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THE TREATMENT OF PELVIC FRACTURES: A PROSPECTIVE STUDY OF ONE HUNDRED PATIENTS

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The series consists of 100 consecutive patients treated in the period 1973–1978. There were 56 men and 44 women, mean age 45 years. There were 44 stable and 56 unstable fractures. Eighty-eight patients were mobilized with a sacroiliac Camp® corset and crutches after an average of 12 days, 7 patients were treated in traction, and 5 patients were operated on. Four of the latter patients had a dislocated acetabular fracture. The average stay in hospital was 23 days and the average period of absence from work was 107 days. Almost half the patients had other fractures, which prolonged both the stay in hospital and their absence from work.

Ninety-two patients answered a questionnaire sent about 3.8 years after the trauma. All patients who still had considerable problems and all those with a fracture of the acetabulum were re-examined. The subjective result was good in 79 cases, satisfactory in 11 and poor in 2 cases. Examination revealed a limp in 7 cases, shortening (1–2 cm) in 5 and restriction of hip movement in 7 cases.

Conclusions: Most patients with double vertical fractures of the pelvis can be mobilized at an early stage without external fixation or other operative treatment. Dislocated acetabular fractures require surgery.

THE STABILITY OF EXTERNAL FIXATION DEVICES

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The mechanical stability of four external fixation devices, which are in clinical use, was tested. Human osteotomized tubular bone diaphysis was used for testing the fixation stability. The torsion and bending resistance and axial deformation in compression were measured.

Two simple mountings with one or two tie bars and four transfixing pins were constructed for each device. The stability of the external fixation devices was tested separately, first with the bone fragments in contact and then with a gap between them.

In the tests every mounting and device showed variable elasticity under stress. The stability of the mounting with one tie bar was found to be approximately one third of that of the mounting with two bars. Thus, the external fixation device cannot be considered rigid. Whether this elasticity is of any clinical importance in practice is another matter. The weak joints of the external fixation device are the connective joints between the bars and the transfixing pins, which give way, and the transfixing pins, which bend under stress. It is obvious that a completely rigid external fixation device cannot be constructed; in fact, it does not even seem to be necessary.

RECURRENCES AFTER PRIMARY PATELLAR DISLOCATIONS

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Seventy-seven primary patellar dislocations were treated with immobilization in a rigid (47) or a semi-flexible (30) bandage for 3 weeks, followed by active exercises of the knee extensor mechanism and early weight-bearing. During a 1-year follow-up there were 16 redislocations. Most patients with a primary patellar dislocation, and especially those with a redislocation, were young females. Redislocation occurred to an equal extent after treatment with both types of bandages but the sick leave period was shorter for patients treated with a semi-flexible bandage.

Patellar dislocations do not always recur. Therefore conservative treatment is justified in selected knees, at

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least until the effect of immediate surgery on the development of arthrosis is determined. In this study conservative treatment resulted in redislocation most often in young females, especially if the reduction of the patella occurred spontaneously.

HAEMOPHILIC ARTHROPATHY: AN ANALYSIS OF 30 PATIENTS

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Joint disorders in 30 haemophilia patients were investigated. The age and sex distribution of this group of patients were representative of the whole haemophilia population of 200 patients in Finland (160 B-type and 40 A-type). In 25 patients the grade of haemophilia was severe, in one intermediate and in three moderate. All had clinical signs of knee arthropathy: 23 had discomfort in the ankles, 22 in the elbows, two in the hip and two in the humeroscapular joint. The wrist joint as well as the tarsal joints were affected in one patient. Twenty patients showed a flexion contracture of the knee joint ranging from 15 to 45 degrees, the average in all the patients being 19 degrees. The range of motion in the knee joint averaged 52 degrees, range 0 to 110. The severity of the joint disorders progressed with the age. The radiological evaluation of this group (according to R. Schreiber) was as follows:

grade	0	I	II	III	IV
knee	2	1	4	10	13
ankle	–	3	7	10	10
hip	12	15	2	–	1

Of the investigated patients 40 per cent seemed to need operative treatment for arthropathy.

The use of cryoprecipitate, introduced as part of the routine treatment in haemophilia bleedings in Finland 1967, has improved the management of the musculoskeletal disorders and the possibilities for operative treatment of haemophilic arthropathy.

RESECTION ARTHROPLASTY OF THE METATARSOPHALANGEAL JOINTS IN RHEUMATOID ARTHRITIS: A FOLLOW-UP STUDY OF 100 PATIENTS

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This paper will be published in full in the Scandinavian Journal of Rheumatology, Vol. 9.

RUPTURE OF THE COMMON FEMORAL ARTERY DURING TOTAL HIP REPLACEMENT: A CASE REPORT

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Iatrogenic damage to a major vessel during total hip replacement is remarkably rare. According to earlier reports such trauma may be caused by the thermal effect of the acrylic cement, the pressure of the retractor, direct injury to the vessel by instruments, or obstruction of the lumen by the position of the patient.

A case of extensive injury to the left common femoral artery during a total hip replacement with a Lubinus endoprothesis is presented. On the first postoperative day the patient complained of the classical syndrome of major vascular trauma with paraesthesia, pallor, pain and no peripheral pulse. Systolic blood pressure in the ankle was low, 38 mmHg (Doppler ultrasound technique) and pulse volume was reduced (pneumoplethysmography). The damaged area of the artery was resected and reconstructed with a venous graft. Both macroscopic and microscopic examination revealed a circumferential intimal and medial layer rupture. During the operation no ectopic cement or direct connection with the field of the primary operation was found. It seemed that the trauma was caused by the pressure of the Mueller retractor instrument. Soon after the second operation there was repeated pain, despite good peripheral pulses. An ischaemic muscle compartment syndrome was diagnosed and successfully treated by fasciotomy. When the patient was last seen 3 months postoperatively there were no signs of arterial insufficiency.

Rapid non-invasive arterial pressure measurements and immediate surgery are indicated in cases of this kind.

ROAD TRAFFIC INJURIES TREATED IN AN EMERGENCY UNIT

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A total of 3,261 consecutive victims of road traffic accidents were treated in the emergency unit of the Department of Orthopaedics and Traumatology, Helsinki, in 1979, accounting for 11 per cent of the total number

of patients treated during that year. Men outnumbered women in all age groups, and 15 to 24 year old males had the highest relative risk of road traffic injury. In males this risk declined in older age groups, but increased in women over 35. Fifteen per cent of those injured in road traffic accidents suffered a trauma of the spine. In 0.7 per cent of the spinal injuries there was a medullary lesion. Of the road traffic injury patients 0.5 per cent died, which is ten times the rate in other patients. Brain injury was the cause of death in 80 per cent of cases. The highest incidence of death (6 per cent) was in the group injured in tram accidents. Seven per cent of the group investigated were under the influence of alcohol when attending the unit, this number being twice as high as in other patients. Forty-four per cent of the patients who died as a result of road traffic accidents were under the influence of alcohol.

SCOLIOSIS ASSOCIATED WITH LUMBAR SPONDYLOLISTHESIS

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Altogether 157 young patients were treated by fusion for lumbar spondylolisthesis during the period 1944–1979. Seventy-seven of these (49 per cent) were found preoperatively to have scoliosis of more than 5 degrees, as measured according to Cobb. The frequency of scoliosis was greatest among patients with the dysplastic type of spondylolisthesis (Wiltse et al. 1976) with slipping of more than 50 per cent. Because no kind of preoperative traction or reposition was used, only the sciatic type of scoliosis disappeared after fusion and no change was observed in the curves due to asymmetrical slipping of the lower lumbar segments. The frequency of purely thoracic curves was higher than in the normal population, but the reason for this is unclear.

PERONEAL ENTRAPMENT NEUROPATHY

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Ten patients with peroneal entrapment neuropathy are reviewed. There were five male and five female patients. The mean age of the patients was 32 years. The average interval between the onset of symptoms and the operation was 8 months. The cause was direct trauma in six cases and hyperextension of the knee with overstretching of the peroneal nerve in four cases. In seven cases the compression was effected by a tendinous arch along the posterior border of the peroneus longus muscle and in three cases of overstretching by fibrotic tissue encircling the nerve.

The follow-up time was 14 months. The result of freeing the nerve was excellent in nine patients. One patient still needs a peroneal brace.

EXPERIMENTAL LEG LENGTHENING USING OSTEOTAXIS

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Gradual distraction of a tibiofibular osteotomy was studied in 14 rabbits using an osteotaxis device for fixation. Eleven rabbits with osteotomy and neutral fixation served as controls. An osteotaxis device constructed by the authors was mounted before osteotomy. The bone osteotomy was distracted for up to 8 weeks at a speed of 1 mm/week. Bony healing was studied by X-ray, and by histology using haematoxylin-eosin and Movat pentachrome staining and tetracycline fluorescence. The rate of callus formation was the same in both groups.

Gradual distraction stimulated bone formation so that consolidation occurred as rapidly in the distraction group as in the neutral osteotomy group. In the distraction group the last place that new bone formation occurred was in the middle of the distraction gap (growth zone) mainly through direct osteogenesis and partly via chondrogenesis. The growth zone was radiologically present from 2 to 7 weeks. The osteotaxis device used was so stable that neutral fixation resulted in bony healing with minimal external callus. The stability also resulted in cortical thinning, on average 13 per cent, and to an equal extent in both groups.

EXPERIMENTAL OSTEOARTHROSIS PRODUCED BY STRENUOUS LOADING AND IMMOBILIZATION: A SCANNING ELECTRON MICROSCOPIC STUDY

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Experimental osteoarthrosis was produced in rabbit knee joints by strenuous exercise. The animals jumped 20 times daily down from a height of 130 cm, and in another group the leg was immobilized with a Tensoplast® cast. In the exercise group two rabbits performed the jumps for 14 days and five rabbits for 21 days. In the immobilized group five rabbits wore the cast for 8 to 18 days and four rabbits for 35 days. Five rabbits served as controls. In both experimental groups scanning electron microscopy showed the first fine morphological degenerative changes in the articular cartilage of the medial tibia after 2 weeks. These changes were essentially the same in all the rabbits and progressed as the experiment continued.

It is concluded that osteoarthrosis in rabbits can be produced for experimental purposes by strenuous exercise as well as by immobilization of the limb. Scanning electron microscopy seems to be a good tool for detecting early arthrotic changes in the joint cartilage.

EFFECTS OF VITAMIN D METABOLITES ON CLINICAL AND EXPERIMENTAL OSTEOPOROSIS

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1α-hydroxyvitamin D_3 (1α-OHD_3) is converted in the liver to $1,25(OH)_2D_3$, which acts as the hormone of vitamin D. However, $1,25(OH)_2D_3$ may also stimulate the production of other metabolites, e.g. $24,25(OH)_2D_3$, known *per se* to induce new bone formation. Attempts were made to test the effect of 1α-OHD_3 on 1) calcium deficiency osteoporosis, 2) corticosteroids, and 3) oophorectomy-induced osteoporosis in adult rats. The skeletal mass and bone mineral content increased significantly ($P < 0.01$) during treatment with 1α-OHD_3, when the rats were reared on a diet containing an optimal amount of calcium (1.12 per cent) for periods varying from 6 weeks to 6 months.

Patients classified as suffering from 1) senile, 2) postmenopausal, or 3) corticosteroid-induced osteoporosis were treated for 1–3 years with 1α-OHD_3 supplemented with calcium. The patients were relieved from pain and became physically more active. Bone density increased almost significantly ($P < 0.05$) in postmenopausal osteoporosis, but an almost significant ($P < 0.05$) decrease in bone mineral content was observed in patients suffering from senile osteoporosis. Patients with corticosteroid-induced osteoporosis showed an insignificant increase in bone mineral. Administration of 1α-OHD_3 may thus lead to new bone formation and mineralization in both experimental and clinical osteoporosis.

EXPERIMENTAL "MYOSITIS OSSIFICANS"

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Heterotopic bone formation, "myositis ossificans" (MO), appears in the leg, for example, after trauma, severe burn injuries, in neurological diseases, in post-traumatic paraplegia and after orthopaedic operations, especially hip replacement. The pathogenesis of MO is obscure and there are no really good preventive measures.

A simple model for provoking experimental MO is presented here. One hind limb of adult rabbits was immobilized by means of a plastic splint. During the immobilization period the splint was removed daily for passive exercising of the leg. Within 1 week, biopsies from a part of the quadriceps muscle showed partial necrosis and oedematous swelling of the muscle bundles with infiltrations of polymorphonuclear leucocytes into the necrotic areas. Within 5 weeks, calcified bone and mature cartilage was found in the outer zone of the MO formations, osteoid-like tissue in the middle zone and proliferation of granulation and fibrous tissue centrally. The morphological and radiological changes were similar to those seen in human MO.

This rabbit model may be useful for studies on the pathogenesis, prevention and treatment of MO.

CARTILAGE FORMATION BY PERIOSTEAL GRAFTS

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Free periosteal grafts form bone enchondrally, i.e. through a cartilage interphase. In clinical practice the problem of articular cartilage defects of various aetiologies has not been solved. For this reason a trial was carried out to stop the proliferative process of periosteum in this cartilaginous phase. Free periosteal grafts in rabbits were transplanted into four "chondrotrophic" environments: into the costal cartilage, into the ear cartilage beneath the perichondrium, into the knee joint as a loose body and into an artificial cartilage defect of a femoral condyle. In the first two recipient areas bone was formed after a prolonged cartilaginous interphase. In the latter two recipient milieux only cartilage formation occurred. In the loose body this cartilage soon died. In the femoral condylar defect hyaline-like cartilage persisted for up to 1 year after transplantation.

ENHANCED CALLUS PRODUCTION AND DISTURBED REMODELLING IN TIBIAL FRACTURES IN PARAPLEGIC RATS

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Pathological fractures in paraplegic and quadriplegic patients usually heal rapidly and form abundant callus. Our recent experimental study (Aro et al. Clin. Orthop. 1980, in press) showed that tensile strength values of tibial fractures in paraplegic rats and in rats with peripheral nerve lesion were significantly higher than those in controls at the early stage of healing. At the osseous phase of healing, however, denervated calluses

were radiologically osteoporotic and irregular in bone architecture.

In the present study, fracture healing in paraplegic rats was analysed further by histoplanimetric and biochemical methods and compared with controls.

The production of fibrous and cartilaginous tissues increased significantly ($P < 0.01$). In addition, accelerated rates of cartilage resorption and new bone production were observed in the denervated calluses. An enhanced osteoclastic resorption produced an abnormal remodelling process in the paralysed limbs. At an early stage, 7th–9th day, the production of nitrogenous components was accelerated. The mineralization rates of osteoid tissues were the same in both denervated and control calluses.

Our results indicate that spinal cord trauma enhances the rate of fracture healing by external callus formation, but the remodelling process remains incomplete.