

Results: The commonest indication for M.R.I. scan was to investigate recurrent giving way. These scans allowed confirmation and assessment of the severity of pathology and revealed unsuspected pathologies including avascular necrosis.

Next, equal numbers of scans were requested for assessment of tibialis posterior pathology, articular surface lesions and suspected intra-articular loose bodies. Scans assessing tibialis posterior differentiated between pathologies of the tendon, facilitating treatment protocols. In general M.R.I. was not the most useful investigation for articular surface lesions or suspected loose bodies.

Other uses for M.R.I. scans were the differentiation of fibrous and osseous union, and the assessment of lateral impingement.

Conclusion and Discussion: In our clinical practice M.R.I. has a role investigation of hindfoot pathology, especially in patients with a history of recurrent giving way or soft tissue pathology. M.R.I. was not necessarily the best method of investigation of suspected loose bodies or articular surface pathology. Future work is planned to evaluate this further.

IS SYMPATHETIC NERVE FAILURE THE CAUSE OF CHARCOT ARTHROPATHY?

C.E. Bruce, C. Haggett, P. Laing, L. Klenerman
(University Department of Orthopaedics, Royal Liverpool Hospital, Liverpool L69 3BX. UK)

It is not clear why up to 50% of diabetics become neuropathic but less than 1% ever develop an overt Charcot joint. We suggest that sympathetic nerve failure may play a significant role in the pathogenesis of Charcot arthropathy.

Our aim was to investigate whether a particular pattern of denervation existed in neuropathic diabetics with Charcot arthropathy but not in other neuropathic diabetics. We studied 6 diabetics with Charcot arthropathy (59.3 yrs (49-67), 6 with neuropathic plantar ulceration (58 yrs (45-72) and 6 who had no evidence of sensory neuropathy (63.3 yrs (57-70).

Cardiovascular autonomic function tests and bilateral quantitative sensory assessment of the feet were all abnormal in both the Charcot and the ulcer groups with no differences between the two groups.

The peripheral vasoconstrictor response to central cooling was indirectly assessed bilaterally, by measuring skin blood flow at the pulp of each great toe by laser Doppler flowmetry and by measuring the skin temperature in the first plantar webspace with a thermistor. The subject was cooled by a water blanket wrapped around the trunk, until there was sustained involuntary shivering.

In response, the mean peripheral blood flow in the non neuropathic, the ulcer and Charcot groups fell by 144.8 (-17.6 to 0372.6), 45.5 (+31.8 to -86.2) and 0.96 (+117.3 to -31.8) flux units respectively. There was a mean fall in peripheral temperature in the non neuropathic and the ulcer groups of 4.05°C (-0.6 to -6.9) and 0.83°C (1.9 to -3.1) respectively, but a mean increase of 0.78°C (+3.3 to -1) in the Charcot group.

The observed differences in response between the non neuropathic and the ulcer groups were statistically sig-

nificant ($p<0.003$) but not for temperature ($p<0.072$). The difference between the Charcot and the ulcer groups were statistically significant for both reduction in blood flow ($p<0.009$) and reduction in temperature ($p<0.001$).

In summary, patients with Charcot arthropathy are distinguished by their failure to peripherally vasoconstrict in response to central cooling. The loss of this response would suggest that sympathetic nerve failure and consequent haemodynamic disturbance, may play a pivotal role in the pathogenesis of Charcot arthropathy.

GP FUNDHOLDING OPERATIONS OF THE FOOT: ANOMALIES AND MISCONCEPTIONS

P.D. Moynagh
(Orthopaedic Department, Chase Farm Hospital, The Ridgeway, Enfield, Middlesex EN2 8JL. UK)

The regulations and OPCS codes for those operations on the foot which NHS hospital providers can charge to General Practitioner Fundholders are not all what they seem. Variable factors include:

The method of original referral (not allowed if an emergency)
The pre-op diagnosis and planned surgery.
The anatomical part.
The actual operation performed.
The precise language used to describe it.
The relevant OPCS code.
The accuracy of coding.

The chargeable foot procedures and some pitfalls were described. Of the main coding groups from the common operations for hallux valgus for instance, the codes for osteotomy, excision arthroplasty (e.g. Keller's) and soft tissue correction (e.g. McBride) are chargeable, but those for arthrodesis, silastic interpositional arthroplasty and simple exostectomy (if coded strictly) are not. There are similar problems with the common operations for the lateral toes.

The accuracy and sophistication of the coding process can be important factors affecting whether a GPFH is billed. Some operations which are a combination of procedures, such as the Robert Jones operation for clawing of the hallux (IP joint fusion and tendon transfers) have specific OPCS codes which are not chargeable. But if described and coded by their separate parts, one of which (the fusion in this example) is a GPFH procedure, then it may incorrectly become chargeable.

Conditions with a choice of operations, some of which are chargeable and some not, might conciously or unconciously tempt a surgeon to perform an operation not best fitted to the patient, and the ethical implications were discussed.

Orthopaedic surgeons need a sophisticated and detailed understanding of these regulations and codes, especially if contracts which hospitals make with different Purchases mean that some patients have to wait longer than others. A full list of the relevant codes with comments on their application is available from the author.