PEDIATRIC ORTHOPAEDIC SURGERY – THE SPECTRUM

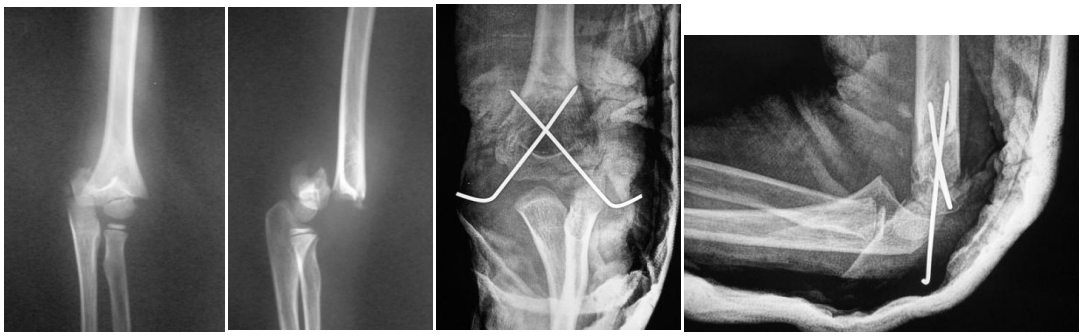
A child's musculoskeletal problems are different from those of an adult. As children are still growing, the body's response to injuries, infections, and deformities may be quite different than what would be seen in a full-grown person. Sometimes, what is thought to be a problem in a child may just be a variation of growth that will resolve with time. A good example of this is 'intoeing' in a toddler. Some bone and joint problems in children do not even occur in adults. On the other hand, an apparently innocuous blunt trauma over the knee may result in a progressive deformity around the joint over time. This can happen due to damage to the 'growth plate' near the joint of the long bones, unique to a growing child. Moreover, the evaluation and treatment of a child is usually quite different than for an adult, even for the same problem.

It is imperative to properly evaluate and treat Pediatric Orthopaedic disorders leading to musculoskeletal (bone, joint, or muscle) problems in a child who is still growing. This includes newborn babies through teenagers and young adults. The unique nature of medical and surgical care of such children is learned from advanced training and experience in practice.

A Pediatric Orthopaedic Surgeon deals with various disorders affecting the musculo-skeletal system in a growing child, and hence the age spectrum he is associated with ranges from new-borns to adolescents or young adults. The conditions that he manages can be classified into **Traumatic & Non-Traumatic**. The latter can again be classified into **'solitary' and 'multi-disciplinary'** conditions.

All cases of Pediatric Orthopaedic Trauma, both acute and chronic, that visit this tertiary hospital in the triage or the out-patient clinics are managed by him. The

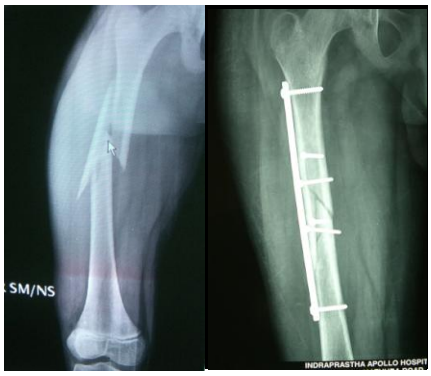
commonest acute trauma that is treated is a **supracondylar fracture of the humerus**. Most grade III fractures are treated successfully by closed reduction and pinning.



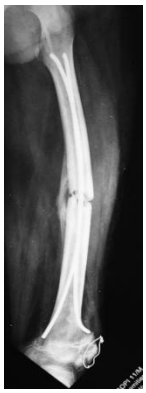
Supracondylar # Humerus Grade III

Closed Reduction and Pinning f/b POP – good result

The other common conditions that are managed are **fractures of the shaft of long bones**, like radius-ulna, femur or tibia. **Monteggia fracture dislocations** and **fractures of the shaft of femur** in an older child warrant appropriate surgery.

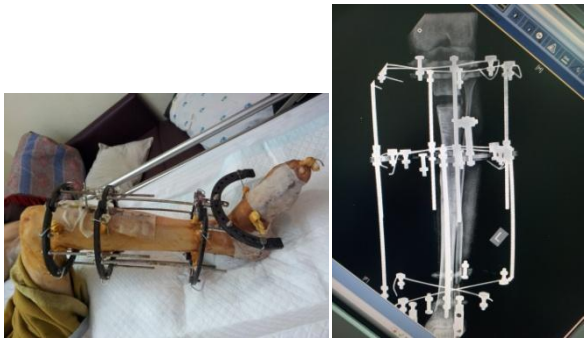


Comminuted # Shaft Femur treated with inter-fragmentary screws & a neutralizing plate



Transverse # of Femoral Shaft in an 8 year old operated using Titanium Elastic Nails

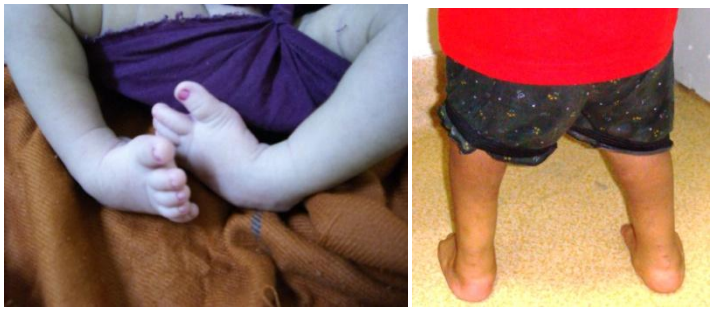
Chronic trauma improperly managed, leading to deformities like **cubitus-varus** or **Genu valgum/varum**, or **limb-length discrepancies** due to damage of the growth plate or physes, are managed through appropriate surgeries on a regular basis. The use of the *Ilizarov Ring Fixator* in selected cases, for deformity corrections and limb lengthening gives good results.



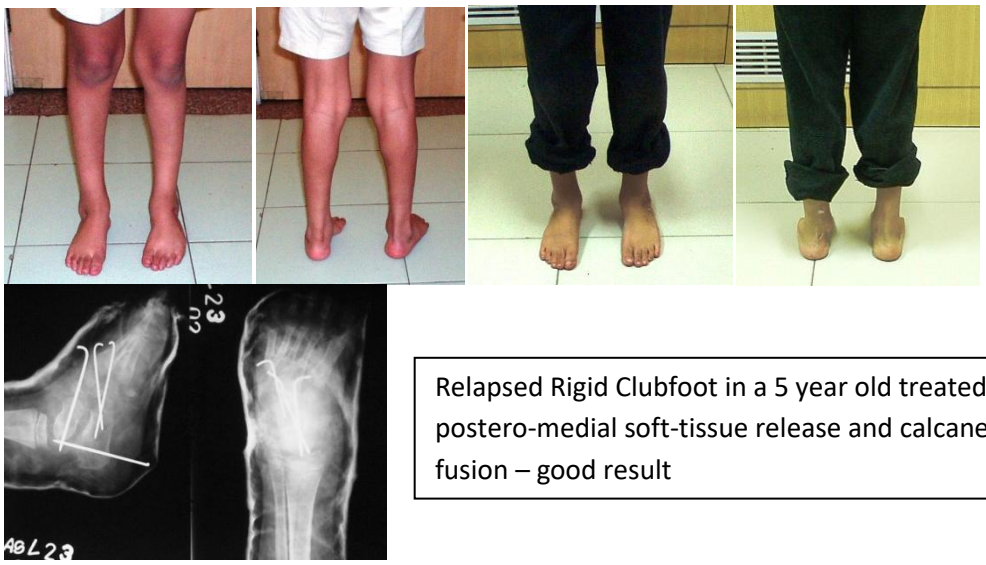
Tibial lengthening by Ilizarov's Ring Fixator

Complicated polytrauma with skin loss, leading to loss of function, have been managed depending on the severity of the condition, in the best possible way.

In non-traumatic cases, the commonest solitary disorder is an **Idiopathic Clubfoot (Congenital Talipo-equino-varus)**. The *Ponseti method of manipulation & casting* accepted world-wide, is the standard treatment followed in most cases during infancy. Older children with rigid clubfeet as well as the teratological vatiety require appropriate surgery.

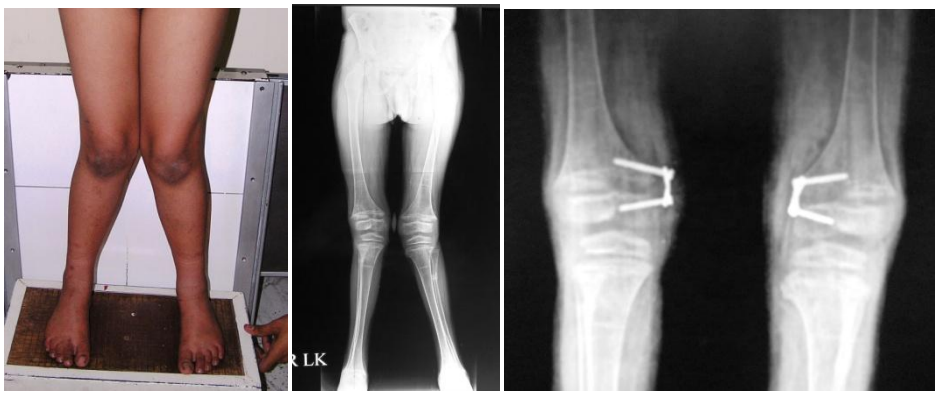


Rigid Bilateral Clubfeet in an infant treated by Ponseti method of manipulation and casting – good result after 1 year (Pirani 0)



Relapsed Rigid Clubfoot in a 5 year old treated by postero-medial soft-tissue release and calcaneo-cuboid fusion – good result

Others include: **Progressive genu valgum and varum** due to various causes that need to be properly evaluated and treated. In children requiring surgery and with adequate growth remaining, one can resort to minimal surgery with less morbidity, using *growth modulation techniques (8 plates)*.

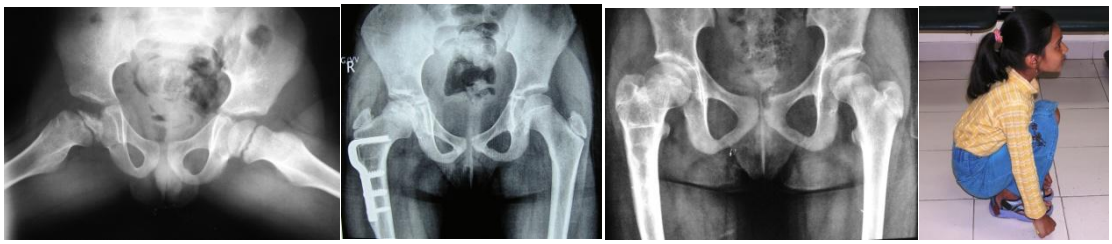


Progressive bilateral Genu valgum in an 8 year old treated by Growth Modulation Plates

Deformity corrections in patients closer to skeletal maturity require conventional corrective osteotomies and fixation of the same.

Congenital pseudarthrosis of tibia is a challenge.We have used *bone transport using Ilizarovalong with bone graft* successfully in a few. Usage of *vascularized*

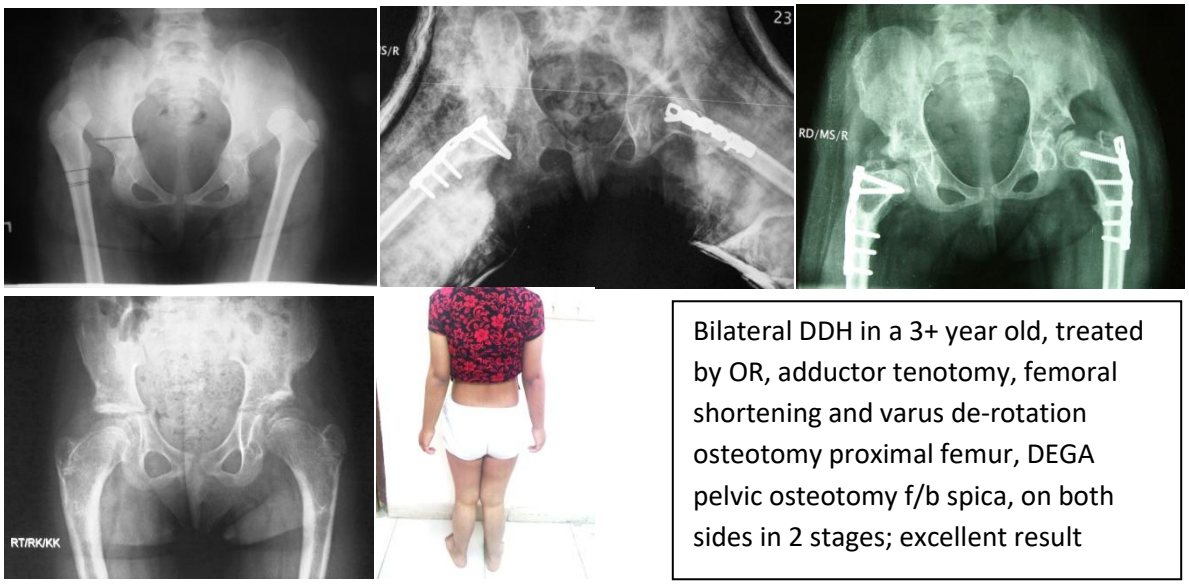
fibular graft in selected cases gives encouraging results. We have long-term follow-up of managed cases of **Perthes' disease**. Appropriate surgeries (*VDROs, Shelf procedure, etc*) in selected cases yield good results after the healing stage.



Perthes stage II-b treated by 'containment surgery' (Varus De-rotation Osteotomy Proximal Femur) – Good Result

Cases of **congenital coxa vara**have been successfully operated using techniques which decrease the chances of recurrence.

We have a large series with long adequate follow-up of cases of **DDH (Developmental Dysplasia of Hips)** in varying age groups. Overall good results are reported, even in cases which have required the 'whole works' (*Open Reduction, Adductor Tenotomy Hip, Proximal Femoral osteotomy and fixation and acetabular osteotomy (DEGA Incomplete Ilial Osteotomy) f/b hip spica.*

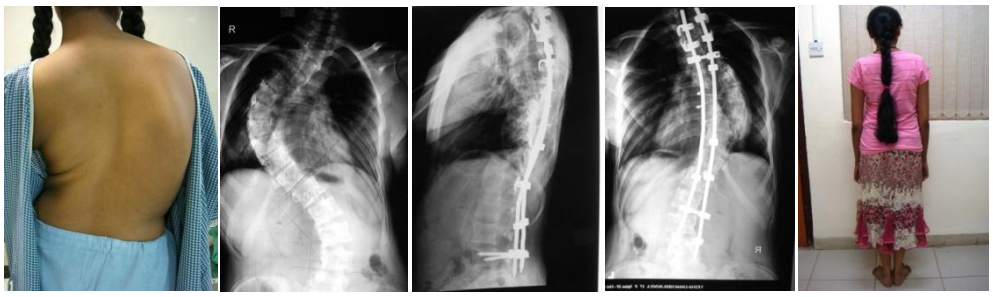


Bilateral DDH in a 3+ year old, treated by OR, adductor tenotomy, femoral shortening and varus de-rotation osteotomy proximal femur, DEGA pelvic osteotomy f/b spica, on both sides in 2 stages; excellent result

Proximal Focal Femoral Deficiencies (PFFD) are not very common we do manage these in various age groups. The use of *Ilizarov ring fixator* in an older child of PFFD has been used successfully to achieve the much needed lengthening.

Our spectrum includes**Slipped Capital Femoral Epiphyses (SCFE).** We manageacute unstable slips like sub-capital femoral neck fractures.Most of the stable slips are managed by *pinning in situ*, whereasthe deformed hips nearing skeletal maturity are assessed and appropriate surgery focusing on restoring useful movement range & function is undertaken.**Safe Surgical Dislocation** has emerged as new modality to re-shape deformed hips.

Scoliosis (Congenital, Idiopathic, Neuromuscular & dystrophic) fall under the treatment spectrum The principle that one follows in all these curves in order of decreasing priority are Fusion (arrest), Alignment (Balance) and Correction. With the advances in types of spinal instrumentation which offer a lot of flexibility, better correction of scoliosis is possible (supplemented by other techniques) depending on the age of the child, cause, and magnitude & rigidity of the curve, in selected cases.

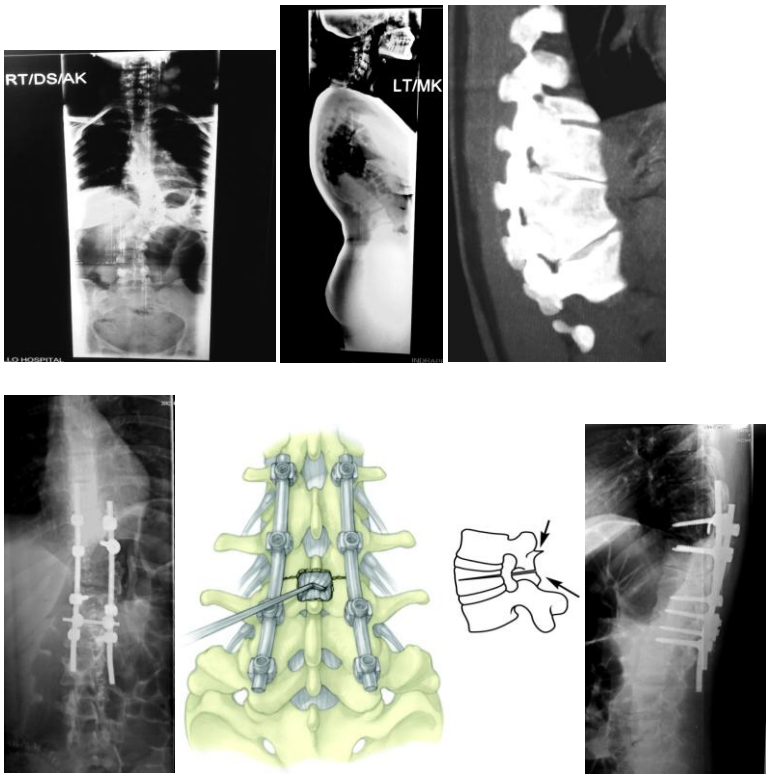


Dorsal Scoliosis right side (King type 3) in a 13 year old treated by Posterior Spinal Fusion with Instrumentation. Post op. clinical snap after 3 years shows a good head-trunk balance with a reasonable correction

In operating congenital curves, it is mandatory that a thorough assessment of the whole spinal axes, urogenital system and heart function is made in these patients before undertaking definitive treatment.

Early Onset Scoliosis (EOS) and **Chest Wall deformities** are relatively tedious and difficult to manage. With the background of a reputed multi-speciality set-up such as Indraprastha Apollo Hospitals that has state-of-the-art Pediatric ICU and anaethetic back-up, coupled with appropriate training, it only helps in making the whole treatment more streamlined, thereby increasing the probability of a good outcome. Repeated regular surgical intervention is necessary to carry forward the management of EOS, and this needs to be understood by the family.

Kyphosis, both Congenital & Acquired (Pott's spine, for instance), are managed using appropriate principles according to age & severity. *Pedicle Subtraction Osteotomy (PSO)* is a very useful technique which he uses in treating selected Kypho-scoliotic older children & adolescents.



A 14 year old male with a lower dorsal kypho-scoliosis showed a fused D10-11 vertebrae. Treated by Pedicle Subtraction Osteotomy (PSO) with pedicle screw fixation. An illustration is also enclosed. PSO is an effective procedure in selected cases of adolescent kyphosis.

Spondylolysis requires careful investigation and management (surgical or non-surgical) depending on the age of the child mainly. **Spondylolisthesis** once detected usually in adolescent age group warrants surgery in the form of *postero-lateral fusion* with appropriate instrumentation. **Sprengel's shoulder** is also

treated by an appropriate surgery focusing on better cosmesis and a reasonably better function.

Torticollis (both congenital muscular and bony) has been managed appropriately in large numbers. *Bipolar release of Sternocleidomastoid* coupled by a focused rehabilitation and appropriate use of cervical collar has given good results even in older kids.

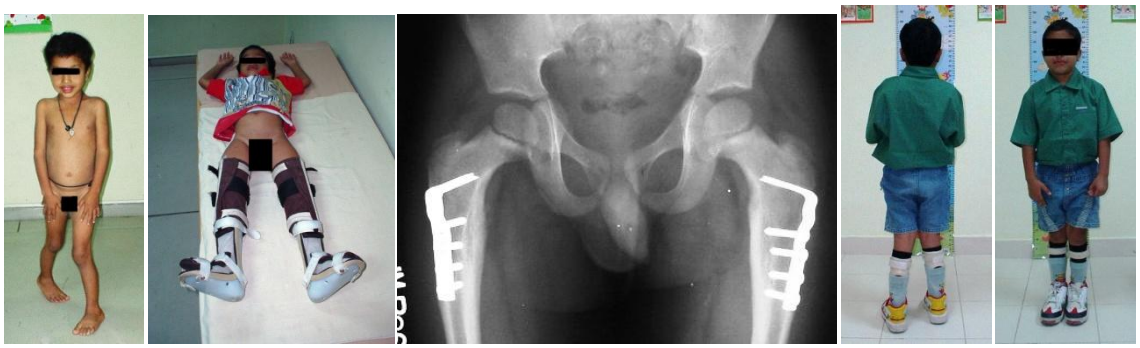
Kleippel-Feil's Syndrome requires a thorough assessment and needs to be tackled according to the nature of deformity and severity of torticollis and presence of any significant uro-genital anomaly. **Solitary bone cysts like unicaramel & aneurysmal** have been managed extensively depending upon the site, size and the symptoms that they cause. Pathological fractures due to these, need to be treated as an emergency and warrant curettage, bone grafting and appropriate fixation.

Limb deficiencies like fibular and tibial hemimelias need proper evaluation and the treatment objective ranges from *limb-saving multiple surgical procedures having more morbidity, to limb sacrificing therapeutic amputations followed by appropriate fitting of prosthesis*. **Radial Hemimelias or radial club hands** are common upper limb deficiencies that he comes across. The treatment broadly consists of *Centralization procedure* around 1-2 years of age, followed by *pollicization* when necessary, after 2 years of age. *Ulnar lengthening* nearing skeletal maturity can be undertaken to equalize limb lengths.

Hand and foot anomalies like polydactyly, syndactyly and macrodactyly are appropriately managed surgically.

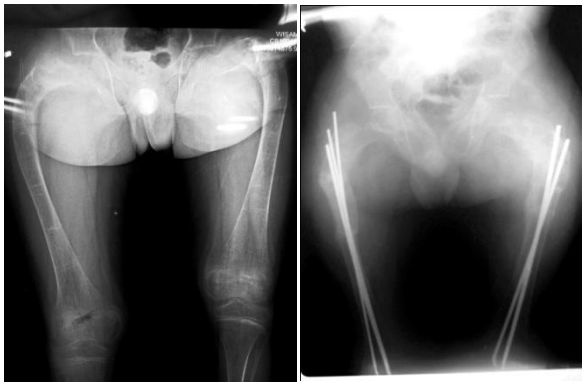
In non-traumatic multi-disciplinary conditions, the commonest condition that we largely manages is **Cerebral Palsy**. It is the spastic variety that warrants a surgical interference somewhere between 4 to 9 years to achieve a balance between *multi-level surgeries* (soft tissue & bony), and child's adaptation to this corrected environment and consolidating on the same with the continued help of appropriate orthosis and aids, and focused physiotherapy, occupational therapy and gait training. Before starting treatment, we invariably counsels the family in terms

of defining the goals of treatment realistically and thoroughly explains the prognosis for the same.



A spastic diplegic cerebral palsy boy aged 6, underwent multi-level surgeries (both bony & soft-tissue). Compliance with appropriate orthosis along with focused rehabilitation including gait training produced good posture and an enormous improvement in gait. Such aggressive approach in treatment works well in selected cases.

We also tackle**Osteogenesis Imperfecta (OI)**. The management is a combination of medical treatment focusing on future fracture prevention, and correction of existing deformities through appropriate surgery using intra-medullary fixation.



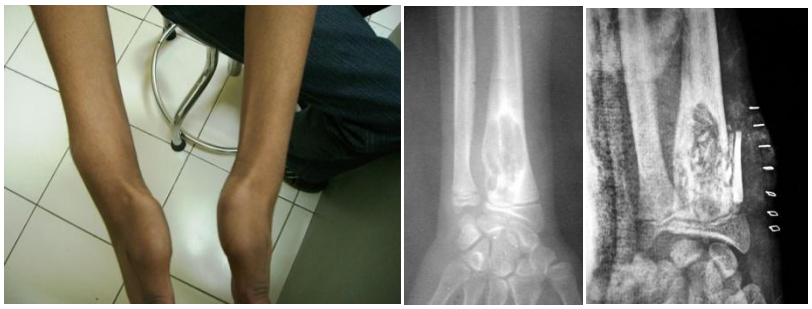
Completely deformed femora in a 9 year old boy with OI, treated with correction using multiple osteotomies and an intra-medullary fixation. A concomitant medical treatment in order to prevent further fractures is also given. Rehabilitation has an important role.

We currently use *expandable intra-medullary fixation* in selected cases with good results.

Arthrogryphosis isanother condition which is commonly managed by us. The spectrum of presentation is wide and each case warrants a proper evaluation and treatment is tailored to individual needs and the requirements of the family. It is very important to realize that these kids have normal intelligence and all efforts should be channeled in providing the best possible treatment focusing on improving

function. This is a combination of appropriate surgeries, splint support and rehabilitation. **Myelomeningocoele sequelae** are very difficult problems warranting not only our inputs but also of pediatric urologist, neurosurgeon, neurologist, orthotist and physiotherapist. Improving the quality of life should be the focus in which appropriate orthopaedic surgeries are performed to better function. Sensory loss has a big role to play in determining the course of management. Inputs of a Plastic Surgeon are sought when necessary to provide any flap cover.

We have experience in managing **malignant bone tumours like Osteosarcomas** of weight-bearing long bones, along with the inputs of the Pediatric Oncologist. With the advent of newer effective chemo-therapeutic drugs, more emphasis is towards *limb-sparing surgeries and fitting of modular prosthesis*. **Bone Cysts due to Fibrous dysplasia** especially in the weight-bearing bones can be tricky to manage. They are best managed by intra-medullary fixation and bone grafting coupled by medical treatment. There can be other causes as Unicaramel Bone Cysts (UBC) or Aneurysmal Bone Cysts.



An aneurysmal bone cyst of lower end radius in a 10 year old treated successfully by curettage & bone grafting

We have come across cases of **Albright's syndrome** which presented with femoral deformities and pathological fractures. They have all been managed surgically using intra-medullary fixation, along with the services of the Pediatric Endocrinologist.

Post-polio residual paralysis is still seen and needs to be evaluated well to plan out the treatment. The objective is to improve function by trying to minimize the number of aids and supports used, improve posture as well as the gait and strive to make the person as independent as possible.

The above lists the spectrum of Pediatric Orthopaedic cases that a Pediatric Orthopaedic Surgeon comes across and manages commonly at the Indraprastha Apollo Hospitals. There are several other disorders in his field which are tackled that are not mentioned here. Children with complex pediatric problems are best managed by a medical-surgical (multi-disciplinary) team approach.

Children are not just small adults. They cannot always say what is bothering them, or answer medical questions, or be patient and cooperative during a medical examination. A Pediatric Orthopaedic Surgeon knows how to examine and treat children in a way to help them be relaxed and cooperative, and has the widest range of treatment options backed by the most extensive and comprehensive training, and hence the expertise in dealing with growing children and treating their musculoskeletal problems. He/she also appreciates the worry that goes with having a child with a musculoskeletal problem, and has experience in communicating with anxious family members.

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