

We have found the method to be reliable and rather simple to apply. The patients tolerate the frame well in their everyday activities and they or their parents have no trouble learning the elongation procedure.

Children

226. Growth disturbances in the radius after forearm fractures conservatively treated in children

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Stimulation of longitudinal growth in long bones secondary to a fracture is a well-known fact. The majority of reports dealing with the overgrowth phenomenon include series of fractured long bones of the lower extremity. We have studied the growth pattern of the radius following different types of forearm fractures treated by conservative method.

Patients and methods: 64 children younger than 15 with forearm fractures treated conservatively were included in a prospective study from 1986 to 1988. Comparative radiographic studies of the fractured and the uninjured radius were carried out in all patients at 3, 6, 12 and 18 months after fracture. The length of the radius was recorded by measuring the distance between the most proximal part of the growth plate of the radial head and the most distal part of the radial growth plate at the radiocarpal joint. Differences of 2 mm or more were considered as length discrepancies. Only 40 patients, 28 boys and 12 girls, with an average age of 9 (1–15) years completed the follow-up period of 18 months. The series included 19 buckle fractures of the radius, 11 green-stick and 10 complete fractures. Fracture of the ulna was associated in 11 cases.

Results: Neither consolidation defects nor angular deformities were found at the end of follow-up. Monitoring radial longitudinal growth according to patient's age, the maximal average growth was observed from the age of 9 to 12 years (2.6 cm in the fractured radius versus 2.4 in the uninjured side). Overall, the average length discrepancy between the fractured and the healthy radius at the end of follow-up was 0.03 (–0.50 to +1) cm. In 9 cases (22%) the fractured radius showed an average overgrowth of +0.44 cm (1–0.20; $p < 0.002$). In 10 other patients (25%) a radial shortening could be detected (average discrepancy –0.29, [–0.50 to –0.20 cm]; $p < 0.0001$). Five of the 9 cases with radial overgrowth had an associated fracture of the ulna. This association was not found in any of the 10 patients with radial shortening ($p < 0.02$). In cases of overgrowth, it was mainly manifested after 12 months follow-up.

Conclusion: These results show that growth stimulation in the radius secondary to fracture can be found in very few cases, being minimal as compared with that reported in femur and tibia. Other etiopathogenic factors than the increased vascularity of the growth plate—as postulated for femur and tibia—must be investigated further in order to explain the frequent absence of radial overgrowth following fracture.

227. Grice subtalar arthrodesis—a review of 131 operations

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A retrospective study of subtalar, extraarticular arthrodesis in 83 patients with cerebral palsy (CP) or meningomyelocele (MMC) was carried out.

In the CP group, 68 feet were operated on in 42 patients with a mean age of 9.5 years without complications. The results were evaluated after a mean observation period of 4.5 years. All but one transplant healed, and the result was satisfactory in 54, acceptable in 9 and poor in 5 feet.

In the MMC group of predominately L4, L5 and S1 affection, 63 feet were operated on in 41 patients with a mean age of 8 years and the results evaluated after a mean observation period of 6.5 years. The transplants healed in 56 feet whereas a pseudarthrosis possibly occurred in 7. The result was satisfactory in 56 feet, acceptable in 3 and poor in 4 feet. One patient sustained necrosis of the talus and a subsequent physeolysis in the distal tibia.

Because Grice arthrodesis may possibly be compromised by ankle valgus, the value of preoperative bracing is discussed.

Conclusion: Grice arthrodesis in this material led to a good functional result in 110/131 feet (84%). The operation may be recommended for children with CP or MMC conditioned valgus deformities.

228. Timing of epiphysiodesis in lower limb length discrepancy with the straight line graph

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In a prospective study 30 children underwent 33 epiphysiodeses for lower limb length discrepancy (LLD). Timing of surgery was based on (bi)annual orthoroentgenograms and skeletal age, and in accordance with Moseley's

straight line graph. The mean predicted LLD was 5.2 cm (3.0–11.0) and the mean LLD at the end of growth was 1.4 cm (0.0–4.3). In 9 patients final LLD exceeded 1.5 cm, caused by insufficient number of preoperative measurements, premature fusion of damaged growth plate, delay in skeletal maturation or surgeon's failure. In total secondary operations were performed three times.

After analysis of the failures we concluded that the accuracy of the straight line graph is mainly limited by the pattern of skeletal maturation. Recommendations to prevent failures by other causes are given.

229. The incidence of late diagnosed hip dysplasia before and after ultrasound screening of newborns

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Ultrasonography has been established as a reliable technique in the diagnosis of congenital dysplasia and dislocation of the hip (CDH) in infants. However, the reliability of this method as a screening method in newborns is still discussed. The purpose of the present study was to find whether ultrasound screening of newborns' hips influenced the incidence of late-diagnosed CDH.

Patients and methods: During 1980–1987, 21,353 children were born in our hospital. The hips were examined by a pediatrician, using the Ortolani and Barlow methods. In 1986–1987, the newborns' hips were also examined with ultrasound. In 1986 we used a subjective, dynamic ultrasound evaluation, whereas in 1987 also the coverage of the acetabular roof was measured.

Results: The incidence of late diagnosed CDH in children born before ultrasound was introduced (1980–1985) was 2.6 per 1000. The incidence was 0.7 per 1000 during the last 2 years when ultrasound was used; this reduction was significant ($p < 0.01$). All the 4 cases of CDH after ultrasound was introduced were born in 1986. The diagnosis was acetabular dysplasia in 3 children and subluxation in one.

Conclusion: The incidence of late diagnosed CDH was reduced when ultrasonography was used for screening of newborns' hips. The results indicate that late diagnosed dislocation can be eliminated by ultrasound screening in newborns, whereas milder degrees (dysplasia, subluxation) still occur.

230. Ultrasound examination of the hip joint in newborns—an interobserver study

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Ultrasound examinations are usually thought to be rather operator dependent. Thus, the aim of the present study was to evaluate the interobserver variation of ultrasound measurements of the hip joint in newborns.

Material and methods: Both hip joints of 100 newborns were examined by two or three examiners. On a longitudinal scan, two distances were measured: from the acetabular floor to the lateral bony acetabular rim (a) and from the acetabular floor to the lateral joint capsule (b). The percentage of $a/b \times 100$ represents the coverage of the femoral head by the bony acetabular roof, and is called bony rim percentage (BRP). All three observers examined 42 newborns, whereas 58 babies were examined by two observers.

Results: The mean interobserver variation in BRP between examiner 1 and 2 was -0.9%, between 1 and 3 the mean difference was 0.4%, and between examiner 2 and 3 the difference was 1.2%. The 95% confidence limit (± 2 SD) for interobserver variation was approximately 8%.

Conclusion: The interobserver variation between three independent examiners in ultrasound measurements was moderate. Thus, our method based on femoral head coverage, seems to be adequate for screening of the hip joints in newborns.

231. Ultrasonography in the diagnosis of slipped capital femoral epiphysis

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The aim of the study was to evaluate the utility of ultrasonography in slipped capital femoral epiphysis (SCFE).

Patients and methods: Nine patients with SCFE were examined by ultrasonography, using longitudinal scanning from the anterior and lateral aspects. The anterior slip between the metaphysis and epiphysis (anterior physeal slip, APS) was measured, as was the distance between the anterior femoral neck and the joint capsule (anterior capsule distance, ACD) and the femoral anteversion angles.

Results: In 7 out of 8 patients with chronic SCFE, the slip was visualized by ultrasound. The mean APS was 6.0 mm. Grading of slip severity by ultrasound was consistent with radiographic assessment of percentage epiphyseal displacement. Two patients with chronic SCFE had moderately increased ACD of the affected hip, indicating hip joint

effusion. One patient with acute SCFE had a pronounced effusion and avascular necrosis of the epiphysis occurred. The anteversion angles of the affected hips were reduced as compared to those of the normal hips.

Conclusion: Ultrasonography was reliable in diagnosing both pronounced and mild degrees of slipped capital femoral epiphysis, whereas the diagnosis could be missed in hips with a minimal physeal slip. The detection of hip effusion could be of clinical importance, because a pronounced effusion, if left untreated, might cause vascular impairment to the epiphysis.

232. Classification in slipped capital femoral epiphysis—sonographic assessment of stability and remodelling

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In a prospective study of 26 hips in 21 patients with slipped capital femoral epiphysis (SCFE), a sonographic method of assessment was developed. In a hip with SCFE, sonography showed the amount of physeal displacement accurately without projectional errors, allowed staging of severity, and was sensitive in detecting changes in the epiphyseal position. It showed the early metaphyseal bony resorption as a start of remodelling. If any remodelling was present, the slip was at least of three weeks' duration. Hip joint effusion was demonstrated in 11 hips.

Serial sonography was more sensitive than roentgenograms in showing reductions in the epiphyseal displacement. The observed reductions were strongly associated with the observed hip joint effusions on admission. The initial slip improved with treatment in seven hips, all of which had effusion. The 15 hips without effusion had no reductions. After stabilization with pinning, the effusion did not recur in any case.

A new classification in acute, acute on chronic and chronic slips is proposed, based on the objective sonographic data. Joint effusion represents physeal instability or recent progression of the slip. Remodelling is a sign of chronicity. An acute slip is characterized by effusion, while a slip without effusion but with remodelling is designated as chronic. An acute on chronic slip is associated with both effusion and remodelling. Joint effusion in SCFE suggests that displacement may improve with closed treatment and such a slip should always be operatively fixed.

233. Transposition of the apophysis of the greater trochanter for reconstruction of the femoral head after neonatal septic arthritis of the hip

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Introduction: Various techniques have been used for the reconstruction of the femoral head by transposition of the apophysis of the greater trochanter in dislocated hips following femoral head necrosis after neonatal septic arthritis of the hip (Salvati 1984). Previous experimental studies have shown that joint cartilage develops after transplantation of apophyseal cartilage to a joint surface (Benum 1974). The aim of this paper is to present the results after subtrochanteric varus osteotomy with transposition of the apophysis of the greater trochanter to the acetabulum.

Patients and methods: Two patients were operated on, both were girls. One patient was operated at the age of 6 years, the other at one year. The hip joints were opened through an anterior approach. After removal of fibrous tissue from the acetabulum a subtrochanteric varus osteotomy was performed. The cartilage of the apophysis of the greater trochanter was trimmed after resection of the attachment of the gluteal muscles. After reduction of the apophysis in the acetabulum the osteotomy was fixated with Steinmann pins and the gluteal muscles were sutured to the lateral subtrochanteric region of the femur. The hips were immobilized with a spica cast for 3 months.

Results: Radiographic controls have shown the development of a new femoral head in both operated hips. In the girl who was operated at the age of 6 years, a femoral head has developed with full congruency to the acetabulum. The appearance of an almost normal joint space indicates persisting cartilage cover of the apophysis 7 years postoperatively. In the younger girl, an ossification nucleus is seen in the new femoral head 3 years after the operation. In both patients the operated hip is stable with good mobility and function.

Conclusion: Subtrochanteric varus osteotomy with transposition of the apophysis of the greater trochanter to the acetabulum may give good clinical results in luxated hips after femoral head necrosis following neonatal septic arthritis. Ossification of the central part of the apophysis and persistence of the peripheral layers of the cartilage may probably contribute to the development of a relatively normal femoral head.

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234. Injuries and risk factors for children during alpine skiing

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Introduction: Children have been reported to be over-represented among injured skiers. The skiing injury pattern in children below 15 years was therefore studied in 4 Norwegian ski resorts.

Material and methods: During the winter of 1985/1986; 59 injured children were recorded and compared with a randomly selected control population of 63 uninjured children.

Results: The most common injury sites were the lower leg (24%), knee (20%) and head (14%). Only 43% of the bindings released in injured children below 10, compared to 73% in injured children 10–14. In accordance with this, skiers less than 10 years old were more than twice as prone to lower extremity equipment related (LEER) injuries as older children. Fracture of the lower leg was the most serious of the LEER injuries, and accounted for 21% in the youngest children and 10% in the age group 10–14 years. In contrast, 18% of the older children suffered head injuries compared to only 5% of the youngest children. Beginners had an injury risk nine times the average, whereas intermediate skiers were underrepresented among the injured skiers. A skiing experience beyond 3 seasons reduced the injury risk. Nine percent of the injuries occurred during powder skiing whereas 26% of the injured and 46% of the uninjured population spent some time powder skiing on the same day.

Conclusion: Fractures of the lower leg were the most common skiing injury in the youngest children, whereas head injuries were common in the older. Being a beginner was the most important risk factor in skiing.

235. The hindfoot valgus in spastic children—a problem of treatment—why not an absorbable screw for fixation?

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Introduction: In children with spastic palsies the subtalar extra-articular arthrodesis is a complicated operation and may lead to failures if performed without fixation. In the

method described by Dennyson and Fulford the achieved position of the subtalar joint is secured by a metallic screw (1). Its disadvantage is the second operation for removal of the screw (2). In the treatment of adults we have achieved successful results in the fixation of cancellous bone fractures with absorbable screws (3).

Materials and methods: Sixteen arthrodeses were performed using the method described by Dennyson and Fulford in eight patients (age 5–15 years) with spastic neuromuscular disease because of valgus hindfoot deformity. Both feet were operated at the same time. On one side, a totally absorbable self-reinforced poly-L-lactide screw (Manufacturer: Bioscience Ltd, Tampere, Finland. Raw material: CCA, Biochem, Gorinchem, Holland: molecular weight of raw material 260 000) was used—allocated at random. On the opposite side the subtalar arthrodesis was fixed with a standard metal AO screw. The subtalar joint was exposed on the lateral side and reduced and fixed temporarily with K wire. Tendon lengthening and ligamentous dissection were performed where necessary. An additional short anteromedial exposure was done to insert the screw from talus into the calcaneus. Cancellous bone chips taken from iliac crest were packed in sinus tarsi covering the inserted screw at the bottom of sinus tarsi. A padded plaster cast was applied for three months. The minimum thread diameter of absorbable and metallic screws was 3.2 mm. The average follow-up time was 24 (18–37) months. The metallic screw was removed after one year on a second operation.

Results: The ambulatory status was improved and radiographic union of the arthrodesis occurred in all feet. Six patients had similar improvement on both sides, one had a better position of the subtalar joint on the side with a SR-PLLA screw and another on the side with a metal screw. Radiographic union was observed at the three months' check-up in all instances. At six months better radiographic union was observed on the side of the SR-PLLA screw in five patients—in two patients the union was similar on both sides. In one patient the radiographic union was less obvious on the side of the SR-PLLA screw at three and six months, but improved to be similar after one year. Enlargement of the drill canal around the metallic screw was observed in five arthrodeses and around the SR-PLLA screw in one. There was one postoperative complication. One SR-PLLA screw was too long, and was not cut at the primary operation—the excess tip remained under the skin and had to be shortened later. In one patient a transient tissue reaction was obvious without any effect on the final result. The absorbable implants used in this study may not cause late problems in fracture treatment or arthrodeses operations in children.

Discussion and conclusion: With self-reinforced absorbable implants developed by us great success in the treatment of fractures in children has been achieved (4,5). The self-reinforced absorbable PLLA screws may offer a great advantage compared with metal screws in fixation of extra-articular arthrodesis in children with a spastic neuromuscular disease. We conclude that self-reinforced absorbable implants are advantageous in the fixation of

cancellous bone fractures, osteotomies or arthrodeses, and especially in children.

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236. Poland's syndrome—a case report

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In 1841, Poland described congenital deficiency of the pectoralis major and minor muscles, associated with syndactyly. This syndrome is a spectrum, often involving chest wall and breast deformity as well.

The patient we present is the only one described in adult life in the Greek literature. She was 24 years old without any familial history. After a detailed clinical and radiological examination we noticed the following:

There was aplasia of both major and minor pectoralis muscles on the right side, associated with ipsilateral slight muscular atrophy of the shoulder girdle. The right mammary gland was also hypoplastic which, in combination with muscle aplasia, made that breast appear smaller and higher than the normal one. The whole right upper limb was also somewhat hypoplastic. In the right hand there was aplasia of the middle phalanx of the index and middle fingers, while the same phalanx was also hypoplastic in the fourth and fifth.

The patient had almost perfect function of her affected hand and had no problem with the rest of the limb. The range of motion of her right shoulder was normal, apart from a slight decrease in the strength of adduction and internal rotation. For this reason, no special treatment was proposed to the patient. It was quite remarkable that this was the first time she had consulted a doctor, having had no real dysfunction up to now.

237. A child born with three legs

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A female child was born in the "Mitera" maternity hospital in Athens in May 1991. The child was the third baby of a young couple (mother 24 years old, father 28). The siblings, 6 and 4 years old, showed no abnormalities. The pregnancy and delivery were normal. Birth weight was 3,700g. No medicines or radiographs had been taken during the pregnancy. There was no family history.

In the ultrasound scan which was done at the gynecologist's office in the 29th week of pregnancy the sex of the child could not be identified, but the meningocele was obvious.

The child was born with the following abnormalities:

a) A third leg, located in between the two normal legs and starting from the coccyx. The leg was shorter than the other legs, stiff, and the knee was in extension. Femur, tibia and foot with toes were easily identifiable and confirmed by radiography. The leg appeared to be articulated with the coccyx.

b) Meningocele in the lumbar spine.

c) Rectal atresia.

d) Recto-vesical fistula.

e) Genu recurvatum of the left knee with slightly shortened quadriceps.

f) The right leg was about 1cm larger in the calf than the left and the right foot 0.5cm longer than the left foot. The legs were equal in length.

The baby was thoroughly checked for other abnormalities. Neurological examination showed slight weakness of the muscles of the lower limbs. IVP showed normal kidneys and MRI showed the extension of the meningocele.

The child was operated on on the 15th day of life by an orthopedic surgeon (the author) and a pediatric surgeon.

The child is still under observation and we hope to see her walking without problems.

238. Bilateral congenital synostosis of the lunate and triquetral carpal bones—a case report of a rare malformation

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Congenital synostosis of the lunate and triquetral bones of the wrist (os lunato-triquetrum) is a fusion of the lunate with the triquetral bone. It is a rare malformation, but the most frequent anomaly of the wrist and nearly always asymptomatic. The coalition is mostly an isolated event or part of a syndrome of multiple anomalies.