

**PARTICIPANT REPORT FROM THE
BAT EDUCATIONAL PROGRAMME
IN PAEDIATRIC ORTHOPAEDICS**

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We were pleased to attend the second EPOS-EFORT instructional programme, directed by Bjarne Møeller-Madsen, Manuel Cassiano Neves and Franz Grill.

This very well prepared BAT traumatology course was held once again at the Speising Hospital in Vienna. The event took place on 12–14 October 2011, and focused on fractures in children, diagnosis, general fracture treatment, and the lower and upper extremities. All presentations were rich in knowledge and prompted considerable discussion. The speakers came from all over the Europe – Austria, Germany, France, Portugal, Denmark, Israel, Poland and the United Kingdom. Some of the speakers from the earlier BAT Course I returned for this latest event. The presentations started from 8 am, and were divided into lecture blocks according to topic. There were rich buffets between the sections, with a tasty lunch in the early afternoon. The day finished around 6 pm.

The first section was devoted to general knowledge about fractures in children. A.M. Weinberg (Germany) presented the biology of bone development and fracture healing. Bone remodelling occurs to a much greater extent in children than in adults owing to faster growth in the skeleton. Weight-bearing and mechanical stress influence the remodelling phase. The next speech was presented by Manuel Cassiano Neves (Portugal), who spoke on epidemiology. A Swedish study found that the probability of a child sustaining a fracture in childhood (up to the age of 16) is 42% for boys and 27% for girls.

Fractures are most common in boys, and upper limbs are affected in 82% of cases. Open, pelvic and spine fractures are very rare, with a rate of less than 0.5%. In the next presentation, Mark Paterson (UK) reiterated Wolff's law (bone is laid down where needed and resorbed when not needed) and Heuter-Volkman's law (compression forces inhibit growth and tensile forces stimulate growth). Bone remodelling is mostly applied to angulation deformities, and in bone overlaps and bone-shortening. Rotational deformities are corrected minimally. He gave examples of remodelling in all parts of the skeleton.

The presentations about diagnosis in children's traumatology started with an examination of x-ray diagnosis from Pierre Lascombes (France). When analysing x-rays, physicians must have a knowledge of normal x-ray variations. All of these variations are summarised in the "Atlas of Normal Roentgen Variants" by Theodore E. Keats. Lascombes also spoke about respect for Shenton's line. A CT scan (as addressed by Manuel Cassiano Neves) is used only in specific indications. It may pinpoint obscure fractures and can help to plan screw placement. An MRI (as addressed by Thomas Wirth) is the best option for an examination of the joints, cartilages, ligaments, muscles and other soft tissues. The presentation by Hemo Yoram, about the use of ultrasound in children's traumatology, closed the morning section. Ultrasound can be used to diagnose fractures because the sound waves are reflected by the cortical bone, but penetrate cartilage. Ultrasound is most reliable in the diagnosis of simple femoral, humeral and forearm diaphyseal fractures.

Dr. Hemo showed many clear examples and referred to his experience with different types of examination.

The afternoon section looked at the general treatment of fractures in children, birth fractures and CAN. Pierre Lascombes (France) warned that many children are treated by orthopaedic surgeons accustomed to dealing with adults. Only 7% of all traumas in children are resolved by surgery. The most common procedure to treat and fix the fracture is the ESIN method. It is important that the flexible nails are placed properly: two nails, placed face to face, and offering maximum flexibility at the fracture site in diaphyseal fractures. The thickness of the nail should be 40% of the medullary diameter. The most common birth fractures occur in the clavicle, humerus and femur. The clinical signs are decreased movement, crepitus, discoloration and pseudoparalysis. Clinicians must always consider infection, nerve injury or dislocation when pseudoparalysis is present. The child abuse presented by Franz Grill (Austria) occurs primarily in children under the age of seven. Clinical findings that suggest abuse are fractures of different stages, fractures that are not adequately explained, occult fractures, fractures before walking age, and fractures of the ribs, pelvis or skull. Unfortunately, 15% of unrecognised abuse results in death.

Thursday morning's session was devoted to trauma in the shoulder, upper arm and elbow. Clavicle fractures were presented by Jaroslav Czubak (Poland). Obstetrical clavicle fractures are healed conservatively. Displaced, irreducible, and truncated fractures, or where there is the potential for skin penetration or neuro-

vascular injury, and open fractures, are indicated for surgery. The percutaneous FIN method, from the lateral to the medial clavicle, is one of the options for surgery. The next speech, from Thomas Wirth (Germany), was about glenohumeral dislocations. This very rare trauma happens in 0.01% of all injuries in childhood. Treatment is principally conservative for the first traumatic, and all multidirectional dislocations. Adult patients may be treated with surgery, either arthroscopically or open.

According to Pierre Lascombes (France), the surgical treatment of proximal humerus fractures is indicated if 100% translation or varus of more than 70 degrees is present in children under 5 years of age, 40 to 70 degrees of varus when a child is between 5 to 12 years of age, and 50% of translation or more than 40 degrees of varus in children older than 12 years of age. We must realise that 80% of humeral growth comes from the proximal growth plate, so consequences can be disastrous but the potential for remodelling is very high. Surgical treatment options are staples, pin fixation or retrograde FIN, which is used the most. Diaphyseal humeral fractures are remodelled mostly in dislocations ad latus (side to side), ad contractionem (up to 1-2cm) and ad axim (15 – 20 degrees). Beware rotational deformity, although this rarely results in a functional problem owing to hypermobility in the shoulder. The ESIN technique is the method of choice.

Supracondylar fractures (Mark Paterson, UK) are very common in children between 4-8 years of age.

The well-known Gartland classification is used to determine the type of dislocation.

Apparently undisplaced and minimally displaced fractures are very insidious, and should not be underestimated. Internal rotation with tilt in the distal fragment causes late-onset cubitus varus, which is not a growth disturbance and should be corrected for example by means of a French osteotomy. The conservative treatment process is traction, medial shift correction, flexion, external rotation and pronation. When the dislocation is unstable, the divergent K wire fixation is very stable and the best option. Open reduction is indicated in neurovascular and irreducible fractures.

Considerable attention was focused on the “pink pulseless hand”. The literature about this problem is confusing. If the pulse is absent upon arrival and PPH is after reduction, observe very closely, watch for compartment and explore with a vascular surgeon at the first sign of compromise. If a pulse is present upon arrival, with PPH after reduction, remove the dressings and extend the elbow. If it is possible that an artery is trapped, explore in the operating theatre. The presentation by A. M. Weinberg (Austria) looked at epicondyle and apophyseal fractures. These fractures do not disturb growth. Elbow dislocations (Manuel Cassiano Neves, Portugal) are not so common in children. The mechanism of dislocation is no bony lesion in type 1, avulsion of the medial epicondyle in type 2 and complex dislocation with radial head fracture in type 3. The pitfall in type 2 and 3 is medial epicondylar entrapment, with cubitus valgus as a late complication. Open surgery should be avoided in radial head and neck fractures (Pierre Lascombes, France) to avoid avascular necrosis of the proximal radius. When fracture of the radial head or neck occurs, an x-ray of the

distal forearm should be taken to exclude possible trauma of the wrist. Pierre Lascombes (France) showed an elegant reduction using the ESIN method, which is indicated in tilts of the radial head by more than 45 degrees. The tip of the flexible intramedullary nail reduces the radial head by a delicate method. Fractures of the proximal ulna (incl. coronoid process and olecranon) are very rare. Treatment is mostly conservative ORIF, indicated only in major irreducible fractures and in Reagan Morrey type III.

The afternoon section concentrated on forearm and hand trauma. Manuel Cassiano Neves (Portugal) divided distal fractures of the forearm into epiphyseal, metaphyseal and Galleazzi fractures. The problem with an epiphyseal fracture is that growth may be arrested. Conservative treatment is the established course of action except for open fractures, articular fractures and neurovascular impairment. Metaphyseal fractures may present as different types – green stick, torus, and displaced fractures. The indications for operative treatment are the same as for epiphyseal fractures, plus angulation displacement of more than 20 degrees. Conservative treatment includes 4-6 weeks of a short cast in stable fractures, and six weeks of a long cast in unstable fractures. The elegant method of percutaneous pin reduction and fixation which was described and demonstrated by Kapandji may be used.

In Monteggia fractures, which are classified according to Bado, it is essential that the diagnosis is not missed. Shenton’s line (radial head and capitulum radii in one line) must be respected.

The best choice is the ESIN method for the ulna, and the radial head will often reduce spontaneously. Neglected Monteggia fractures most commonly occur because the bowing of the ulna is missed. These missed fractures with radial head dislocation can be treated by an ulnar osteotomy, often with no ligament repair. Forearm shaft fractures (Thomas Wirth, Germany) are common in children. The principles of treatment are conservative in children aged six and under, and the ESIN method in children aged seven and over. Plate or external fixation methods are indicated only in rare conditions. The take-home message from Jaroslaw Czubak (Poland) was little angulation and no rotation is acceptable in metacarpal fractures. In fractures of the scaphoideum, if in doubt, a cast should be given and closed reduction with cast is the method of choice.

The last day was dedicated to lower limb trauma, beginning with proximal areas. Pelvic trauma and fractures (Manuel Cassiano Neves, Portugal) are very rare, but represent a serious impairment to the body. Always evaluate the child in general, because 70% of associated injuries are not orthopaedic. The examination (inlet and outlet view) can be managed after haemodynamic stabilisation, for example using a C clamp. The most frequently used classification is that drawn up by Torode and Zieg. Pelvic fractures are mostly treated conservatively. Only in pelvic asymmetry (more than 1.1 cm) and articular separation (more than 2mm) is open reduction indicated. Proximal femur fractures are also very uncommon, so there is little knowledge of the algorithms for treatment. The treatment concept according to Thedy Slongo (Switzerland) is the

following: 1) undisplaced fractures – aspiration of haemarthrosis and lag-screw or fully-threaded K-wire fixation; 2) completely displaced fractures – quick, definite, gentle open reduction with haematoma evacuation, stabilisation by LCP plate and strict follow-up checks 3-5 years later.

Femoral shaft fractures (Thomas Wirth, Germany) are very suspicious if a child is not yet walking, and CAN should be considered. Conservative treatment by spica cast or in combination of traction is indicated. The treatment indications are highly controversial in the grey zone (4-6 yrs). The ESIN technique dominates at this age group nowadays. The method of choice in children over the age of six is ESIN. Plating should be avoided, and external fixation is used only in open fractures. Physeal fractures in the distal femur are more frequent than lesions on ligaments. Trauma in the distal femoral physis mostly results in growth disturbance and deformities owing to the high growth potential of the distal femoral plate. Undisplaced fractures are treated conservatively. The surgical treatment of choice is pin fixation. Avoid plates if possible.

The next presentation after the coffee break was about knee soft-tissue injuries, by Prof. Thomas Wirth (Germany). ACL ruptures received considerable attention. ACL reconstructions prevent secondary meniscal lesions, as demonstrated by medium-term results. The extraphyseal-intra-articular ACL reconstruction technique is a good alternative to the more common transphyseal techniques in young children. The criteria for avoiding growth disturbances are no thermic damage in the

growth plate, no bony parts within the physis, penetration of the growth plate must be as central as possible, there can be no metal implants that cross the plate, the average diameter of the drill holes must be selected according to age of the patient and size of the knee, drill holes should be perpendicular to the physis and there should be no damage to the perichondral structures.

In his presentation on fractures of the tibia and its shaft, Mark Paterson (UK) warned of residual valgus. Tibia valga (Cozen's deformity) occurs owing to a loss of reduction, the tethering of the fibula, damage to the perichondral ring and differential medial/lateral growth. Specific fractures, such as toddler and stress fractures, were broadly discussed. Most tibial fractures in children can be treated conservatively. ESIN is the method of choice if surgery is needed. Always watch for compartment syndrome as a possible serious complication.

Problems with Salter II fractures of the distal tibia (Pierre Lascombes, France) are irreducibility and trapped periosteum. Extensor retinaculum syndrome, with compression of the deep peroneal nerve, must be considered and treated in these fractures. Tillaux fractures (Salter III) are caused by open lateral physis in adolescent patients and should be fixed with screws. Triplane fractures (Salter IV) are mostly displaced and must be corrected using the ORIF method. In medial malleolus fractures (MacFarland fractures), there is a high risk of epiphyseodesis. When epiphyseodesis occurs, there are two options: 1) desepiphyseodesis (epiphyseolysis, resection of bridge – cement or fatty tissue, 1cm lengthening,

correction of varus) or 2) complete epiphyseodesis with correction of deformity and lengthening at the age of ten or contralateral epiphyseodesis at the age of 14. Fractures of the hind foot are very rare. Only articular fractures are indicated for surgery. It is very important to know the blood supply to the talus because of the high risk of osteonecrosis.

The workshops which were an integral part of every day were highly informative once again. The Taylor spatial frame workshop led by Clifton Phiri and Christof Radler was both instructional and interactive, giving us an opportunity to try the hexapod system to correct deformities in artificial shaft bones. Pierre Lascombes delivered a lively and interactive lecture about the ESIN method in other of the workshops. The pitfalls of this method were pointed out. Each of us had an opportunity to implant the flexible intramedullary nails in artificial shaft bones. New instruments in paediatric orthopaedics were presented in the large display room by OrthoPediatrics. Case presentations from participants were very educational and broadly discussed. These presentations also delivered a great deal of important advice about the treatment of special trauma conditions.

The EPOS-EFORT BAT programme more than fulfilled the expectations of the 100-plus attendees. Maintaining the quality of presentations from the first BAT course, this second course focused on paediatric traumatology. The core curriculum in paediatric orthopaedics will form the heart of the March 12 basic course on disorders of the upper limb and knee, musculoskeletal infections and the spine.

We can look forward to another quality programme with excellent speakers amid the outstanding facilities of the Speising Hospital in Vienna. Please do not hesitate to apply for the third and last of these Vienna instructional courses.

