

## PROCEEDINGS OF THE FINNISH ORTHOPAEDIC ASSOCIATION

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### RADIOLOGICAL AND BIOMECHANICAL CHANGES IN TUBULAR BONE AFTER INTRAMEDULLARY NAILING

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The effects of stable intramedullary nailing on non-osteotomized and osteotomized rabbit tibiofibular bones were analyzed radiographically and torsionometrically 3-24 weeks postoperatively. Periosteal callus formation was moderate, and remodeling of the callus was demonstrated from 9 weeks on. Distinct cortical atrophy was seen in both groups at 24 weeks, suggesting that the nail provides protection against stress. A sleeve of new bone surrounding the entire nail was seen in both groups after only 12 weeks. The osteotomy line has disappeared in all cases at 24 weeks, when resorption was usually observed in the osteotomy area. The biomechanical strength of the osteotomized bones decreased markedly up to 24 weeks and remained subnormal throughout the experiment. The torsional strength of the non-osteotomized bones was clearly low at 3 weeks postoperatively, obviously due to reaming of the medullary canal.

The results suggest that stable intramedullary nailing protects the bone from stress, which in turn induces marked cortical atrophy. Biomechanically this causes weakening of the torsional strength of the bone.

### A CASE REPORT OF LATE FLEXOR TENDON RUPTURE AFTER FRACTURE OF THE DISTAL RADIUS

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Extensor pollicis longus tendon lesions occurring 4-5 weeks after Colles' fracture with minimal dislocation are well known in clinical work. A flexor tendon lesion is rare as a late complication despite the volar bony prominences often seen in X-ray pictures.

A 40-year-old man fell 3 m and suffered a comminuted compound fracture of the distal radius. The reduction was primarily acceptable but during the 5 weeks' immobilization a moderate dorsal tilting (15°) and shortening of the radius (4 mm) occurred. The patient returned to work 13 weeks after the fall with stiffness in the wrist and fingers. One week later he suffered a rupture of the long flexor of the thumb and progressively impaired flexion of the index and middle fingers.

On surgery the long flexor tendon of the thumb was found to be totally ruptured at the bony prominence, which had perforated the pronator muscle and scarred the index-flexor tendons with severe synovial irritation. The bony edge was excised and the bone covered with muscle. The tendon had to be reconstructed with a transplant and a synovectomy performed to achieve an acceptable result.

### EXTRAMEDULLARY PLASMACYTOMA

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Ten extramedullary plasmacytomas (EMP) were diagnosed in a series of bone tumor samples consisting of 869 histologically verified cases. The EMP's comprised seven males and three females (age 17-77 years, mean 50). The duration of symptoms was 1-26 months (mean 10.5 months). The location of the tumor was the nose in seven cases, and the pharynx, the maxillary sinus and the inguinal node in one case each. Three patients were treated surgically, three with surgery and subsequent radiation, two with radiation therapy only and two re-

ceived no specific treatment. The 5-year survival rate for EMP was 60% and the 10-year survival rate 30%.

#### THE USE OF PAIN DRAWINGS IN STUDIES ON PAIN IN THE LOWER BACK

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Patients with back pain were classified into the three back disease groups "low-back pain", "facet syndrome" and "sciatica" using pain drawings. Psychological factors were also evaluated using a seven-point scale. The subjects comprised 55 hospital inpatients or outpatients who had completed two personality questionnaires (M.H.G. and M.P.I.) and the pain drawing. The groups formed on the basis of the pain drawings were compared with respect to clinical diagnosis and psychological evaluation (based on the personality tests). Typical cases of sciatica could be identified from the pain drawings. The psychological evaluation correlated with hysteria and partly with extroversion.

The pain drawing method is simple and can be used for a rough classification of pain in the lower back in epidemiological studies; the psychological evaluation can be used together with the pain drawing in clinical work.

#### THE RESULTS OF SURGICAL TREATMENT FOR RECURRENT DISLOCATION OF THE SHOULDER

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Between 1969 and 1977, 52 patients were treated surgically and a follow-up examination was performed an average of 4.9 years after the operation (range 2–10 years). Of the 41 patients who agreed to the examination, 30 were men and 11 women. They had a mean age of 31.1 years on surgery. Forty-two shoulders of 41 patients were operated on. The Eden-Hybbinette operation was performed in 31 cases and its modification by Lange in 11.

Attention was given to subjective symptoms, restriction of shoulder movement, redislocations, the position of the bone graft in X-ray films, osteoarthritis and soft tissue calcification.

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The result was fair in two cases, but with restriction of joint movement in three or more directions.

The result was poor in three redislocations with no new trauma. There was still one redislocation with a new, severe trauma.

#### HEALING OF AN EXPERIMENTAL LIGAMENT RUPTURE. A SCANNING ELECTRON MICROSCOPE STUDY

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The medial collateral knee ligaments of 16 rats were cut; 16 were allowed to heal spontaneously while 16 were immediately sutured under a microscope. Four sham-operated rats served as controls. The ligamentous status in each group was recorded after four to five weeks of immobilization under a scanning electron microscope (SEM).

In the control ligaments collagen bundles of variable thickness were seen as the main supporting elements. Numerous thin elastic fibers were seen between the bundles. The surgically corrected ligaments demonstrated a microstructural picture which was often difficult to distinguish from that of the controls. The unsutured ligaments, however, showed a much more variable picture. In some cases ligamentous healing was totally blocked by extensive scar formation. In many cases, however, initial ligamentous regeneration could be observed.

It is concluded that the SEM is a useful tool in experimental studies on ligamentous healing.

#### REMODELLING OF TUBULAR BONE AFTER RIGID PLATE FIXATION

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Porotic transformation of the cortical wall of tubular bone was induced by attaching a four-hole stainless steel ASIF plate onto the tibiofibular bone of rabbits. The plate was removed 12 (group I) or 24 weeks (group II) postoperatively. Recovery was followed by testing the bone specimens in a torsionmeter and radiographically from zero to 18 weeks in group I and zero to 36 weeks in group II after removal of the plate. Immediately after removal of the plate the strength of the plated bones compared with that of paired control bones was only 55 per cent in group I and 72 per cent in group II. Full recovery of torsional strength took 12 weeks and 18 weeks respectively. The radiological signs of cortical porosity and periosteal new bone formation, which had been observed at the moment of plate removal, also started to disappear, but were still visible at the end of the experiment.

## EXTERNAL FIXATION OF FRACTURES OF THE DISTAL ANTEBRACHIUM

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We used the Hoffman apparatus with a distraction bar on 20 patients. The indications were open fractures, comminuted fractures, fractures with malalignment in plaster treatment and fractures demanding too much flexion for retention. An attempt had first been made to treat each fracture with a plaster cast. External fixation seems to be a small and safe procedure. With this method shortening can be corrected, the position is easy to correct later on, and the natural wrist position permits better finger exercises. Complications may follow, such as pin infection, loosening, nerve and tendon injuries, pseudarthrosis and late collapse. We saw one late collapse, two superficial pin infections and two loosening.

In most cases we used intravenous anesthesia, although plexus blockade or general anesthesia are also possible. The operator and one assistant are needed. The second metacarpal bone and the radius are used as anchorage bones and three pins are drilled into each of them. The pins are led through small skin incisions against the upper cortex and the carefully drilled manually through both cortices. The penetration must be followed on an X-ray television monitor. The device is prepared for fixing before the operator reduces the fracture manually. Finally the skin is protected with an antibiotic paste.

## INFECTED FRACTURES OF THE LOWER LEG: PRINCIPLES OF TREATMENT

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Twenty-two infected fractures of the lower leg caused by either severe trauma or surgical failure were treated over an 8-year period. The series was divided into two subgroups according to the method of treatment. In the first group (9 patients) the implants were retained or exchanged for more stable plates and nails, soft tissue coverage was obtained by muscle transposition flaps and bone grafting was postponed until abatement of infection. In the second group (13 patients) the implants were removed and the fracture stabilized with external frames. Soft tissue coverage was obtained by muscle transposition flaps or microvascular composite grafts: cancellous bone grafts were made in connexion with these procedures. The healing time in the first group was  $47 \pm 11$  weeks and in the second group  $26 \pm$

4 weeks (mean  $\pm$  S.E.M.). The results achieved point to the beneficial effect of early bone grafting combined with revascularizing procedures and external fixation.

## SURGICAL TREATMENT OF ACROMIOCLAVICULAR DISLOCATION

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The results of surgical treatment of 39 total (Type III) acromioclavicular dislocations are reported. The surgical procedure used was suturation of the coracoclavicular ligament and transfixation of the AC joint with an ASIF-malleolar screw passed through the acromion into the lateral end of the clavicle. The screw was removed 6 weeks after operation.

The overall results in 36 patients re-examined after an average of 4 years were good in 92% of the cases. The range of motion in flexion and abduction was excellent (over  $170^\circ$ ) in 90% of cases.

Stress radiographs showed signs of osteoarthritis in four cases, and correlated well with a poor clinical result. Radiological signs of post-traumatic osteolysis were observed in 12 cases. All except one patient had returned to their pre-operative occupation within an average of 2 months.

## INCIDENCE OF LUMBAR SPINE SURGERY IN FINLAND IN 1980

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A questionnaire concerning the frequency of lumbar spine operations was sent to Finnish hospitals. Operations for fractures of the spine and scoliosis were excluded.

Lumbar spine surgery was performed in 58 hospitals. In 1980 a total of 1982 operations were performed for herniated nucleus pulposus (41/100000/year). The incidence was higher in the eastern and northern parts of the country. 378 decompressive operations were performed for lumbar spinal stenosis (8/100000/year) and 96 for spondylolisthesis (2/100000/year). Only 115 fusions of the lumbar spine were carried out: 84 for spondylolisthesis (1.75/100000/year) and 31 on the basis of the disc degeneration (0.65/100000/year).

### HEALING OF EXPERIMENTAL OSTEOTOMIES TREATED USING EXTERNAL FIXATION AS COMPARED WITH RIGID PLATE FIXATION

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A transverse experimental osteotomy of the midshaft of the rabbit tibia was secured by external fixation (30 animals) or rigid steel plates (19 animals). The animals were killed at intervals between 3 and 36 weeks. All the fractures had knitted when tested with a torsionmeter. In the external fixation group, the fracture repair was effected by subperiosteal and subendosteal callus. In the plate fixation group repair occurred by direct end-to-end consolidation of the fracture without any visible

callus (primary bone healing). The biomechanical strength of the fracture increased from 3 to 12 weeks postoperatively in both groups, but earlier in the group of osteotomies treated with external fixation. This may reflect the better mechanical strength and holding capacity of the callus tissue observed in the specimens with external fixation. After 12 weeks the strength decreased in both groups, reflecting cortical atrophy. Cancellous transformation of the cortical bone was more profound in the plated bones.

The results suggest that external fixation of fractures provides more favorable conditions for fracture repair than does rigid plate fixation. Secondary cortical atrophy, induced by the rigid nature of the fracture fixation device, is less profound after external fixation. This difference seems to be attributable to the preservation of more cyclic loading on the tubular bone during fracture repair with external fixation.