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Experimental orthopedics

The fixation of distal osteotomy of the femur by biodegradable thread. An experimental study in rabbits

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Twenty-four rabbits were operated on to investigate the use of biodegradable thread in the fixation of osteotomy in the spongy bone. The distal femoral osteotomy was fixed by biodegradable thread, pulled into the drill holes through the fragments. The rabbits were killed at 1, 3, 6, 12, and 24 weeks after operation. Macroscopic and radiographic examinations were performed before the distal part of each femur was removed. The specimens were embedded in methylmethacrylate, sawed to a thickness of 80 microns for OTC studies and microradiography, and cut to 5 microns for histologic studies. The macroscopic analysis showed that all 24 fixations were firm. Three osteotomies at 12 and 24 weeks had radiographic nonunion, but in these cases there was strong callus formation on the outside of bone. On the basis of microscopic studies, new bone formation was strongest at 3 and 6 weeks in the osteotomy. After 12 and 24 weeks, 6 osteotomies of 9 had healed. In the remaining 3 cases, there was new bone on both sides of the osteotomy and around the condyles.

Conclusions: The biodegradable Dexon® thread has mechanical tissue properties suitable for the fixation of the spongy bone in rabbits.

The effect of rotational stability of intramedullary nailing on bone healing

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Our experimental studies on 165 long bone osteotomies in rats demonstrated that rotational instability, in contrast to bending instability is detrimental to healing. The rotational strength of three intramedullary nails with variable locking was 0.05, 0.18, and 0.34 (intact femur = 1.0). The rotational stiffness was 0.28, 0.37, and 0.38, respectively. In the first group, the increase in strength to one half of the intact bone was delayed for 8 weeks. Bending instability by flexible nailing improved the amount and quality of callus.

Our clinical study of 107 interlocking nailings of the femur and tibia did not show any significant difference in healing between dynamic (interlocking screws in one end of the nail) and static (both ends locked) nailing. The interlocking was kept static until and after consolidation in 31 cases. All of these fractures healed within the same period as their dynamic counterparts, and the number of malalignments was less.

We conclude that excessive rotational instability delays fracture healing. The locking of the intramedullary nail at both ends guarantees the maintenance of reduction. The bending elasticity of the nail improves callus formation.

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Secondary radial nerve paralysis associated with fractures of the shaft of the humerus

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A series of 17 patients with secondary complete radial nerve paralysis, arising after closed reduction of a fracture of the humeral shaft, was analyzed. The age of the patients was 34 (6–79) years. The fracture was in the middle third of the shaft in 6 patients and in the distal third in 11 patients.

An early exploration of the radial nerve and internal fixation of the fracture within 3 weeks after the accident were done in 10 patients. Expectance and a later exploration, if needed, was the therapeutic approach in the remaining 7 patients.

Complete recovery of the radial nerve function occurred in 80 per cent of the patients, with no difference between patients with and without early exploration. At exploration the continuity of the radial nerve was preserved in all of the patients. The only common denominator of the patients with no recovery of radial nerve function was abundant callus. Consequently, a secondary radial nerve paralysis complicating a humeral shaft fracture cannot be regarded as an absolute indication for early surgery.

Nonunion and delayed union of the carpal scaphoid: treatment of bone grafting and compression staple – preliminary results

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Six nonunions and two delayed unions of the carpal scaphoid were operated on using the original volar Russe approach. Cancellous bone grafting was secured by a compression staple (Richards®). The consolidation was uneventful in 7 cases, whereas one nonunion in a 69-year-old man was still obvious 34 weeks after the operation. The consolidation time for the other 7 patients was 8 to 32 weeks (mean 17 weeks).

The method is simple and only the volar approach is needed. No loosening of the staple were seen. The clinical series has now been expanded to include also fresh, grossly dislocated scaphoid fractures and fracture dislocations.

Spine

Fatal injuries of the cervical spine in road traffic accidents

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Fatal road traffic accidents of private cars and trucks in Finland during the period 1972–1982 where an injury of the cervical spine was the main cause of death were analyzed. The material comprised 289 cases.

Front-seat and rear-seat passengers had an equal risk of sustaining a fatal cervical injury. However, front-seat passengers had injuries more often ($P < 0.001$) than the drivers. Twenty-one per cent had worn safety belts, but there was no statistical difference between safety belt wearers and nonwearers. Patients between aged 16 and 25 years had the lowest risk of injury, and most fatal cervical spinal injuries were found in patients over aged 60 years ($P < 0.001$).

Forty-eight per cent of the cases sustained multiple injuries. Safety belt wearers had more ($P < 0.001$) multiple injuries. Of the patients who died of cervical injury, 9 per cent survived the transport to the hospital and 1 per cent survived longer than 24 hours. Direct contusion was the cause of the cervical trauma in 47 per cent and indirect deceleration was recorded in 13 per cent. Deceleration was more common in victims wearing a safety belt ($P < 0.001$). However, the wearing of a safety belt would have saved 40 per cent of the victims. Further, head and neck supports would have saved 14 per cent of those whose cervical spine trauma was caused by deceleration.

Long-term anatomic results in severe fractures of the thoracic and lumbar spine treated using the Harrington instrumentation

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Thirty-four patients with severe fractures of the thoracic or lumbar spine treated with the Harrington instrumentation during the years 1977–1982 were analyzed. The long-term result was assessed on an average 1 year after the removal of the rods and hooks.

The mean age of the patients was 28 (15–51) years. There were five fractures of the midthoracic spine, 23 of the thoracolumbar junction, and six of the lower lumbar vertebrae. The type of fracture was classified as wedge compression in 9 patients, burst in 14, and rotation in 11.

As for the restoration of the spinal canal, the most favorable results were seen in the thoracolumbar junction, where the Harrington rods were effective in reducing the posterior margin, in restoring the height of the vertebral body, and in correcting the traumatic scoliosis. The kyphosis, on the contrary, increased after the removal of the rods, except in the midthoracic spine. The long-term results were modest in the lower lumbar spine, showing no significant permanent improvement. Dislodgement of the hooks, too, occurred most often in the lower lumbar fractures. Fifty per cent of the patients with fractures of the thoracolumbar junction or lower lumbar spine had local pain that was associated with the anatomic result.

Computed tomography versus myelography for diagnosis of lumbosacral radicular pain. Correlation with surgical findings

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The value of computed tomography (CT) and myelography in diagnosing herniated nucleus pulposus and lumbar spinal stenosis was evaluated in 96 consecutive patients undergoing spinal operations for radicular pain. For diagnosis of disc herniation, CT was accurate in 95 per cent, compared with the 85 per cent accuracy of myelography. For diagnosis of lumbar spinal stenosis, CT was confirmed by the operative finding in 83 per cent and myelography in 74 per cent. With regard to lumbar spinal stenosis, myelography gives valuable information of the sagittal diameter of the spinal canal. Our study suggests that CT is the method of choice for preoperative evaluation of lumbar disc herniation when definite clinical signs of disc herniation are present.

Lower extremity

The treatment of osteochondral fractures of the knee using autologous cortical bone nails

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Four large osteochondral fragments (3 patellar and 1 femoral condylar) were fixed using cortical bone pegs from the anterior tibial surface. The patients were aged 14 to 18 years. All the patients recovered fully and were asymptomatic at follow-up examinations. The method serves as a physiologic alternative to the use of ASIF-miniscrews in the treatment of osteochondral fractures of the patella and femoral condyles. Grafts are easily obtainable and provide firmness of fixation during the healing phase. In addition, there is no need to remove osteosynthesis material.

Fresh rupture of the tendon of quadriceps femoris

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Twelve patients operated on for rupture of the quadriceps tendon were examined. The follow-up period was on an average 5 years and in no case less than 2 years. All the patients were more than 40 years of age and 6 were overweight. The result was good in 7 patients, fair in 4, and poor in 1. A fresh rupture of the quadriceps tendon can be successfully treated by end-to-end suturing or by fixation of the tendon in the insertion area through drill channels to the patella. Plasty or steel-wire reinforcement is not required. Considering the risk of infection, resorbable suturing material is recommended.

Acute dislocation of patella. Clinical, radiographic, and operative findings in 64 consecutive, prospectively treated cases

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The clinical, radiographic, and operative findings in 64 consecutive cases of acute patellar dislocation were analyzed. Both patellofemoral joints were asymptomatic before dislocation in 58 patients. In these patients, the radiographic findings of the patellofemoral joints (height of the patella, lateral patellofemoral angle, lateral displacement of the patella, sulcus angle, and shape of the patella) were analyzed using a paired *t* test and McNemari's test.

No radiographic parameter differed statistically between the injured and the uninjured knee. The stability of the patella could not be reliably estimated in tangential views taken with the knee in 20 degrees of flexion: there were numerous false negative findings. Fractures of the medial margin of the patella resulting from a dislocation were best seen on tangential views, and radiography can be used for indirect diagnosis of acute patellar dislocation.

Stress radiology in the acute knee injury

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Stress radiographs were performed in 85 consecutive knee injuries. The results were compared with the stability under general anesthesia.

Results: Medial collateral ligamental injuries were detected in 10 of 13 cases when both the deep and the superficial part were torn. Partial ruptures remained negative in 6 of 10 cases. All 15 of the knees with positive stress results were also unstable in the clinical examination. Anterior cruciate tears in 10 of 37 cases were found in stress radiography, seven of them were clinically stable and six were isolated tears. Twenty-seven torn anterior cruciate ligaments remained false negative and 18 of them were isolated tears. Seventeen knees were also stable at clinical examination. All four posterior cruciate injuries could be demonstrated in stress radiography. Three of them were stable at clinical examination.

Stress radiography gave no additional information as regards medial instability when compared with

the clinical examination, and sagittal stress radiography is unreliable for diagnosing cruciate ligament tears.

AO-osteosynthesis versus biodegradable fixation in displaced fractures of the lateral malleolus. Early results of a prospective study

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In a prospective clinical study, 30 consecutive patients with a Weber B-type fracture of the lateral malleolus showing an initial displacement of 2 mm or more, but without rupture of the distal tibiofibular syndesmosis, were randomly allocated to two groups. One was treated with conventional AO-osteosynthesis (Group A) and the other with a biodegradable rod and sutures of polylactide-glycolide copolymer (polyglactin 910) (Group B). The cylindrical rod was placed in a drill channel from the tip of the malleolus. The ankle was immobilized for 6 weeks in a below-the-knee plaster cast in both groups. The groups were similar for demographic data and severity of the initial displacement of the fracture. The mean patient age was 38 years. A rupture of the deltoid ligament was present in 9 patients.

The mean duration of the operation was 23 minutes in Group A and 29 minutes in Group B. The fixation was retained, and an uneventful union of the fracture was seen in 28 patients. In 2 patients, 1 in each group, a partial failure of the fixation and secondary displacement of 1.5 mm, not necessitating a reoperation, occurred.

Considering the early results, no significant differences emerged between the treatment groups. Consequently, the advantage of avoiding the removal procedure associated with metallic implants renders such an equality in favor of the biodegradable fixation method.

Treatment of lateral ligament injuries of the ankle. A prospective clinical study

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One hundred and fifty consecutive, severe, lateral ligamentous injuries of the ankle were randomized into three categories and treated either by bandaging, plaster cast, or suture and plaster casting. The patients treated operatively showed somewhat better results as compared with the other groups. The follow-up examination 2 years after the trauma showed that an operation was the best way to achieve radiographic stability, as judged by talar tilt and anterior drawer sign. Thromboembolic complications were seen in 5 cases in the traumatized leg after 4 weeks of immobilization in a plaster cast, whereas no thromboembolic complications occurred in the patients treated only with bandaging.

The role of arthroscopy in the diagnosis of acute injuries of the knee

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Three hundred and seven acute knee injuries with hemarthrosis were examined by arthroscopy after clinical examination. The findings at arthroscopy were compared with the clinical examination. The usefulness of arthroscopy was then estimated according to the modified classification of Jackson & Abe (1972). Arthroscopy was very useful in 107 cases of 307 acute knee injuries with hemarthrosis (35%), useful in 91 (30%), and was useless or harmful in 109 cases (35%). The harmful cases were 2 mild wound infections. In conclusion, arthroscopy can be recommended in every knee injury with hemarthrosis for early diagnosis and treatment of essential tears in ligaments and menisci and for finding radiographically invisible osteochondral fragments.