BRITISH ORTHOPAEDIC FOOT SURGERY SOCIETY

Glasgow, UK - November 10, 1995

Chairman: Mr Eric G. Anderson

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A PROSPECTIVE STUDY OF MODIFIED SILVER'S MCBRIDE PROCEDURE FOR HALLUX VALGUS

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We prospectively reviewed the results for twenty seven feet (19 patients) in whom hallux valgus deformity had been corrected with modified Silver's McBride procedure, that is, excision of medial eminence, adductor hallucis release and its transfer to 1st metatarsal neck, medial capsular reefing and sesamoid alignment.

Patients were followed for seven months at least. The pre-operative hallux valgus angle averaged 32° (range 22° - 52°) and the post-operative angle measured 15° (range 2° - 30°). The pre-operative intermetatarsal angle averaged 15° (10° - 18°) and the post-operative angle 10° (6° - 17°). Pedobarographic measurements, pre-operative area of great toe averaged 7.3 cm^2 and the post-operative 8.8 cm^2 ($p < 0.05$). The total force of the foot pre-operatively, 822 Newtons and post-operatively 852 Newtons ($p < 0.05$). Pressure of total foot and great toe pre-operatively averaged 92 N/cm^2 and 63 N/cm^2 and post-operatively 78 N/cm^2 and 47 N/cm^2 respectively ($p < 0.05$).

Out of 27 feet 89% were completely satisfied with the result of the procedure. 11% were satisfied with minor reservations. The complications encountered were symptomatic hallux varus deformity in one foot and two residual hallux valgus deformity.

We have found significant correlation between clinical, radiological and pedobarographic assessments and there is also reduction in the incidence of hallux varus complication with the modified procedure as compared to other series.

MRI OF THE FOOT AND ANKLE

N. Raby (Western Infirmary, Glasgow, Scotland)

The variable combinations of foot position, scanning planes and imaging sequences make it essential that there is good communication between referring clinician and radiologist. MRI is best utilised to confirm or refute a specific clinical diagnosis. Regular joint review of images at a clinico-radiological is the best way to ensure that all concerned are optimising use of MRI scanning.

Achilles tendon abnormalities can be identified and tears classified as complete or partial. Achilles bursitis can also be diagnosed with a high degree of accuracy. Although less common, tears or partial tears of the peroneal tendons and the medial tendon group especially the posterior tibial tendon can also be demonstrated.

The medial and lateral ligament complex can be visualised but particular care must be taken to obtain very thin slices in multiple planes with the foot in either dorsiflexion or plantarflexion depending upon the ligament of interest. The use of recently available flexible coils facilitates such detailed imaging. Other diverse conditions such as sinus tarsi syndrome, plantar fasciitis and Morton's neuroma are amenable to MRI diagnosis.

MRI of the diabetic foot can be extremely valuable since it can distinguish between a superficial cellulite and deeper infections. The diagnosis of associated osteomyelitis can be made with MRI but it is important to note that an aseptic neuropathic joint will have similar appearances and caution is required if trying to distinguish between the two.

TIBIALIS POSTERIOR DYSFUNCTION IN CHILDHOOD

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Tibialis Posterior Dysfunction is well recognised as a cause of acquired flat foot deformity in adults. The patients are typically middle aged overweight ladies, sometimes with a history of diabetes and/or hypertension. Acquired mobile flat foot deformity in children due to Tibialis Posterior Dysfunction is usually associated with a history of a penetrating injury to the foot.

We would like to present an as yet unreported phenomenon in two children of 10 and 11 years of age, who presented to the Paediatric Orthopaedic Department with painful unilateral flat foot deformity, but with mobile hindfeet and swelling over the Tibialis Posterior Tendon. Both had an episode of inflammatory joint disease, the girl with a history of acute swelling of the knee 8 years before, and the boy with a knee effusion at the time of presentation. He also had a HLA B26 positive brother with a history of pauci-articular type J.C.A. They were extensively investigated and were found to be both HLA B27 positive after referral to the Rheumatology Clinic. As there was no response to non steroidal anti-inflammatory drugs and as their deformity was progressive, surgery was considered to be appropriate. At operation, the synovial covering of the tibialis posterior tendon was grossly inflamed but the tendon itself was intact and under normal tension.

Decompression and synovectomy was performed with a good result in one case, but recurrent deformity in the second, requiring an os calcis osteotomy. Historically, the tenosynovium showed chronic inflammatory changes only. Their HLA status suggests that the tendonitis can be considered to be yet another manifestation of B27 or enthesitis associated arthropathy.

HALLUX RIGIDUS: THE LONG TERM RESULTS OF DORSAL WEDGE OSTEOTOMY AND ARTHRODESIS IN ADULTS

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A variety of treatments are recommended for hallux rigidus. These include arthrodesis of the first metatarsophalangeal (MTP) joint and dorsal wedge osteotomy of the proximal phalanx. This latter operation was first described by Kessel and Bonney for use in adolescents. In their original paper they suggest that it may be used in adults. A retrospective review of a series of ten osteotomies and twenty arthrodeses after an average of twelve years for hallux rigidus in the adult was undertaken. Patients were assessed at a follow-up clinic and their foot pressures analysed using a Musgrave pressure plate system. Three anatomical sites were selected for analysis: the hallux, the first and fifth metatarsal heads. The duration of loading and the peak local load were compared between groups for each site.

Although the two groups were not strictly comparable, some conclusions could be drawn. Both operations were successful in terms of pain relief. In the osteotomy group two patients still had some pain. Following arthrodesis, four patients still had some pain. One patient was awaiting removal of the screw. Two other patients had transfer metatarsalagia following arthrodesis (none in the osteotomy group). There were more complications following arthrodesis: three wound infections and one delayed union. Callosities at the IP joint were more common after arthrodesis (11/20 in the arthrodesis group compared to 3/10 in the osteotomy group). The mean range of movement at the IP joint following arthrodesis was 42.5° compared to 29.5° in the osteotomy group. A greater duration of load occurred towards the fifth metatarsal following arthrodesis. A greater force occurred under the first metatarsal following an osteotomy rather than an arthrodesis.

It was concluded that dorsal wedge osteotomy of the proximal phalanx is a good alternative operation for hallux rigidus in the adult. If the osteotomy fails to relieve symptoms then an arthrodesis can be performed as a salvage procedure.

POST TRAUMATIC FOOT DISORDERS, SURGICAL SALVAGE, CUSTOM FOOT ORTHOSES AND FOOTWEAR AS A QUEST FOR A SOLUTION TO MINIMIZE DISABILITY

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Trauma to the foot changes the gait immediately without providing a chance for adaptation. The degree to which an acceptable functional result can be achieved is a matter of debate and a great deal of experience is required on the part of the surgeon to decide whether to save the foot or amputate it.

Two short case studies follow and some of the relevant post traumatic clinical problems are considered:-

Case 1. A young soldier in an armoured personnel carrier sustained extensive closed fractures of the hindfoot due to a landmine explosion. The feet were immobilised in a functional position until bony union could be ascertained. Movement was encouraged and impressions were made of the feet to attempt to construct suitable orthopaedic footwear. On one side an adequate solution was found with the use of a well constructed inlay. This permitted almost full weight-bearing. One the other side an orthopaedic shoe was insufficient and an orthotic PTB device had to be added to the shoe to permit free ambulation. The patient is quite happy with his footwear and is being followed in the outpatient service.

Case 2. A young baker got his left foot trapped, degloved and crushed by a dough rolling machine. He subsequently lost his hallux and intermediate phalanx of the second toe due to dry gangrene. The foot structure and therefore its function were altered as this surgically salvaged foot healed. The patient was walking with a limp and his foot fully supinated due to him not wanting to weight-bear on the medial aspect of his foot and also as a consequence of his first metatarsal head being rigidly plantarflexed. A full length forefoot valgus prescription leather

orthosis was dispensed to restore a normal midstance pattern to his gait. The orthosis is worn in normal footwear and can be changed from laced shoe to laced shoe. The patient is seen at intervals and no hyperkeratotic formation under the first metatarsal head is noted after a seven year period.

When a decision is made to attempt a salvage procedure one must bear in mind a number of basic guidelines:-

1. Reconstructive procedures are technically difficult, often infected and the rehabilitation period is protracted.
2. Tolerance of painful ambulation is generally very limited with resulting frustration and despair.
3. The availability of ideal foot orthosis materials which are durable, cosmetically and financially acceptable and biomechanically recommended are a previso in the consideration of lower limb salvage.
4. A large portion of the success or failure of the rehabilitation team depends on the shoe prescription, foot orthosis prescription, the skill and craftsmanship of the manufacturer. Without these artisans of the highest quality, failure may be eminent.

The best prosthesis in the world will not allow good ambulation on a bad stump, so the best surgical procedure of the multi traumatised foot will fail without the correct support within and without the shoe. In situations where a high level of craftsmanship is not available one should approach the question of salvage with guarded optimism.

POST OPERATIVE LOCAL ANAESTHESIA FOR CHEVRON OSTEOTOMY

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Forefoot surgery is painful. Recently local anaesthetic techniques have significantly reduced the level of pain experienced post operatively. These techniques have reduced side effects compared to the more traditionally used systemic opiates.

Purpose: This prospective double blind cohort study evaluates two modes of local anaesthetic administration for post operative pain.

Method: 16 patients underwent bilateral chevron osteotomies performed by a single surgeon. At the conclusion of the procedure 5-7.5 ml of Bupivacaine hydrochloride (Marcain Astra) were injected into each foot with a maximum delay of five minutes between each foot. The left foot had wound infiltration and the right foot a first metatarsal block.

Patients were assessed at 2, 6 and 24 hours post operatively using a visual analogue scale. Assessors and patients were both blinded as to the mode of local anaesthetic usage.

Result: There was no statistical difference between the two sides. (P Valve >0.05) regarding level of pain. No patients were totally pain free for all three time periods but four were totally pain free at one time period. Only 16 total morphine injections were required.

One patient developed a neuropraxia in the blocked foot which resolved after one month. No feet developed infection or delayed wound healing.

Conclusion: This trial has resulted in a change in clinical practice. The wound infiltration technique is quick, easy, safe and effective and is now preferred to the block technique.

Future: 19 further bilateral chevron osteotomies are planned and 10 of these will be used as controls. The paper will then be submitted for publication.

THE THOMAS METHOD FOR ANKLE ARTHRODESIS. 2 - 20 YEAR FOLLOW-UP

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The Thomas method for ankle arthrodesis involves resection of a segment of fibula above the ankle joint, followed by resection of the tibio-talar articular surfaces using curved gouges, to create matching curved cancellous bone surfaces, which are then apposed and stabilised using external compression. The purpose of this study was to evaluate the success of the technique and to determine the long term consequencces of ankle arthrodesis.

Forty-one patients had 44 ankle arthrodeses performed. Complete records were available for 33 procedures which was successful in 31 (94%). Twenty-one patients with 22 arthrodeses, for post-traumatic osteoarthritis (15), osteoarthritis (2) (1 patient), rheumatoid arthritis (4), and poliomyelitis (1) were available for review 2 to 20.5 years post operatively. The mean Mazur Score at review was 69/90, but it was noted to vary between diagnostic groups being 75 ± 7 in osteoarthritis (mean ± sd), 55 ± 6 in rheumatoid, and 27 in the patient with polio ($p < 0.001$).

The mean ankle position was 3° plantarflexion (range 0 - 9°). The hindfoot position was considered to be 5° varus in three patients and 5 - 10° valgus in two patients.

Eleven osteoarthritis patients were reviewed at 2 to 10 years. Their Mazur scores were 73 ± 6 and three had evidence of subtalar degenerative changes. Six patients were reviewed at 11 to 19 years. Their Mazur scores were 75 ± 8. One had evidence of subtalar degenerative changes and another had a subtalar fusion. Both of these patients had some malalignment of the heel. There was no evidence for a deterioration in function with time or for an increased incidence of subtalar changes, though heel malalignment may contribute to this.

The Thomas method provides a favourable environment for bony union, with maximal cancellous bone contact and stability, giving a high success rate. These factors may be relevant to the success of arthroscopic techniques. It also enables the surgeon to concentrate on correcting the hindfoot alignment and rotation as the foot can be positioned in the correct plantigrade position after bone resection.

UNION FOLLOWING HINDFOOT FUSIONS

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Thirty eight primary hindfoot fusions in thirty three patients were performed between August 1991 and December 1994. There were nineteen men. Twelve ankles were arthrodesed arthroscopically. Four went on to non-union, of which three were refused arthroscopically. Eleven triple arthrodeses were performed. Eight talonavicular joints were fused, one of which went on to non-union and was subsequently rearthrodesed. All seven subtalar arthrodeses united uneventfully. The deformity recurred following one triple, one subtalar and two talonavicular arthrodeses.

We assessed the influence of the age and weight of the patient, the method of fixation, the type of bone graft used (autograft or allograft) and the period of immobilisation on the incidence of non-union and recurrence of deformity following hindfoot fusions. Non-union was related to the weight of the patient and the period of immobilisation. Recurrence of deformity was related to the age of the patient.

THE CONSERVATIVE KELLER'S OPERATION FOR THE MANAGEMENT OF HALLUX RIGIDUS AND FREIBURG'S DISEASE

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A new technique was developed over the past five years aimed at preserving more of the proximal phalanx in excision arthroplasty for advanced hallux rigidus and Freiberg's disease. Maintained skeletal distraction for four weeks avoids the complication of impingement following minimal excision from the base of the proximal phalanx, while preserving toe length and functional range of movement of the MTP joint. Complications such as excessive shortening, hyperextension of the hallux and abnormal gait following conventional Keller's arthroplasty, or abolishing MTP joint movement with second OA changes in the IP joint following MTP joint fusion, or breakage of the silastic prosthesis and synovitis following silastic replacement could be avoided.

The operative technique is similar to the original Keller's procedure but excising only 2-3 mms from the base of the proximal phalanx. To preserve the space created, traction is applied to the big toe and 1.6 mm Kirschner wire is passed transversely through the PP of the big toe, then into that of the 2nd toe whilst traction is maintained. The ends of the K wire are kept protruding, bent over and trimmed, allowing for removal in the O.P.C. in four weeks. A similar procedure was performed in Freiberg's disease. The K wire was passed from the hallux to the 2nd toe in 2nd MT head disease, and from the 2nd to the 3rd toe in 3rd MT head disease.

At an average follow up of 36 months, 12 patients treated for hallux rigidus were very satisfied. The patients were symptom free, with maintained toe length and functional range of movement and no restriction on shoewear. There were two minor complications in this series related to improper positioning of the K wire. Attention to detail during the insertion of the K wire is therefore mandatory. Four patients treated for Freiberg's disease also had an excellent result at an average follow up of 28 months.

Although rehabilitation is lengthy compared to conventional Keller's the authors feel that the procedure is justifiable in view of the benefits observed.

A NEW SCREW FIXATION TECHNIQUE FOR ANKLE ARTHRODESIS

P.G. Murphy, S. Dudeney, L. D'Souza, M.M. Stephens (Cappagh Orthopaedic Hospital, Finglas, Dublin, Eire)

Pin site infection, loss of position, non-union and malunion are complications which frequently occur using external fixation as a method for ankle arthrodesis Internal fixation on the other hand avoids these problems and the fusion rate is reported to be 93%. We present a review of our experience of a new screw fixation technique for arthrodesis of the ankle.

A lateral approach to ankle joint is used. An oblique osteotomy of the distal 1/3 fibula, a 2 cm bony block being resected proximally, is followed by a longitudinal osteotomy of the medial 1/3 fibula. Two 6.5 mm cancellous screws are inserted from lateral side of neck of talus and directed proximally, medially and posteriorly to achieve compression of arthrodesis. The fibula is fitted snuggly over the lateral side of the joint as an onlay/inlay graft secured with two 4.5 mm cortical screws.

Of all ankle arthrodesis carried out between 1990 and 1995, this new technique for internal fixation was used in 11 ankles. There were 10 patients in the study (M=7, F=3) whose mean age was 58.8 (range 31-73). Ankle pain, deformity or both was the indication for surgery, the underlying disease processes being osteoarthritis (5), rheumatoid arthritis (3) and post-traumatic arthritis (3).

All surgical procedures were carried out by the senior author. All fusions were protected in cast for an average of 3 months (range 6/52 - 4/12) a walking heel being applied at 6/52. If the arthrodesis was not consolidated at this stage then an ankle-foot orthosis was prescribed. The mean follow-up period was 13.8 months (range 6/12 - 21/12) and the mean length of time to fusion being 5 months (range 2/12 - 14/12). Our fusion rate was 91%).

We recommend the use of this technique in all osteoarthritic cases requiring surgery. We would reserve the use of external compression devices for rheumatoid cases.

A METHOD FOR STANDARDISING DATA ACQUIRED WITH THE MUSGRAVE FOOTPRINT® SYSTEM

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Over the last 20 years there has been growing interest in the use of plantar pressure distributions for both research and clinical applications. Dynamic pressure measurements display a step-to-step variability of up to 15% in the peak pressure values. Therefore, it is necessary to conduct multiple trials on each subject.

The Musgrave Footprint® system consists of 2048 miniature load cells arranged in a 32 × 64 matrix, giving a total sensing area of 199 mm × 394 mm. This is large enough to allow the measurement to be taken without the need for the subject to target their foot at the pressure plate and hence disrupt their natural gait. Unfortunately, it is also large enough for there to be considerable spatial and rotational variation in foot placement between consecutive trials. Comparisons between the multiple trials necessary for each subject are, consequentially, difficult and somewhat subjective.

To overcome this problem, which is inherent to all such

systems, analysis software has been developed which standardises the spatial and temporal components of data from consecutive trials. The software was developed using the MATLAB™ package (*The Mathworks Inc, MA, USA*) and aligns the spatial components of the data from multiple trials to within 1° of rotation and 4 mm of translation; temporal components are completely normalised. The software then extracts relevant outputs such as centre of pressure curves, peak pressure contour plots, total pressure curves, pressure-time integral etc, and produces a best fit mean to all data sets.

This method greatly increases the accuracy of dynamic foot pressure measurements for clinical and research purposes. Though originally designed for use with the Musgrave system, the software could easily be modified for use with other systems.

DIAGNOSTIC INJECTION OF THE HINDFOOT - A VALUABLE PRELUDE TO ARTHRODESIS IN THE RHEUMATOID FOOT

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The results of ankle and triple fusion may be unpredictable, sometimes because diagnostic isolation of a painful joint can be difficult, despite the pre-operative use of CT and magnetic resonance imaging. These joints have been independantly injected with local anaesthetic to improve diagnostic accuracy, as a prelude to fusion.

Thirty five patients with Rheumatoid disease and severe hindfoot symptoms have been injected and assessed prospectively. In each case 2 mls of 1% Lignocaine was injected into either the ankle or the subtalar joints, or into both, using contrast medium and fluoroscopy to target the injection site. Pain was assessed on a linear analogue scale where 0 represented no pain and 10 very severe pain. In each case a CT scan was also performed.

Forty one feet have been injected and where resolution of symptoms was achieved in the ankle joint, the subtalar joint complex was not injected. A total of 82 joints have been injected. An average pain level of 8.6 (5-10) was scored before injection and 3.2 (0-9) following injection. Sometimes the effect was dramatic with complete abolition of symptoms and in 13 feet (31%) the effect was prolonged, lasting up to several months. In 37 feet (90%) the injection had an important influence on patient management, and in 16 of these (39%) the initial clinical decision was altered following the injection response.

Each patient had multi-joint involvement making an accurate assessment of mobility and its response to injection extremely difficult.

The decision to operate is based on 1) clinical assessment, 2) radiology and 3) injection response. Seventy-five per cent of the feet injected, i.e. 31 feet to date, have now been listed for fusion of the appropriate joint/s. Given the difficulties which may be encountered in isolating symptomatic joints, the authors feel this provides a valuable diagnostic aid in patient and joint selection for fusion. In addition a lasting therapeutic effect has been achieved in a number of cases.

AN IMAGING PROTOCOL TO SUPPORT DECISION MAKING IN OS CALCIS FRACTURES

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Recent advances in imaging and surgical technique have led to a reviewed interest in the operative management of os calcis fractures. Although the long term advantages of open reduction and internal fixation have not yet been conclusively demonstrated, it is likely that patients displaced intra-articular fractures will gain the most benefit.

An imaging protocol is presented which has been used for the assessment of os calcis fractures. Plain radiographs are supplemented where appropriate with high definition helical computed tomography. The volume data is reformatted into coronal, sagittal and horizontal planes, and 3D surface images are constructed to view the subtalar joint as well as the medial and lateral surfaces of the os calcis.

This paper demonstrates how this information can be used to answer a specific set of questions which define the fracture pattern, requirement for surgery, feasibility of surgery and appropriate technique.

THE ADAPTATION OF THE FOOT TO HEAVY LOADS. PLANTAR FOOT PRESSURES STUDY

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The function of the foot while weight-bearing was studied mainly under static conditions. We designed an experiment to explore the adaptation of the foot to walking with weights. 10 healthy subjects participated in the study. They walked barefoot over an EMED force plate which is based on multiple pressure capacitance sensors. Each subject walked three times. The first walk was without any weight, the second walk with weight of 20 kg organised in backpack and the third walk with weight of 40 kg. There were increases of pressures and loads in most areas of the foot except for the midfoot in the 20 kg group. Adding more 20 kg to the weights did not increase the loads on the midfoot and the lateral forefoot.

The human foot adapts itself under loaded condition by increasing the contact area mainly in the medial longitudinal arch. Increasing the loads further activates compensatory mechanisms which maintain the longitudinal arch and shifts the centre of pressure laterally.