ISSN: 2249 - 9008

The Official Journal of Paediatric Orthopaedic Society Of India

PORS

Vol. 1 Dec 2011 Issue 1

Paediatric Orthopaedics and Related Sciences

www.posi.in/

Paediatric Orthopaedics and Related Sciences

Paediatic Orthopaedics and Related Sciences (PORS) is a peer reviewed official publication of the Pediatric Orthopedic Society of India.

EDITORIAL OFFICE:
Dr. Vrisha Madhuri,
Editor Paediatric Orthopaedics and Related Sciences,
Paediatric Orthopaedic Unit,
Christian Medical College,
Ida Scudder Road,
Vellore- 632004,
Email: madhuriwalter@cmcvellore.ac.in
Phone: 0416–2282081
Fax: 0416 – 2232035.

Published on behalf of :
Paediatric Orthopaedic Society of India

Printed by:
K.Vidyadhar Nayak,
No. 11/14. Embassy center,
High Grounds,
Bangalore - 560001.

Advertising policy:
Advertisements are invited for display in PORS journal. For enquiry please contact the editorial office.

Change of address:
The journal is circulated to the registered members of the POSI with addresses in India and is also available for free download in the official website of POSI (www.posi.in) Any change of address should be intimated to the editorial office of PORS for proper delivery of the hard copy of the journal. The journal is not sent to previously undelivered addresses.

INDEX

Editorial

2010 marks the centennial anniversary of the first report of Perthes disease by Legg. In this time the Orthopaedics Clinics of North America's issue and the Journal of Paediatric Orthopaedics supplement have consolidated the advances made in the understanding of the etiopathology and treatment of the disease and its sequelae therefore developing a consensus around the world on principles of management of disease.[1]

Perthes management aims to prevent head deformity during the stages of the disease before late fragmentation, which is achieved by containment - either by conservative or operative means. In the late fragmentation stage the goal is to correct hinged abduction and minimize head deformity.[1]

Two factors are key to determining prognosis –Age and Extrusion. Children under 5 years of age rarely need treatment irrespective of severity and needs only observation for extrusion which, though rare, would require containment treatment and thus needs to be picked up by serial follow-up. Children between 6 to 8 years require staging (greater than 50% involvement) and follow-up for extrusion to determine need for containment. An extrusion of greater than 20% requires containment early in the disease (before late fragmentation). After 8 years containment is indicated straight away after diagnosis.[1] After 12 years, recommendations suggest treatment as in adults with avascular necrosis of the femoral head.

Extrusion is best prevented by containment in severely involved or older child and surveillance and containment if greater than 20% in the younger child.[1]

Treatment in the late fragmentation stage focuses on reducing deformity. Containment when possible is considered with decreased expectation. In the presence of irreducible hinge abduction a valgus osteotomy is accepted as a means to decreasing symptoms of impingement.[1]

Approach to the healed stage of disease focuses on minimizing pain, impingement and defer the onset of secondary osteoarthritis. Treatment is also indicated for trochanteric overgrowth, coxa breva, impingement, acetabular roof insufficiency and symptomatic osteochondritis dissecans.[1]

Newer modalities include anti-inflammatory drugs and factors which promote bone anabolism and retard bone resorption. Anti-resporptive agents such as bisphosphonates and experimental drugs such as denosumab act by preventing necrotic bone resorption and collapse. Synergistic strategies with Bone Morphogenetic Proteins (BMP) are being explored in animal models.[2]

Recently, there have been two interesting studies with implications on the role of growth factors and antiresorptive agents in Congenital Pseudarthrosis of Tibia (CPT). Cho et al[3] showed that though the mesenchymal stem cells isolated from the fibrous hamartoma of CPT express the mRNA of BMP2, BMP4 and their receptors, they do not undergo osteoblastic differentiation in response to the exogenous rhBMP-2 (recombinant human BMP-2). The fibrous hamartoma cells are also more osteoclastogenic than the normal tibial periosteal cells. The authors suggest that the first finding may explain the lack of successful response to rhBMP-7 in one study and rhBMP-2 in another study. The second finding forms the rationale for exploring the role of bisphosphonates in congenital pseudarthrosis of tibia.

Schindeler et al[4] in a preclinical study using neurofibromatosis type 1 deficient mouse model with fracture tibia found that three quarter did not heal when treated with locally delivered BMP2. This non-union rate was halved by the addition of zolendronate postoperatively indicating the role of antiresorptive drugs in this disease condition.

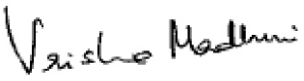
Editorial

These studies increase the understanding of the etiopathogenesis of congenital pseudarthrosis of tibia and open the avenues for new therapies.

The POSITIVE in its new avatar "Paediatric Orthopaedics and Related Sciences" (PORS) the official journal of Paediatric Orthopaedic Society of India is a peer reviewed journal.

I request contributions of original articles, review articles and case reports from the readers in the format mentioned in the instructions for submission.

Vrisha Madhuri



References:

1) Joseph B, Price CT. Consensus statements on the management of Perthes disease. Orthop Clin North Am 2011;42:437-40.

2) Little DG, Kim HK. Future biologic treatments for Perthes disease. Orthop Clin North Am 2011;42:423-7.

3) Cho TJ, Seo JB, Lee HR, Yoo WJ, Chung CY, Choi IH. Biologic characteristics of fibrous hamartoma from congenital pseudarthrosis of the tibia associated with neuro fibromatosis type 1. J Bone Joint Surg Am 2008;90:2735-44.

4) Schindeler A, Birke O, Yu NY, Morse A, Ruys A, Baldock PA, Little DG. Distal tibial fracture repair in a neurofibromatosis type 1-deficient mouse treated with recombinant bone morphogenetic protein and a bisphosphonate. J Bone Joint Surg Br 2011;93:1134-9.

TNOA Pediatric Orthopedic Session Announcement

The annual Tamil Nadu Orthopaedic Association (TNOA) meeting (9th to 11th February 2012) at Christian Medical College, Vellore, has 2 paediatric orthopaedic sessions of interest to paediatric orthopaedic surgeons and residents. On 9th afternoon there is a paediatric trauma workshop and on 11th morning there is a half a day highly educative paediatric session. The faculty includes Dr. Theddy Slongo (Switzerland), Dr. Unni Narayanan (Canada), Dr. Bruce Foster (Australia), Dr. Alwyn Abraham (UK), Dr. Benjamin Joseph and other regional faculty.

Please visit www.tnoacon2012vellore.org for further details.

Outcome evaluation of clubfoot treated by postero-medial soft tissue release through the hemi-Cincinnati incision: A mid-term follow-up study

Amarinder Singh, Hitesh Shah

Abstract: The outcomes of surgical treatment by postero-medial soft tissue release through the hemi-Cincinnati incision of 67 idiopathic clubfeet were assessed at a mean age of 8.5 years. Morphological, functional, radiological and subjective outcomes were assessed on a scale with a maximum of 75 points for each of these domains. The mean morphological, functional, radiological and subjective evaluation scores were 71 ± 4.6, 60 ± 7, 36 ± 10 and 72 ± 3 respectively. Thirteen children complained of mild pain after strenuous physical activity. All children had some loss of motion of the ankle. Forty three of the 45 parents (or patients) expressed satisfaction with the outcome of treatment. Fifty-eight feet did not require any additional surgery following the index operation while nine feet required additional surgery for relapse. There was good correlation between functional and morphological scores and moderate correlation between radiological and morphological scores. Subjective scores were poorly correlated to all other scores.

Amarinder Singh, Hitesh Shah
Pediatric Orthopedics Service
Kasturba Medical College, Manipal
hiteshshah12@gmail.com

INTRODUCTION

Though a majority of idiopathic clubfeet can be managed effectively by non-operative means, surgery is warranted for a few, either for failure of non-operative treatment or for late presentation.

Among the various soft tissue procedures for clubfoot treatment are posterior release[1-3], postero-medial release[4] and complete subtalar release.[5] Our approach has been to reserve posterior release for hind-foot equinus with fully corrected varus and adduction deformities. We rarely undertake complete subtalar release where in all components of the deformity are very severe and rigid. In a vast majority of instances we performed a postero-medial soft tissue release and over the last fifteen years it has been through the hemi-Cincinnati incision.[6]

We now evaluate the outcome of postero-medial release through the hemi-Cincinnati incision performed on a group of children with idiopathic clubfoot.

The specific aim of the study was to evaluate the feet by objective and subjective criteria to determine if adequate correction of the deformity and satisfactory function has been obtained following our surgical intervention.

MATERIALS AND METHODS

In this retrospective study we included 45 children (33 boys and 12 girls) with idiopathic clubfoot who underwent postero-medial soft tissue release through the hemi-Cincinnati incision[6] and were followed up for a minimum period of 4 years.

Forty five children, 22 bilateral and 23 unilateral clubfoot (Right= 10, Left= 13) and a total of 67 feet were evaluated. Thirty eight children (57 feet) were operated for failure of non-operative treatment while seven children (10 feet) were treated primarily by surgery because they presented after 2 years.

The mean age at surgery was 11.98 months (8 months- 39 months); the mean age at final follow up was 8.5 years (5.4 years - 13.9 years). The mean follow-up period after the index surgery was 7.6 years (4.7 years - 13.6 years).

Surgical technique and postoperative protocol

The incision used was the medial half of the Cincinnati incision, stopping just short of the Achilles tendon. The latter was lengthened by

z-plasty. Posterior capsules of the ankle and subtalar joints were divided and the posterior talofibular ligament was sectioned. The neurovascular bundle was mobilized and the sheath of the flexor hallucis longus tendon was divided. The entire medial capsule of the subtalar joint and the superficial deltoid ligament were divided. The tibialis posterior tendon was lengthened and the talo-navicular joint reduced by dividing the capsule and releasing the spring ligament. The abductor hallucis muscle was sectioned. A flexor hallucis tenotomy was performed if ankle dorsiflexion induced excessive flexion of great toe. The lengthened Achilles tendon and the tibialis posterior tendon were sutured and the wound closed in layers. The skin was closed with simple interrupted silk sutures. A compression bandage was applied, the tourniquet was released, and an above-knee cast was applied with the foot held in the plantigrade neutral position. In the early postoperative period, the plaster cast was split down to the skin to accommodate for postoperative edema. The sutures were removed under anesthesia on postoperative day 14 and the foot was manipulated into maximum dorsiflexion and eversion. A fresh groin-to-toe cast was applied with the knee flexed to 90°. Plaster immobilization was maintained for a total period of 3 months postoperatively. Denis Browne shoe was given to all children after 3 months. The shoe was discontinued after achievement of active power of dorsiflexors and evertors.

At final follow-up each foot was assessed using the scoring system of Munshi et al [7] that involves three domains of evaluation viz., morphological, functional and radiological. In addition to this, subjective evaluation of the parent's (or patient's) satisfaction was included as the fourth domain. Each domain has a maximum score of 75 points.

Morphological assessment

The feet were assessed for persistence or over correction of hind foot equinus, hind foot varus, forefoot adduction, forefoot inversion and forefoot equinus. Each of these deformities were graded as nil, mild, moderate, severe or overcorrected. A mild deformity was one which could be overcorrected passively beyond neutral; a moderate deformity was one which could be passively corrected up to neutral position while a severe deformity could not be passively corrected up to the neutral position. An overcorrected deformity was tabled, however its degree wasn't quantified.

Functional assessment

Each foot was evaluated for gait, muscle power and range of movements of the ankle and foot. The gait of the child was evaluated while the child walked on level ground and while walking up and down an inclined surface. The gait was considered as normal if the child walked with a plantigrade tread, a heel-toe sequence, a normal foot progression angle and without a limp. The power of triceps surae, ankle dorsiflexors, peronei, tibialis posterior and toe flexors were assessed according to MRC grading scheme by manual muscle testing. The ranges of movement at various joints were measured with a goniometer.

Subjective assessment

The parents and patients were interviewed regarding their satisfaction with respect to the appearance of the foot and the scar, limitation of the activities of daily living and sports. They were also carefully questioned about pain in the foot at rest and after physical exertion. Pain was the variable that was given maximum weightage accounting for one third of the total subjective score (Table 1).

Radiological assessment

On the anteroposterior radiograph the talo-calcaneal angle and the talar first metatarsal angles were measured. The calcaneo-cuboid alignment was graded according to the Thometz classification.[8] On the stress dorsiflexion radiograph the angle of calcaneal dorsiflexion was measured. From the stress dorsiflexion and plantar flexion radiographs the talar arc and the talo-calcaneal angle difference [9] were computed.

Table 1: Scoring for subjective assessment

Variable	Response	Score
Appearance of the foot	Very satisfied	10
	Satisfied	5
	Dissatisfied	0
Appearance of the scar	Very satisfied	10
	Satisfied	5
	Dissatisfied	0
Activities of daily living	Does not limit any activity	10
	Limits strenuous activities	5
	Limits routine activities	0
Sports	Does not limit outdoor sports	10
	Discomfort after outdoor sports	5
	Cannot participate in outdoor sports	0
Footwear	Finding shoe of choice is not a problem	10
	Not comfortable with market shoes	5
	Not comfortable with any shoes	0
Pain	Never painful	25
	Pain after strenuous activities	20
	Pain after moderate activities	15
	Pain after routine activities	10
	Pain at rest	0

Reproducibility study

Twenty-two feet were assessed twice on separate occasions by the same investigator and all clinical and radiological measurements were performed on these feet on each occasion.

Statistical methods

The paired t-test was used to assess the reproducibility of the measurements in this study. The independent t-test was used to compare the outcomes of patients with unilateral and bilateral involvement. Pearson's correlation coefficients were calculated to compare the four domain scores (morphology, function, subjective and radiology).

RESULTS

Morphological evaluation

Persistent forefoot adduction was the commonest residual deformity noted; some degree of forefoot adduction was present in half the number of total feet (Table 2). Residual hind foot varus and equinus were infrequent. Overcorrection of any of the components of the clubfoot deformity was not encountered in this study. The mean score for deformity correction was 70.6 $\pm$ 4.6 (maximum score: 75).

Functional evaluation

Gait

Majority of the children (n = 43) walked with a plantigrade tread while walking on level ground and up and down an inclined surface. However, the foot progression angle was abnormal in 30 patients who had an in-toeing gait. The mean score for gait was 20.75 ± 4.62 (maximum score: 25).

Muscle power

Weakness of the tibialis posterior muscle was very frequently encountered; the muscle had only fair strength (MRC 2, 3, or 4) in 45 feet while it had poor strength (MRC 0 or 1) in four feet. Weakness of triceps surae, tibialis anterior and peronei were infrequently seen (Table3). The mean score for muscle power was 22.15 ± 1.89 (maximum score: 25).

Table 2: Frequency of residual deformities and morphological scores at final follow up in 67 feet of 45 children

Severity of deformity	Hindfoot equinus	Hindfoot varus	Forefoot adduction	Forefoot inversion	Forefoot equinus
Nil	63	61	35	53	67
Mild	0	6	28	14	0
Moderate	3	0	4	0	0
Severe	1	0	0	0	0
Morphology score (Mean ± SD)	14.33 ± 2.78 (Max = 15)	14.55 ± 1.43 (Max = 15)	12.31 ± 3.05 (Max = 15)	14.4 ± 1.63 (Max = 15)	15 (Max = 15)

Overall Morphological Score: 70.6 ± 4.6 (Maximum: 75)

Table 3: The frequency of muscle weakness and muscle power scores at final follow-up in 67 feet of 45 children

Muscle strength	Triceps surae	Ankle dorsiflexors	Peroneii	Tibialis posterior	Toe flexors
Strong (MRC 5)	66	64	61	18	66
Weak (MRC 4, 3, 2)	1	3	6	45	1
Absent (MRC 1, 0)	0	0	0	4	0
Muscle power score (Mean ± SD)	4.96 ± 0.36(Max = 5)	4.87 ± 0.62(Max = 5)	4.73 ± 0.86(Max = 5)	2.69 ± 1.48(Max = 5)	4.96 ± 0.37(Max = 5)

Overall muscle power score: 22.15 ± 1.89 (Maximum: 25)

Joint range of motion

Some reduction of ankle motion was noted in every foot; plantar flexion was more frequently reduced than dorsiflexion. Motion of the subtalar and mid-tarsal joints was less frequently affected (Table 4).The mean score for joint range of motion was 17.26 ± 2.76 (maximum score: 25). The overall mean functional score was 60 ± 7 (maximum score: 75).

Radiological evaluation

The radiological results are shown in table 6. The calcaneo-cuboid alignment was normal in 47 feet and grade 1 mal-alignment was noted in 20 feet. The lateral talo-calcaneal angle was greater in the stress dorsiflexion film than in the plantar flexion film in 41 feet. The mean radiology score was 36.34 ± 10.6. (maximum score: 75).

Table 4: The range of motion of the foot and ankle at final follow-up in 67 feet of 45 children

	Ankle joint		Subtalar joint		Mid-tarsal joint	
	Dorsiflexion	Plantarflexion	Eversion	Inversion	Eversion	Inversion
Normal motion retained	0	0	64	52	50	65
>50% motion retained	46	32	3	15	NA	NA
Range of motion in degrees (Mean ± SD)	14.95 ± 6.48	26.86 ± 5.89	11.19 ± 2.89	20.44 ± 4.9	16.34 ± 4.81	38.65 ± 6.83
Range of motion score (Mean ± SD)	2.06 ± 1.4	1.43 ± 1.5	4.91 ± 0.84	4.55 ± 1.09	1.86 ± 1.09	2.42 ± 0.42

Mean range of motion score: 17.26 ± 2.76 *NA = Not applicable.

Subjective evaluation

All the parents were satisfied with the appearance of the scar. Four parents were not fully satisfied with the overall appearance of the foot. The activities of daily living were not restricted in forty four children and forty three participated in outdoor sports. Ten children complained of mild pain after strenuous activity while one child had some pain after routine activity (Table 5).The mean subjective score was 72.91 ± 3.7 (maximum score:75).

Additional surgery

Additional surgery was needed in 9 feet and the final results were poorer in these feet as compared to feet that did not require additional surgery (Table 7).

Table 5: The subjective criteria score at final follow-up in 67 feet of 45 children

Criterion	Maximum score	Score (Mean ± SD)
Appearance of foot	10	9.48 ± 1.54
Appearance of scar	10	10
Activities of daily living	10	9.85 ± 0.86
Sports	10	9.70 ± 1.94
Footwear	10	10
Pain	23	23.66 ± 2.69
Total subjective score	**75**	**72.91 ± 3.7**

Table 6: The assessment of radiological outcome at final follow-up in 67 feet of 45 children

	Angle in degrees (Mean ± SD)	Radiology score (Mean ± SD)
Talocalcaneal angle in anteroposterior view (TCA-AP)	21.05 ± 9.82	4.03 ± 4.10
Talus-first metatarsal angle (TMT)	12.79 ± 14.12	2.84 ± 3.16
Talocalcaneal angle in plantar flexion (TCA-PF)	18.78 ± 9.87	NA
Talocalcaneal angle in dorsiflexion (TCA-DF)	22.54 ± 9.53	NA
Talocalcaneal angle difference	16.07 ± 6.27	7.39 ± 3.62
Angle of calcaneal dorsiflexion	19.58 ± 12.67	6.79 ± 4.41
Talar arc	30.22 ± 14.41	6.71 ± 4.96
Calcaneo-cuboid mal-alignment	NA	8.43 ± 2.33

Correlations between outcome domains

There is positive correlation between morphological and functional scores (= 0.76, p < 0001), morphological and radiology scores (= 0.40, p < 0.001) and functional and radiology scores (= 0.40, p < 0.001). There was negligible correlation between morphological and subjective scores (= 0.09), functional and subjective scores (=0.12) and radiology and subjective scores (= 0.10).

DISCUSSION

The goals of treatment in clubfoot are to provide a supple, plantigrade foot that looks normal and functions well without pain. This study attempted to evaluate if these goals were achieved; inclusion of a subjective domain of assessment to the morphological, functional and radiological domains of the Munshi etal [7] scoring system facilitated such a comprehensive evaluation.

Table 7: Comparison of final outcome scores between children who required repeat surgery for relapsed clubfoot and those who did not

Score	Repeat surgery not done n=58 (Mean ± SD)	Repeat surgery performed n=9 (Mean ± SD)	P
Morphological	71.12 ± 5.13	67.22 ± 7.54	0.052
Functional	60.66 ± 6.66	55.66 ± 8.41	0.047
Gait	21.12 ± 4.49	18.33 ± 5.00	Not Significant
Muscle power	22.19 ± 1.82	21.19 ± 2.42	Not Significant
Range of motion	17.52 ± 2.57	15.44 ± 3.39	0.035
Subjective	72.84 ± 3.87	73.33 ± 2.5	Not Significant
Radiological	37.59 ± 9.18	28.33 ± 12.24	0.009

Residual forefoot adduction was noted in a sizeable proportion of children in this study and this has been reported in other studies as well.[10,11,12] However, persistence of other deformities was infrequent and in none of the children was the deformity overcorrected. In particular, there were no instances of hind foot valgus or mid-foot break as noted in some series.[11] It was encouraging to note that overcorrection was not seen as it is particularly difficult to treat an overcorrected clubfoot.

Though the feet were plantigrade in most children, an in-toeing gait was noted in some children. This appears to be a frequent occurrence, with Harvey et al[12] noting this aberration in as many as 60% of his patients.

Muscle weakness following soft tissue release operations have been reported in the literature.[13] This is not surprising as tendons are tenotomised or lengthened in these operations. Weakness of the tibialis posterior was seen in a substantial number of children in this study. Despite this, valgus deformity of the hind foot and loss of the medial longitudinal arch were not seen.

Aronson and Puskarich[13] reported a 24% reduction in plantar flexion power but we could not demonstrate appreciable weakness of plantar flexion by manual muscle testing in most of our children. It is possible that some weakness of the muscle could have been demonstrated if we had measured muscle power by dynamometry. Nevertheless the power of the triceps surae was sufficient to afford a push-off that appeared normal while walking on level ground and on an inclined surface.

Despite the fact that the feet were supple all feet had some reduction in the range of motion of the ankle. The mean dorsiflexion of 14.95 degrees and the mean plantar flexion of 26.86 degrees noted in the study are sufficient for facilitating the three normal rockers during the stance phase of the gait cycle. This is why there was no discernable limp when these children walked. Though the reduction in motion may not be severe enough to impair gait or normal activity it needs to be acknowledged that a full range of normal motion cannot be regained following soft tissue release operations.[2,10,11,14,15]

The low radiological score suggests that alignment of tarsal bones was not completely restored following surgery in several feet. The talo-calcaneal angles were better than that reported by some authors[14] but were not comparable to normal feet. Despite this, demonstrable varus deformity of the hind foot was infrequently seen in this study. Though an abnormal talo-first metatarsal angle was noted in several children, calcaneo-cuboid mal-alignment was not present in 47 feet. This suggests that in these 47 feet an abnormal talar-first metatarsal angle is due to metatarsus adductus and not mid-tarsal mal-alignment.[16] The talar arc that has been considered as a good measure of the range of motion of the ankle was satisfactory (mean: 30.22 degrees). While this shows that the ankle is not stiff it does not give any insight into whether either the dorsiflexion or plantar flexion was restricted.

A previous report from this centre had suggested that higher the talo-calcaneal angle difference (difference between the stress dorsiflexion and plantar flexion angles), higher the likelihood of a satisfactory correction of the hind foot deformity and that a lateral talocalcaneal angle difference of 20 degrees gives a 93% probability of correction of the hind foot deformities.[9] The mean talo-calcaneal angle difference noted in this study was 16.07 degrees; and as would be expected the frequency of residual hind foot deformity was low.

The subjective scores noted in this study are good and this suggests that our treatment was effective from the patient's perspective. However, it is important to be aware that subjective responses of the patients may not necessarily reflect the quality of correction achieved. For example, Hutchins et al reported that 81.4% of patients reviewed by them were satisfied with the outcome despite the fact that navicular subluxation was present in 27%, 30% had problems associated with the surgical scars, 74% had flattening of the talar dome and residual deformities were noted in a sizeable proportion of their patients.[11]

In this study there was a good correlation between the morphological and functional scores suggesting better foot function with better deformity correction. The correlation between the morphological and radiological scores was however only fair implying that the tarsal relationships may not be completely restored even if the external appearance of the feet suggests adequately corrected deformities. The subjective scores however, poorly correlated to the morphological, functional and radiological scores implying that the patient may be satisfied with a less than optimal correction or conversely be dissatisfied with what appears to be a satisfactory correction on clinical and radiological grounds.

Irrespective of the surgical approach, a proportion of patients will require repeat surgery for recurrence.[2, 3, 4, 11, 17-19] The frequency of re-operation in our series is comparable to these earlier reports. The final outcome of those who required re-operation was inferior to those that did not. This again is a feature that has been documented in the past.[11]

Several studies have described results of clubfoot treatment.[1-5, 10-15, 18-23] However, it was difficult to compare our results with these reports since the outcome measures varied a great deal from report to report. This highlights the necessity of a common method of evaluation of outcome of clubfoot management.[7, 24]

We have found the format of evaluation outlined by Munshi et al [7] to be reproducible and with the inclusion of the subjective evaluation we believe the evaluation described in this report is comprehensive. We suggest that this format be used as a method of evaluating treatment of clubfoot and further suggest that the results of treatment be expressed as separate scores for each domain of treatment (e.g. M: 70.6; F: 60; R: 36.3; S: 72.9 noted in this study) without summating them.

Finally, the children in this study were only followed up till a mean age of 8.5 years. However a follow up till at least skeletal maturity is essential to confirm that the encouraging results noted at this point remain unchanged.

ACKNOWLEDGEMENT:

The authors gratefully acknowledge the comments of Dr. Benjamin Joseph regarding the manuscript.

REFERENCES:

1) Attenborough CG. Early posterior soft tissue release in severe congenital talipes equinovarus. Clin Orthop Relat Res 1972; 84:71-8.

2) Green AD, Lloyd-Roberts GC. The results of early posterior release in resistant clubfeet. J Bone Joint Surg Br 1985; 67:588-93.

3) Hogervorst T, van der Eijken JW. Treatment results of posterior procedures in clubfeet. J Pediatr Orthop B 1993; 2:182-87.

4) Turco VJ. Resistant clubfoot-one stage posteromedial release with internal fixation. A follow-up report of a fifteen-year experience. J Bone Joint Surg Br 1979; 61:805-14.

5) Ghali NN, Smith RB, Clayden AD,Silk FF. The result of pantalar reduction in the management of congenital talipes equinovarus. J Bone Joint Surg Br 1983; 65:1-7.

6) Joseph B, Ajith K, Varghese RA. Evaluation of the hemi-Cincinnati incision for posteromedial soft-tissue release in clubfoot. J Pediatr Orthop 2000; 20:524-28.

7) Munshi S, Varghese RA, Joseph B. Evaluation of outcome of treatment of congenital clubfoot. J Pediatr Orthop 2006; 26:664-71.

8) Thometz JG, Simons GW. Deformity of the calcaneocuboid joint in patients who have talipes equinovarus. J Bone Joint Surg Am 1993; 75:190-95.

9) Joseph B, Bhatia M, Nair NS. Talo-calcaneal relationship in clubfoot. J Pediatr Orthop 2001; 21:60-4.

10) Porat S, Kaplan L. Critical analysis of results in clubfoot treated surgically along the Norris Carroll approach: seven years of experience. J Pediatr Orthop 1989; 9:137-43.

11) Hutchins PM, Foster BK, Paterson DC, Cole EA. Long-term results of early surgical release in clubfeet. J Bone Joint Surg Br 1985; 67:791-99.

12) Harvey AR, Uglow MG, Clarke NM. Clinical and functional outcome of relapse surgery in severe congenital talipes equinovarus. J Pediatr Orthop B 2003; 12:49-55.

13) Aronson J, Puskarich CL. Deformity and disability from treated clubfoot. J Pediatr Orthop 1990; 10:109-19.

14) Roye BD, Vitale MG, Gelijns AC, Roye DP Jr. Patient based outcomes after clubfoot surgery. J Pediatr Orthop 2001; 21:42-9

15) Edmondson MC, Oliver MC, Slack R,Tuson KW. Long-term follow-up of the surgically corrected clubfoot. J Pediatr Orthop B 2007; 16:204-8.

16) Bhatia M, Joseph B. Plain radiographic evaluation of mid-tarsal mal-alignment in clubfoot. The Foot 2002; 12:63-9.

17) Atar D, Lehman WB, Grant AD, Strongwater AM. Revision surgery in clubfoot. Clin Orthop Relat Res 1992; 283:223-30.

18) Magone JB, Torch MA, Clark RN, Kean JR. Comparative review of surgical treatment of the idiopathic clubfoot by three different procedures at Columbus Children's Hospital. J Pediatr Orthop 1989; 9:49-58.

19) Centel T, Bagatur AE, Ogut T, Aksu T. Comparison of soft tissue release methods in idiopathic clubfoot. J Pediatr Orthop 2000; 20:648-51.

20) Wientroub S, Khermosh O. Comparative evaluation of initial surgical procedures in clubfoot. J Pediatr Orthop B 1994; 3: 171-9.

21) Alkjaer T, Pedersen EN, Simonsen EB. Evaluation of the walking pattern in clubfoot patients who received early intensive treatment. J Pediatr Orthop 2000; 20:642-7.

22) Dewaele J, Zachee B, De Vleeschauwer P, FabryG. Treatment of the idiopathic clubfoot: critical evaluation of different types of treatment programs. J Pediatr Orthop B 1994; 3:89-95.

23) Uglow MG, Clarke NM. The functional outcome of staged surgery for the correction of talipes equinovarus. J Pediatr Orthop 2000; 20:517-23.

24) Bensahel H, Kuo K, Duhaime M; International Clubfoot Study Group. Outcome evaluation of the treatment of clubfoot: the international language of clubfoot. J Pediatr Orthop B 2003; 12: 269 71.

Management of neglected nonunion of paediatric fracture neck of femur by ball and socket subtrochanteric valgus osteotomy

Alok C. Agrawal

Abstract: Neglected femoral neck fractures in children often result in coxa vara and nonunion. We found it unhandy to perform sine and cosine table aided subtrochanteric valgus osteotomy or use readymade cuts as described by Campbell with accuracy. We prefer instead to do a mechanically more stable ball and socket subtrochanteric osteotomy with predictable results.

Six (Delbet type 2 &3) neglected paediatric fracture neck of femurs with resultant coxa vara and nonunion were treated by a ball and socket subtrochanteric osteotomy. Union occurred in all patients within 3 months and the neck shaft angle increased to an average of 125 degrees (range 110-140 degrees), the mean correction of coxa vara being 40 degrees (range 30-50). All were able to partially weight bear and squat at 3 months and fully weight bear by 5-6 months. The average IOWA hip score at 2 years was 95.83 out of a maximum 100. Results were graded as good in all patients.

Our modification of subtrochanteric valgus osteotomy by a dome cut in the coronal plane renders a more pliable axis of angulation. It eliminates the need for bone excision and grafting and yields a stable osteotomy. A six or seven holed locking compression plate is pre-contoured to the estimated valgus angle and fixed to the proximal fragment prior to osteotomy to achieve a better control of the fragment. One or two threaded pins stabilize the non-union from either side of the plate. This procedure is recommended for acquired coxa vara and nonunion of fracture neck of femur as femoral head vascularity is not affected and early union is achieved.

Alok C. Agrawal
Associate Professor,
Bundelkhand Medical College, Sagar, M.P.
dralokcagrawal@yahoo.co.in

INTRODUCTION

Fractures of the hip are relatively uncommon in children. Their importance is related not to the frequency of fracture but rather to the frequency of its complications. Many of these complications can be minimised by anatomic, sometimes open reduction and internal fixation. Potentially distressing complications like osteonecrosis, coxa vara, premature epiphyseal closure, limb length discrepancy and non-union occur in high frequency following fracture neck of femur.

Neglect in femoral neck fractures in children is a common occurrence in our state due to poverty, illiteracy and treatment by osteopaths. Patients often present to the orthopaedic surgeon at a late stage with a painful limp. Coxa vara and nonunion also occur following closed reduction and hip spica. Neglected femoral neck fractures in children often result in acquired coxa vara and nonunion. Progressive remodelling in coxa vara has been reported to occur only in young children, when the neck-shaft angle is more than 110 degrees.[1]

In Campbell's series, in young children with neck-shaft angle of more than 120 degrees, remodeling occurred to some degree, and even if it did not, it caused little disability. Significant coxa vara causes a shortened extremity, an abductor or gluteal lurch and late degenerative arthritis. For these reasons they routinely used a lateral closing wedge sub-trochanteric valgus osteotomy fixed by a lateral plate and single screw into the proximal segment. They have used the same procedure even for nonunion of fracture neck of femur so as to make the fracture line more horizontal thereby converting the shearing forces at the fracture site into the compressive forces.[1] Trigonometric functions are used to evaluate the effect of proximal femoral osteotomy.

We have found that it is difficult to use sine and

cosine tables or use readymade cuts as described by Campbell [1, 8] with accuracy and so are reporting a ball and socket subtrochanteric osteotomy which is stable, simple to perform and with predictable results.

MATERIALS AND METHODS

Six neglected paediatric fracture neck of femur (Delbet type 2 & 3) with acquired coxa vara and nonunion presented to us between October 2003 and October 2008. All these children were males with their age ranging from 3 years to 10 years. Two of them presented four months after the initial trauma and ostensibly had not taken any treatment. The remaining four children developed coxa vara and nonunion following closed reduction and hip spica application. (Table 1) All of these 6 children were treated by ball and socket subtrochanteric osteotomy as mentioned above.

Technique of ball and socket subtrochanteric osteotomy:

The desired angle of correction and the degree of coxa vara were assessed preoperatively. The patient was positioned on a fracture table and the limb gently adducted and abducted under image intensifier guidance to assess nonunion and correction of coxa vara. The nonunion was stabilized with one or two 4mm cancellous screws or Moore's pin and the desired angle of correction recalculated. Correction of 30 to 50 degrees can be done easily with this method. By a lateral approach the lateral surface at the proximal femur was exposed and an aluminum template was molded to the shape of the proximal femur from the tip of greater trochanter to 3-4 cm below the proposed osteotomy site. A Locking Compression Plate (LCP) was contoured to the shape of template and prebent to the desired angle of correction of coxa vara. The LCP was fixed to the greater trochanter and stability assessed. The osteotomy site was marked on the anterior subtrochanteric area by multiple drill holes in a hemi-spherical manner with its convexity directed superiorly. It was completed with a fine osteotome or gouge and the distal fragment was secured to the LCP with 2 or 3 screws. The length of the screws and correction of coxa vara were confirmed by image intensifier and stability of fixation assessed by doing gentle adduction and abduction movements.

In none of these cases the non-union site was exposed and bone grafting used. Depending upon intra-operative stability and child compliance, hip spica was given for 6 weeks when deemed necessary. The children were followed at 6 weekly intervals for the first 6 months and thereafter at 6 monthly intervals for a duration of 2 years. They were evaluated by the IOWA hip score.

RESULTS

We treated 6 children, all males, aged 3 to 8 years (mean= 6.25 years) with neglected fracture neck of femur with nonunion and acquired coxa vara, with a ball and socket subtrochanteric osteotomy (Figure 1). The coxa vara ranged from 70 degrees to 110 degrees. In all six cases the fracture united within 3 months and the neck shaft angle was increased on an average to 125 degrees (range= 110^{o}-140^{o}). The average correction of coxa vara was 40^{o} (range= 30^{o}-50^{o}).

Children were able to squat or walk bearing partial weight at 3 months and full weight by 5-6 months. None of them developed infection, osteonecrosis or premature physeal closure. The plate was removed in two children due to excessive lateral prominence and no child showed a Limb Length Discrepancy (LLD) of more than 1 cm. The average IOWA score was 95.83 out of a maximum 100 (Table 1). Four of our children had abductor lurch for the initial 3-6 months which gradually corrected with physiotherapy. Results were graded as good in all the children.

DISCUSSION

The importance of operating on a child's hip is not easily understood or accepted by the parents in our set up. This is the major cause of neglect in the management of paediatric

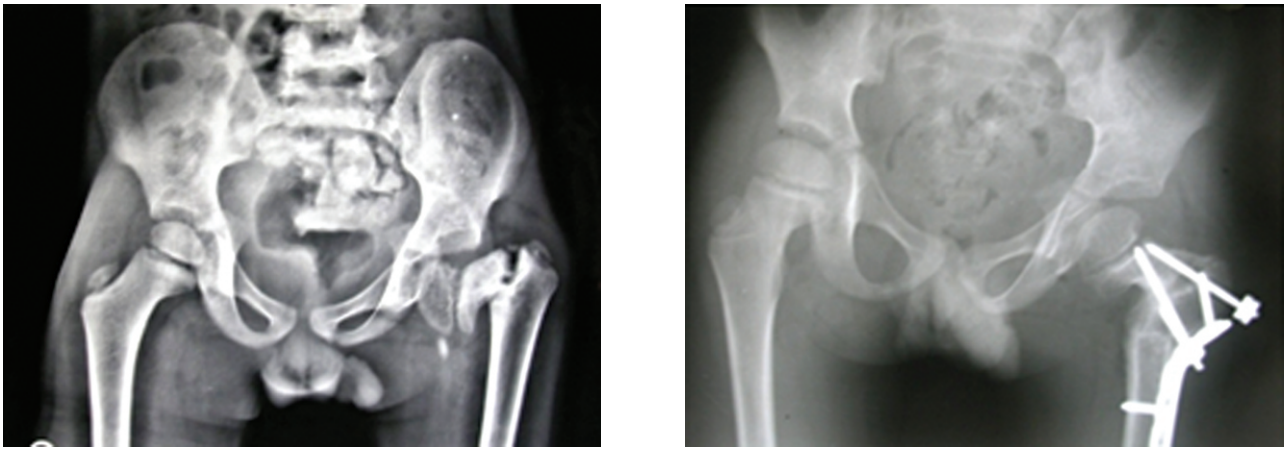


Figure 1:A four year child with nonunion and coxa vara of 70^0 treated. X-ray at union shows correction of coxa vara to 110^0.

Table 1.Details of IOWA Hip Score

Parameters →	Function (Marks 35)	Freedom from Pain (Marks 35)	Gait (Marks 10)	Absence of deformity (Marks 10)	Range of movement (Marks 10)	Muscle strength	Squatting/ Sitting cross legged	Total IOWA score
Case1	32	35	8	10	10	Grade 5	Possible	95
Case2	32	30	8	10	10	5	Possible	90
Case3	34	35	10	10	10	5	Possible	99
Case4	34	35	10	10	10	5	Possible	97
Case5	34	35	8	10	10	5	Possible	97
Case6	34	35	8	10	10	5	Possible	97

(Average IOWA score: 95.83)

fracture neck of femur leading to acquired coxa vara and nonunion. Aggressive treatment of hip fractures in children is considered necessary to prevent late complications of osteonecrosis, coxavara, nonunion and premature physeal closure.[1,2]

Forlin et al[3,4] reported treatment of trans-physeal fractures in five children (8 to 26 months old) with spica casting without reduction. In their series four fractures healed with varus deformity and in two with open proximal femoral physes, the deformity corrected with growth. They recommended primary in situ spica casting of the fracture in children younger than 2 years and later correction of coxa vara or limb-length discrepancy by osteotomy so as to avoid further trauma to the initial injury.[3,4] Odent et al[5] reported osteonecrosis of capital femoral epiphysis in all of their five adolescent patients with transepiphyseal fractures treated with open reduction and screw fixation. Gerber et al[6] also reviewed 28 type II femoral neck fractures in children from seven Swiss hospitals, who were treated by early capsulotomy of hip joint to release the distended capsule followed by internal fixation which resulted in 30% incidence of osteonecrosis. Type II transcervical fractures were at greater risk (50%) than type III fractures. Gerber et al also concluded that immediate open reduction and internal fixation does not prevent osteonecrosis in displaced type II and III fractures. None of our cases with nonunion or coxa vara developed osteonecrosis in spite of late surgery. Non-

interference with the non-union site (to excise the pseudarthrosis tissue and place bone graft) avoids damage to the already precarious blood supply to the femoral head and so late fixation of these neglected fractures along with subtrochanteric ball and socket valgus osteotomy can be considered to be a viable option to avoid this dreaded complication.

Operative treatment as soon as possible is recommended for nonunion. In contrast to osteonecrosis which occurred in 43% of Canale and Beaty's series,[1] nonunion rate was low (6.5%), possibly due to the use of internal fixation. They did a valgus subtrochanteric osteotomy, as recommended by Ratliff[7], to make the nonunion more horizontal and allow compressive vertical forces to aid in union. Internal fixation was routinely employed across the nonunion site, and a spica cast was worn for 12 weeks. We have modified subtrochanteric valgus osteotomy by a ball and socket osteotomy in the coronal plane. This renders a more malleable axis of angulation, eliminates need for bony excision and thus the need for bone grafting and yields a stable fracture and osteotomy site.We used a narrow 6 or 7 holed locking compression plate pre-moulded to the desired valgus angle and fixed to the proximal fragment before osteotomy to have a better control on the fragments. One or 2 threaded pins are used across the fracture site passing by the side of the plate to stabilize the nonunion. This is an easy procedure which doesn't compromise femoral head vascularity and leads to an early union and return to function. Hence we recommend this procedure for neglected femoral neck fractures, acquired coxa vara and nonunion of fracture neck of femur.

CONCLUSION

We used a subtrochanteric ball and socket valgus osteotomy for coxa vara and nonunion neck of femur achieving fixation by one or two 4mm cancellous screws and a 3.5mm LCP making the procedure very simple. The results are encouraging and this procedure is thereby recommended.

REFERENCES:

1) Canale and Beaty. Hip Fractures in Children. In Campbell's Operative Orthopaedics, 11th edition. 2007, Philadelphia, Mosby Elsevier. 1613-28.

2) Ingram AJ, Bachynski B. Fractures of the hip in children: treatment and results. J Bone Joint Surg 1953; 35A:867-87.

3) Forlin E, Guille JT, Kumar SJ, Rhee KJ. Complications associated with fracture of the neck of the femur in children. J Pediatr Orthop1992; 12:503-9.

4) Forlin E, Guille JT, Kumar SJ, Rhee KJ. Transepiphyseal fractures of the neck of the femur in very young children. J Pediatr Orthop 1992; 12:164-8.

5) Odent T, Glorion C, Pannier S, Bronfen C, Langlais J, Pouliquen JC. Traumatic dislocation of the hip with separation of the capital epiphysis: 5 adolescent patients with 3-9 years of follow-up. Acta Orthop Scand 2003; 74:49-52.

6) Gerber C, Lehmann A, Ganz R. Femoral neck fractures in children: experience in 7 Swiss AO hospitals. Orthop Trans 1985; 9:474.

7) Ratliff AHC. Complications after fractures of the femoral neck in children and their treatment. In proceedings of the British Orthopaedic Association. J Bone Joint Surg 1970; 52B:175.

8) Harper MC, Canale ST, Cobb RM. Proximal femoral osteotomy: a trigonometric analysis of effect on leg length. J Pediatr Orthop 1983; 3:431-4.

Announcement: POSI inland travelling fellowship

Young surgeons are invited to utilize the POSI inland travelling fellowships where in they get the opportunity to spend time with the best POSI faculty. Selected fellow will get an opportunity to spend 4-6 weeks in different recognized centres. One time stipend will be paid to meet the expenses of the candidate.

Eligibility:

1. Young orthopaedic surgeons (MS/DNB), less than 40 years at the time of last date for application.
2. Proof of his/her interest in the field.

How to apply?

Eligible candidates must submit two copies of his/her bio data addressed to the Secretary, POSI clearly superscribing the application with "Application for POSI fellowship".

You may download the application form from the POSI web site www.posi.in or contact the secretary.

POSI-Dr. Kameshitha Young Surgeon's Forum Prize

Criteria:

1. Young surgeon < 40 years age at the time of application
2. Original scientific work done in India by an Indian POSI member
3. New by its nature
4. Significant research contribution

Award:

1. Certificate and award
2. Entitled to present his work in a special session of 15 minutes in next POSI annual meeting. Abstract, final full copy submissions to be sent to the Secretary

Short term experience of Ponseti method for clubfoot correction in underprivileged urban population in India: a prospective analysis

Sanjay K Chilbule, Harshad G Argekar

Abstract:

Introduction: The effectiveness of Ponseti method in the Indian urban underprivileged population has not been previously reported. This study aims to evaluate the effectiveness of Ponseti method in the socioeconomically deprived population of one of the slums in Mumbai.

Material and Methods: Nineteen patients with 32 clubfeet from the Dharavi slum area in Mumbai were treated with Ponseti method. All patients were assessed by Pirani scoring system at initiation of treatment and at serial follow ups. They were thereafter advised to use foot abduction orthosis. Lack of compliance with abduction splintage was managed with continued fortnightly above knee cast till walking age.

Results: Nineteen patients with thirty two affected feet with median age at presentation of 6.8 weeks underwent clubfoot correction with Ponseti method in one year. Eighteen children with thirty affected feet were alive and evaluated at the end of the study. All patients achieved full correction. Twenty feet (66.66%) in eleven children required tendoachillis tenotomy. The average Pirani score at presentation was 5.6 and average number of casts required for correction was 5.83. Twenty eight feet (93.33%) achieved good correction at final follow up. Eight patients (44%) did not comply with bracing protocol and were managed by casting. No significant complications occurred.

Conclusion: The Ponseti treatment for clubfoot correction was found effective in the underprivileged population of urban India. Pirani scoring system was easy to apply and convenient for serial evaluation of clubfoot and was a predictive parameter for the number of plasters required for correction. Parents could be motivated to follow weekly plaster protocol and there was no dropout during treatment. Noncompliance with the brace was the major obstacle. This was managed effectively in this series with the bimonthly casting protocol till walking age.

Sanjay K Chilbule, Harshad G Argekar
Department of Orthopaedics,
Lokmanya Tilak Memorial Municipal Medical College and General Hospital, Sion, Mumbai.
drsanjaychilbule@gmail.com

INTRODUCTION

In the 1960s Dr. Ignacio Ponseti devised his method of conservative management of clubfoot based on the fundamentals of kinematics and pathoanatomy of the deformity thereby successfully realigning clubfoot in infants without extensive surgeries.[1, 2, 3]

The current consensus rests on early intervention to render a pliable, plantigrade, painless and normal looking foot to the child.[2] Parent education and compliance however remains a neglected part in its management.[2, 3, 4]

Hurdles in implementation of a national program on clubfoot in Indian population remain undiscussed.[6, 7] Clubfoot is a major cause of disability among Indian children in rural as well as urban areas.[8] Although urban India boasts an impressive health infra-structure, underprivileged urban communities continue to take a backseat. Existing public infrastructure is often suboptimally used. Interrelated factors such as under-development, inequitable distribution of primary healthcare services, poor referral systems, inadequate inter-sectoral linkages, limited resources even in tertiary referral centers, attitudinal and management challenges and inefficiency of data

management systems adds to the neglect of preventable and easily treatable conditions.[9, 10]

This study evaluated Ponseti's method of clubfoot management using Pirani scoring system in patients from socioeconomically underprivileged population in urban slums.

The children belonging to a slum in Mumbai were assessed for the effective delivery of Ponseti treatment in a municipal hospital system with focus on patient compliance with casting and brace protocol.

MATERIAL AND METHODS

This prospective study was conducted in the Department of Orthopaedics, Lokmanya Tilak Memorial Municipal Medical College and General Hospital, Sion, Mumbai between November 2006 and November 2007. After receiving the informed consent from parents,all children with idiopathic clubfoot whose parents residing in Dharavi slum near the hospital were included in this study. Nineteen children with 32 clubfeet were started on treatment with Ponseti method of clubfoot correction. Neuromuscular, recurrent or relapsed clubfeet were excluded. Neonates born in the hospital were advised to come at 1 week of age for casting. All feet were assessed by Pirani scoring system by a senior orthopaedician (HA) before starting treatment and until its last follow up. Tendoachillis tenotomy was done if ankle dorsiflexion remained less than 10^{o} even after two to three casts. Anaesthesia for tenotomy was based on parent's preference. Post-tenotomy, the final plaster was applied in 70^{0} external rotation and 15^{0} dorsiflexion for six weeks. All castings and tenotomies were performed by a single surgeon (SC).

Post procedure protocol: Parental education with emphasis on cast care and follow up was provided. A score of less than 1 at last follow up was considered a good outcome. Foot abduction orthosis was applied in 70^{0} external rotation of both feet in bilateral cases and 40^{0} on the unaffected side in unilateral cases. Parents were advised splint usage for more than 23 hours a day for the first 4 months followed by night splinting. If parents were found non-compliant maintenance casts in full correction were applied bimonthly for the next 4 months.

RESULTS

Nineteen patients with 32 clubfeet (15 boys and 4 girls) underwent clubfoot correction following Ponseti method in one year with median age at presentation of 6.8 weeks (range= 1 week to 7 months). Majority of patients (11) presented at 3 to 4 weeks (Table 1). Thirteen patients were born in the same institute, five were born in other hospitals and one was delivered at home. Thirteen had bilateral and six had unilateral involvement (4 right and 2 left) with total 32 feet under correction. Twelve children were first born and 7 were second born. Two children were admitted in neonatal intensive care unit for low birth weight and prematurity respectively. Two children had a family history of club foot. Two had associated congenital anomalies, one with atrial septal defect and other with umbilical hernia. One child died of respiratory tract infection during the treatment period. The remaining 18 patients with 30 clubfeet were evaluated at the end of the study with a follow up after splinting ranging from 2 weeks to 10 months.

Table 1: Age at presentation and Average number of casts

Age of presentation	Number of patients	Number of feet	Average number of casts
0 -2 wks	2	3	4
3 -4wks	**11**	**20**	**5.7**
1 -2mts	1	1	6
2-5mts	2	3	7
>5mts	2	3	7.3
	18	**30**	**5.83**

Table 2: Average initial Pirani score and Average number of casts

	Initial Pirani score	Number of patients	Number of feet	Average number of casts
	3.5	1	1	2
	5	2	2	6
	5.5	3	5	5.2
	6	12	22	5.36
Average	5.6	18	30	5.83

Average Pirani score at presentation was 5.6 (range 3 to 6) and average number of casts required for correction were 5.83 (Table 2). For a pre-treatment Pirani score of 3.5, 2 casts were sufficient while a score of 6 required an average of 5.36 casts. For 2 patients with late presentation and a score of 5, six casts were applied. Twenty out of 30 feet (66.66%) in 11 children required tendoachillis tenotomy which was done under local anesthesia as an outpatient procedure. In 2 children the parents opted for general anesthesia. Average Pirani score in tenotomy group was 5.4 and 5.3 in non-tenotomy group. Average number of casts for tenotomy group was 6.1 as compared to 4.6 for non-tenotomy group. Twenty eight out of 30 feet (93.33%) had good outcome with Pirani score of 0 (23 feet) and 0.5 (5 feet) at final follow up. Following full correction all patients were advised to use foot abduction orthosis. Eight out of 18 parents (44 %) were however non-compliant as assessed by an interview. Their children were thereby casted bimonthly in fully corrected position till last follow up. No relapse was seen in noncompliant group as the management was altered before the occurrence of adverse event.

None of the patients had plaster related complication such as slippage of cast or plaster sores.

DISCUSSION

Ponseti and Smoley in 1963 described their method of clubfoot management with good results in 71% and minor residual deformity in 28% and poor outcome in just one percent.[1] Since then many reports of outcome using Ponseti technique have been published in various population groups and ages with a wide range of socio-economic backgrounds.[11, 12, 13, 14]

In this study Ponseti method was found very effective (93.33%) in achieving correction and no child required referral for surgery. The positive aspects of this study which helped to achieve these results were recruitment at an early age of less than one month in the majority and a 100% follow up till the completion of treatment. In this prospective study the dropout rate from the study was avoided by offering free treatment, counseling and availability of the treatment center close to the locality. Avilucea et al have proved the effect of the cultural factors and distance from the treatment centre in rural American population. This is pivotal to parental motivation and subsequently in the treatment of clubfoot deformity.[7]

Average number of plasters required for the correction of the clubfoot in this study (5.83) is comparable with the other studies.[11, 12, 13] Number of casts required for the correction showed a distinct relation to Pirani score and age at presentation as more number of plasters was required for higher Pirani score and for late presentation for treatment. This is consistent with the published reports.

In this study Pirani scoring system was used for evaluation and found to predict the number of plasters required for the correction. In contrast the pre-treatment Pirani score did not predict the need of tendoachillis tenotomy in this study. Cher et al compared Pirani and Dimeglio

scoring systems for prediction of tenotomy.[14] 72% feet required tenotomy in their study, out of which 85.2% feet had Pirani score 5 or more and 94.7% feet with Dimeglio score of Grade IV. Flynn et al assessed Pirani and Dimeglio scoring system independently and found correlation coefficients were 0.90 (p = 0.0001) for the Pirani classification and 0.83 (p = 0.0001) for the Dimeglio classification.[16] Dyer et al had shown good correlation between initial Pirani score and number of plaster casts required to correct the deformity and also with the need for tenotomy.[17] Non compliance with the clubfoot brace is the major cause of recurrence.[1,2,3,6,7,11,18,20] Management of non compliance is probably one of the most difficult issues in clubfoot management. In the population studied here non compliance for the bracing protocol was found is 44% of parents, and was difficult to deal with. Even after counseling the parents, compliance rate failed to improve mainly because of poor socioeconomic and educational background. The difficult problem of non compliance with the brace in our study group was overcome by offering serial maintenance casts for the next 4 months after the early detection of non compliance which proved to be successful. In literature, compliance improvement measures described are education and parental counseling.[6,8] Dobbs et al has observed odds ratio of 183 for recurrence of deformity with non compliance for brace and odds ratio of 10 with parent education level.[18] Changulani et al noted brace non compliance in 68% of patients with clubfoot recurrence.[19] Kazibwe et al studied barriers experienced by parents of children with clubfoot in Uganda stating that 79% of parents did not know that it is their responsibility to put on the foot abduction orthosis.[6] Very few reports on the compliance with bracing protocol are available in Indian population.[20,21] Bhaskar et al has reported high rate of non compliance to the orthosis in the same region (Mumbai) with recurrence in 8 out of 66 clubfeet treated with Ponseti method.[20]

Despite a number of shortcomings such as a short followup and small number of cases, the study demonstrates that the clubfoot care delivery using Ponseti technique in an urban slum population can be highly effective provided it is inexpensive, locally accessible and monitored. Bracing issues need to be resolved.

REFERENCES:

1) Ponseti IV, Smoley EN. Congenital clubfoot: Results of treatment. J Bone Joint Surg Am 1963; 45:261-344.

2) Staheli L. Clubfoot: Ponseti management. 3rd edition; Global- HELP publication. 2009:4-5. http://www.global-help.org/publications/books/help_cfponseti.pdf.

3) Ponseti IV. Treatment of congenital clubfoot. J Bone Joint Surg Am 1992; 74:448-54.

4) Ponseti IV. Relapsing clubfoot: causes, prevention, treatment. Lecture delivered at IX National Congress of the Italian Society of Paediatric Orthopaedics and Traumatology, Rome, October 2001. Iowa Orthopaedic Journal 2002; 22:55-6.

5) Lu N, Zhao L, Du Q, Liu Y, Oprescu F, Morcuende J. From cutting to casting: Impact and initial barriers to Ponseti method of clubfoot correction in China. Iowa Orthopaedic Journal 2010; 30:1-6.

6) Kazibwe H, Struthers P. Barriers experienced by parents of children with clubfoot deformity attending specialized clinics in Uganda. Tropical Doctor 2009;39:15-8.

7) Avilucea FR, Szaley EA, Bosche PP,

Sweet KR, Schwend RM. Effect of cultural factors on outcome of Ponseti treatment of clubfeet in rural America. J Bone Joint Surg Am 2009; 91:530-40.

8) Jain K, Mruthyunjaya, Ravishankar R. Need of a formal psychotherapist-delivered counseling as a part of management of bony deformities, with emphasis of clubfoot. Indian J psychiatry 2010; 52:388.

9) More NS, Bapat U, Das S, Patil S, Porel M, Vaidya L, Koriya B et al. Cluster randomized controlled trial of community mobilization in Mumbai slums to improve care during pregnancy, delivery, postpartum and for the newborn. Trials 2008; 9:1-7.

10) Daruwalla N, Fernandez A, Salam J, Shaikh N, Osrin D. Conflict, crisis, and abuse in Dharavi, Mumbai: experiences from six years at a centre for vulnerable women and children.PLoS Med 2009;6:e1000088.

11) Haft GF, Walker CG, Crawford HA. Early clubfoot recurrence after use of the Ponseti method in a New Zealand population. J Bone Joint Surg Am 2007;89:487-92.

12) Bouchoucha S, Smida M, Saïed W, Safi H, Ammar C, Nessib MN, Ghachem MB. Early results of the Ponseti method using Steenbek foot abduction brace: Prospective study of 95 feet. J pediatr Orthop B 2008; 17:134-38.

13) Shack N, Eastwood DM. Early results of physiotherapist delivered Ponseti service for the management of idiopathic congenital talipes equinovarus foot deformity. J Bone Joint Surg B 2006; 88:1085-9.

14) Scher DM, Feldman DS, van Bosse HJP, Sala DA, Lehman WB. Predicting the need for tenotomy in the Ponseti method of the correction of the clubfoot. J Pediatr Orthop 2004; 24:359-52.

15) Munshi S, Verghese R, Joseph B. Evaluation of outcome of treatment of congenital clubfoot. J Pediatr Orthop 2006; 26:664-72.

16) Flynn J, Donohoe M, Mackenzie W. An independent assessment of two Clubfoot-classification systems. J Pediatr Orthop 1998;18:323-27.

17) Dyer PJ, Davis N. The role of Pirani scoring system in the management of clubfoot by the Ponseti method. J Bone Joint Surg B 2006; 88:1082-4.

18) Dobbs MB. Factors predictive of the outcome after use of Ponseti method for treatment of idiopathic clubfoot. J Bone Joint Surg Am 2004;86:22-7.

19) Changulani M, Garg NK, Rajagopal TS, Bass A, Nayagam SN, Sampath J, Bruce CE. Treatment of idiopathic clubfoot using Ponseti method: Initial experience. J Bone Joint Surg B 2006; 88:1385-7.

20) Bhasker A, Shraddha R. Results of treatment of clubfoot by Ponseti method in 40 cases: pitfalls and problems in the Indian scenario. Ind J Orthop 2006;40: 196-9.

21) Gupta A, Singh S, Patel P, Patel J, Varshney M. Evaluation of the utility of Ponseti method for correction of the clubfoot deformity in developing country. International orthopaedics (SICOT) 2008; 32:75-9.

A three year old boy presented with progressive stiffness of neck and chest of 45 days duration. Initially the mother noticed tightness of eyelids and nape of neck. Later he developed induration of the skin over the chest and upper back. Clinical examination showed stiff interphalangeal joints of both the great toes and left great toe brachydactyly. Diffuse firm swelling was noted in his neck region with restriction of cervical spine movements. Chest radiographs did not yield any significant findings. Foot radiographs revealed accessory ossicle adjacent to metatarsal heads (Figure 1). The neck radiographs were done and are presented (Figure 2 & 3) The lab parameters are as follows. What is the clinical diagnosis & line of management?

Lab investigations:

Serum calcium	*8.5 mg%*
Serum phosphorus	*4.6 mg%*
Alkaline phosphatase	*112 U/L*
LDH (Lactate dehydrogenase)	*533 U/L*
CPK (Creatinine phosphokinase)	*179 U/L*
CRP (C- reactive protein)	*<3.08 mg/l*
ESR (Erythrocyte sedimentation rate)	*4 mm/hr*
Differential counts	*N: 47 L: 45 E: 2 M: 6*

Figure 1

Figure 2

Figure 3

Plain radiographs of both feet and neck:
Answer in the next issue

The association between clubfoot and developmental dysplasia of the hip.

D. C. Perry, S. M. Tawfiq, A. Roche, R. Shariff, N. K. Garg, L. A. James, J. Sampath, C. E. Bruce

From Alder Hey Children's Hospital, Liverpool, United Kingdom,

J Bone Joint Surg [Br] 2010; 92-B: 1586-8.

Study type: Diagnostic study

Study design: Observational cohort study

Level of evidence: Level III

Objective of the study: To identify any association between idiopathic Congenital Talipes Equino Varus (CTEV) and Developmental Dysplasia of Hip (DDH).

Population studied: 119 neonates with idiopathic CTEV who were screened for DDH by clinical examination and ultrasonogram of hip done at 6 weeks of age between May 2002 to December 2008.

Outcome: Association between idiopathic CTEV and idiopathic DDH.

Results: 5.9% (7 out of 119) of patients with idiopathic CTEV had associated DDH requiring treatment. The severity of clubfoot and DDH based on Pirani and Graf's domains respectively did not correlate however.

Author's conclusions: The study supports an association between idiopathic CTEV and DDH with 5.9% (one in 17) of those with CTEV requiring treatment for DDH also.

Remarks: Selective ultrasound screening of children 'at risk' of DDH in addition to routine clinical examination increases the chance of detecting positive cases. 'At risk' group includes positive family history, breech delivery, torticollis, first born female, Caucasian child, oligohydramnios and foot deformities. Though there is an association between children with CTEV and DDH, those not 'at risk' of DDH tend to be overlooked.

In a similar study in 2009, Paton[1] and Choudry looking at the association of foot deformity with DDH found no association between CTEV (496 children) and DDH and higher association between congenital talipes calcaneovalgus, metatarsus adductus and DDH.

1. Paton RW, Choudry Q. Neonatal foot deformities and their relationship to developmental dysplasia of the hip: an 11-year prospective, longitudinal observational study. J Bone Joint Surg Br. 2009;91:655-8.

Late reduction in congenital dislocation of the hip and the need for secondary surgery: radiologic predictors and confounding variables.

Benjamin J. Bolland, Abdul Wahed, Sariyah Al-Hallao, David J. Culliford, and Nicholas M.P. Clarke.

University Orthopaedics and Research Development Support Unit, Southampton General Hospital, Southampton.

J Pediatr Orthop 2010; 30:676–682.

Study type: Prognosis

Study design: Retrospective Study

Level of evidence: Level III

Purpose of the study: To determine the incidence of those undergoing pelvic osteotomy among patients with late presentation of DDH managed by open and closed reduction. These cases presented either late or following failure of conservative management.

Population studied: Children with late presentation or failed conservative management of DDH who eventually underwent open (OR) or closed (CR) reduction of hip were involved in the study. All patients were operated by a single surgeon. N= 238 (OR= 134, CR= 104) with average age at reduction being 14 months in the pelvic osteotomy group and 15.8 months in the non-pelvic osteotomy group.

Intervention: Open or closed reduction of the affected hip.

Control: The comparison was between open and closed reduction of hips.

Outcome: Incidence of Pelvic Osteotomy (PO), Avascular Necrosis (AVN), Acetabular Index (AI), Ossific Nucleus (ON) development.

Results: Overall secondary procedure rate in this study was 35%.There was a significantly lower secondary procedure rate in OR (19%) group compared to CR (58%).The youngest age at which the reduction of a dislocated hip decreased the incidence of secondary procedure rate in this study was 18 months. There was no statistical difference in the AVN rates of OR and CR groups with 11.2% AVN rate on an average which compared positively with other studies. Confounders like prior treatment with Pavlik harness and mean age at reduction did not affect the PO rate. Surgeon's learning curve was correlated with PO rates. The need for PO decreased with increasing experience. Acetabular index is a reliable indicator of the need for PO 1.5 years post reduction. There was no association between the ON development and the need for PO. Analysis of severity of dislocation indicated that higher the Tonnis grade, greater the need for OR. But the severity of dislocation does not affect the odds of subsequent PO.

Author's conclusions: Late open reduction in children more than 18 months old did not increase the need for a secondary procedure. However there was a significant learning curve for this procedure which definitely affects the outcome.

Remarks: This study states that late open reduction does not increase the secondary procedure rate or the rate of AVN. However it depends on the part of the learning curve in which the surgeon stands. Better results can be expected in the hands of an experienced surgeon. As correctly pointed out by the authors, the outcome of various protocols for treatment of DDH are affected by the surgical experience of the treating surgeon and caution needs to be exercised when superiority of one surgical algorithm over the other is considered.

Lateral growth arrest of the proximal femoral physis: a new technique for serial radiological observation.

S. McGillion , N. M. P. Clarke.

Southampton University Hospitals, NHS Trust, UK.J Child Orthop (2011) 5:201–207.

Study type: Therapeutic

Study design: Retrospective case series

Class of evidence: Level III

Purpose: To present a new technique to identify early lateral growth arrest in femoral head in children treated for DDH. Early identification may allow timely surgical intervention to prevent poor outcome.

Population: Patients with lateral growth disturbance in femoral head after open reduction (N = 11), mean age at secondary intervention (screw epiphyseodesis) = 12 yrs.

Intervention: Screw epiphyseodesis to prevent progressive valgus deformity of femoral neck due to lateral growth arrest.

Control: One case in which screw epiphyseodesis was not done out of the 11 cases.

Outcome: Correction of valgus angulation of femoral neck and tilt angle.

Results: The angle between the physeal line and Hilgenreiner's line was measured as “tilt angle”. Normally it runs from superolateral to inferomedial. A negative value is assigned if the line runs from inferolateral to superomedial. Tilt angle measurements were recorded from 2.5

years of age for all cases. The tilt angle remained constant in normal hips but deteriorated in hips with lateral growth arrest, more after 8 years of age.Control case without intervention for lateral growth arrest showed no deterioration of tilt angle over time. Medial screw epiphyseodesis improved the tilt angle in seven cases, no improvement in tilt angle in one case and tilt angle continued to decline in two cases.

Author's Conclusion: Tilt angle progression in serial radiographs of patients with lateral growth arrest can help to decide the appropriate timing of guided growth of proximal femoral epiphysis.

Remarks: Radiographic measurements of angles are subject to error and the tilt angle is not an exception. Standardized position of the patient and x ray beam and obtaining standing weight bearing radiograph of pelvis with both hips with patella pointing forwards can reduce the errors of imaging. However it is difficult to ascertain the accuracy of the positioning in a retrospective study. Studies to evaluate inter and intra observer reliability of tilt angle is warranted before it can be used as a tool for prediction of timing of epiphyseodesis. As the author's concede, two-dimensional imaging has its own limitations compared to 3D imaging. However the cost effectiveness and radiation hazards ought to be weighed before choosing the best imaging modality. With these limitations, guided growth of proximal femur is a novel approach to manage lateral growth arrest of proximal femur. A prospective randomized trial if feasible can compare its effectiveness with standard management strategies like trochanteric epiphyseodesis and corrective osteotomy.

Vitamin D sufficiency screening in preoperative paediatric orthopaedic patients.

Joshua Parry, Elroy Sullivan and Allison Cooper Scott.
University of Texas Medical School at Houston; and Shriners Hospital for Children, Houston, TX.J Pediatr Orthop 2011; 31:331–333.

Study Type: Diagnostic

Study Design: Retrospective case series

Class of Evidence: Level III

Purpose: To assess the vitamin D sufficiency in paediatric orthopaedic patients admitted for bony procedures which require adequate bone healing.

Population: Children admitted for osteotomies of long bones, hip osteotomies and spinal fusions. N= 70, mean age 13 years.

Intervention: Serum 25OH Vitamin D levels measured by immunochemolumino- metric assay.

Control: nil

Outcome: Vitamin D sufficiency - >32ng/ml, insufficiency - <32ng /ml, deficiency - <20ng/ml, severe deficiency - <12ng/ml.

Results: 16% had severe vitamin D deficiency and 10% had sufficiency above 32ng/ml. African American children are more prone to severe vitamin D deficiency. Vitamin D levels were lower in winter months. Older children had vitamin D deficiency when the cut-off was set at 20 ng/ml. There was no correlation between BMI (Body Mass Index) and vitamin D levels.

Author's conclusion: African American children should be evaluated for vitamin D sufficiency before orthopaedic surgery. Studies to find the effect of vitamin D insufficiency on bony surgical outcomes is advocated as 90% of children in this study group had vitamin D insufficiency.

Remarks: Inspite of increased awareness of vitamin D deficiency, pre operative assessment of its level has not yet become a common practice. Though vitamin D deficiency is defined as < 20 ng/ml, those having serum levels of 20 to 30 ng/ml have been said to have insufficiency in this study, based on the literature review done by the authors. A proper study to determine its health effects, toxicity

and bone healing properties seems prudent. The ill effects of its overuse should also be considered. Over treatment of so called insufficiency might lead to toxicity.

Risk factors for failure after open reduction for DDH: a matched cohort analysis

Sankar WN, Young CR, Lin AG, Crow SA, Baldwin KD, Moseley CF.

Division of Orthopaedic Surgery,The Children's hospital of Philadelphia and Shriners hospital Los Angeles.

J Pediatr Orthop 2011; 31:232–239

Study type: Prognosis

Study design: Retrospective match controlled study.

Class of evidence: Level III

Purpose: To evaluate the predictors of redislocation of hip after open reduction for Developmental Dysplasia of Hip (DDH) by a single experienced surgeon.

Patients: Patients who underwent revision open reduction of hip for DDH. N=22, mean age at surgery= 3.1years.

Intervention: Open reduction of hip.

Control: Patients who underwent primary open reduction of hip matched for age, laterality and sex with the study group. N=22. Mean age = 3.1 years.

Outcome: Reasons for failure.

Results: Acetabular index, pelvic width, triradiate cartilage width, height of dislocation, size of ossific nucleus, abduction angle in spica cast, Tonnis grade and Severin grade were assessed in the initial radiographs. At followup Sharp's angle, centre edge angle, migration index and continuity of Shenton's line were assessed. Mean follow up was 6.4 years for the study group and 8.2 years for the control group. Right sided or bilateral DDH were more prone for redislocation in this study cohort. Larger pelvic width and lower abduction angle in the post operative spica cast are risk factors for redislocation. Findings at surgery revealed dysmorphic femoral head and abnormal femoral version which can lead to redislocation. Subluxation rate and Severin grade were high for redislocation group at final followup. There was no increase in the incidence of Avascular Necrosis (AVN).

Author's conclusion: The authors conclude that the major reason for redislocation were large dysmorphic femoral head and abnormal femoral anteversion. Lack of sphericity may be responsible for unavoidable failure in some cases. Failure due to the abnormal femoral anteversion could be avoided by derotation osteotomy. The other risk factors identified were right side/ bilateral involvement, more mature child as evidenced by increased pelvic width and inadequate abduction in the spica cast.

Remarks: The authors highlight the poor accessibility of advanced imaging in their centre and thus it would be difficult to distinguish a post operative dislocation from a perioperative dislocation. The degree of hip abduction in a spica cast is an important variable with a mean of 38.8 degrees in the failed group and 50.8 degrees in the control group. Though there is higher chance of AVN with higher angle of abduction after open reduction, the amount of hip flexion needed in the spica cast is less than 90 degrees after open reduction of hip as compared to closed reduction which needs more than 100 degrees hip flexion. Thus a higher abduction angle around 45 to 50 degrees can be used for spica cast without the fear of AVN after open reduction of hip. It would be wise to assess the femoral neck version and head shape prior to surgery so as to be able to counsel the parents and take corrective steps during surgery.

Compiled by: Abhay Deodass Gahukamble, Balakumar.B, Sangeet Gangadharan.
Paediatric Orthopaedic Unit,
Christian Medical College, Vellore

Image quiz answer: Infantile cortical hyperostosis involving scapula

Answer to the quiz in POSITIVE September 2009 issue: Infantile cortical hyperostosis involving the scapula

Infantile Cortical Hyperostosis (ICH) was described by Caffey in 1945.[1] It is a self limiting inflammatory condition of the bone in a newborn or infant. The familial form is inherited as auto- somal dominant with variable penetrance manifesting on an average of 6 to 8 weeks after birth. The sporadic form is more common and manifests at 9-11 weeks of age with the maximum being reported as 6 months of age.[2] The affected infant has the classical triad of soft tissue swelling, bony lesions and irritability. The incidence rate reported is 3/1000 for infants younger than six months of age. [2]

The disease is spontaneous and sudden in onset with asymmetric, firm and often tender swellings in different bone and soft tissues. The bones commonly involved are mandible, tibia, ulna, clavicle, scapula, ribs, other long bones, skull, ilium and metatarsals. With mandibular involvement feeding is affected. Scapular involvement, as seen in this child, is reported in 10% of cases.[3]

The severe prenatal form of cortical hyperostosis is also associated with COL1A1 gene missense mutations as in the sporadic and familial forms.[4] The severe lethal form where the onset is before 35 weeks of gestation is associated with polyhydramnios, lung disease and prematurity. Mild form occurs after 35 weeks of gestation and resolves without complications.[5]

Infantile form shows typical periosteal reaction over the entire diaphysis of the bone in layers with cortical thickening. The diameter of the bone and the periosteal bone density increases and becomes homogenous with the underlying cortex and eventual remodelling leads to complete resolution of the bony lesions and normal appearance of bone.[6]

The disease needs to be clinically and radiologically differentiated from osteomyelitis and Ewing's sarcoma in this case. In long bone involvement hypervitaminosis D, child abuse, scurvy and prostaglandin E administration for cardiac malformation also need to be considered.[6] In this child erythrocyte sedimentation rate and total white blood counts were elevated raising the suspicion of infection. This case emphasises the clinical and radiological features and the self limiting course of ICH. A biopsy is warranted only when malignancy is considered.

Relapse and remissions occur in ICH. Clinically symptomatic cases can be treated with indomethacin or naproxen.[7] This child required ibuprofen therapy and clinical improvement occurred over a period of six weeks. Steroids are indicated if there is no response or if there is significant mandible and rib involvement affecting respiration.[6] While resolution is spontaneous and without sequelae, in rare events crippling chest and spine deformity have been reported after a chronic course.[6]

REFERENCES:

1) Glorieux.F.H. Caffey disease: an unlikely collagenopathy. J Clin Invest 2005; 115: 1142–4.

2) Kamoun-Goldrat A, le Merrer M. Infantile cortical hyperostosis (Caffey disease): a review. J Oral Maxillofac Surg 2008;66:2145-50.

3) http://emedicine.medscape.com/article/406697-overview

4) Schweiger S, Chaoui R, Tennstedt C, Lehmann K, Mundlos S, Tinschert S. Antenatal onset of cortical hyperostosis (Caffey disease): case report and review. Am J Med Genet A 2003 ;120A:547-52.

5) Wright JR Jr, Van den Hof MC, Macken MB. Prenatal infantile cortical hyperostosis (Caffey's disease): a 'hepatic myeloid hyperplasia-pulmonary hypoplasia sequence' can explain the lethality of early onset cases.Prenat Diagn 2005;25:939-44.

6) Herring J, ed: Infantile Cortical Hyperostosis. In: Tachdjian's Pediatric Orthopaedics. 3rd edition. Philadelphia, Pa: WB Saunders; 1561-5.

7) Dutta S, Jain N, Bhattacharya A, Mukhopadhyay K.Infantile cortical hyperostosis. Indian Pediatr 2005;42:64-6.

Instructions for submission

PORS (Paediatric Orthopaedics and Related Sciences) invites original articles, case reports and invited articles related to paediatric orthopaedic surgery and related basic science work. Maximum words allowed in an original article are 200 for the abstract and 2500 for the main text excluding references. Case reports should have a maximum of 1000 words. Invited articles can have 3000 words. Image quiz can also be submitted with clear images and text adequate to explain the clinical scenario accompanied by the answer as a word document.

The abstract should be unstructured. The article should be structured with introduction, materials and methods including statistical information, results, discussion, conclusion and references. The article should have an introduction stating area of interest including aims and objectives followed by material and method stating the study methodology, inclusion and exclusion criteria and the statistical methods used. The results should detail the findings of the study and that of statistical analysis. Discussion should be succinct and relevant to the article with adequate literature support and analysis of the results of the study presented with valid conclusions.

The article should be original and not published elsewhere. Consent of the subjects of the article and institutional review board clearance is required. Any conflicts of interest should be mentioned at submission. The article should not be under consideration in other journals. A letter of transmittal stating the same is needed at submission. Those who have contributed to the article by data collection alone, statistical analysis without intellectual input in the data of the paper and editing or grammar correction can be acknowledged at the end of the article. A maximum of six authors are allowed for original articles and case report except in large multi institutional studies. Invited articles should be from experts in their corresponding field of study.

The references should be in the National Library of Medicine Index Medicus format and indicated in the order of appearance in the main body of article. Individual book chapters, web references and abstract references should tag on the standard format as in all indexed journals. The individual references should be written as a superscript in the main article. The figures and legends as appropriate should be submitted in the TIFF or JPEG format with full resolution. The editor has the right to edit the contents and delete as necessary. Maximum four tables are allowed with legends. All acceptable articles will be blinded and sent for peer review and the comments of reviewers sent back to authors for making appropriate corrections.

The decision to accept will be determined by the editor after hearing form the reviewers and statisticians. All the decisions regarding acceptance, rejection and corrections considered necessary will be communicated to the authors by email. The final decision of acceptance and rejection is vested with the editor. A minimum of three months is needed to make a decision on a submitted paper. The accepted article becomes the copyright of the PORS journal and formal permission is needed to reproduce the material elsewhere. Plagiarism of any form is to be avoided and reproduction of images or data from other published literature will need copyright transfer obtained from the publisher to be produced at the time of submission in PORS journal. We accept advertisement for conferences and other educational activities to convey as a note to the readers of this journal. Contact email address for all correspondence and submission:

madhuriwalter@cmcvellore.ac.in

Stimulan® Kit
SYNTHETIC HIGH PURITY $CaSO_4$

Stimulan® Rapid Cure Kit (Calcium Sulphate Hemi-hydrate)

Complete with Calcium Sulphate powder, mixing solution, spatula, mixing bowl, pellet mould and a scraper for pasting the Stimulan onto the mould. The 20cc kit contains two moulds. Designed for pellet formation only. Available in 5cc, 10cc and 20cc sizes.

Optional: To make antibiotic-impregnated biodegradable pellets, when infection is present or anticipated. Ensures sustained elution of antibiotics. Being completely biodegradable, obviates the need of additional surgery (unlike PMMA beads` removal). Non-exothermic, offers flexibility in choosing your antibiotics.

**Post-traumatic osteomyelitis*
**Infected non-unions*
**Management of open and long-bone fractures where infection is present or anticipated (to give prophylactic local antibiotic therapy)*
**Revision Arthroplasties(infected Joints)*
**Antibiotic Prophylaxis in total joint replacements in high-risk group patients*
**Management of Diabetic foot ulcers*
**Soft tissue infections*

Your contacts in India:
1. Alok Saxena – Territory Manager Mobile: 0-99813 25551 Email: asx@biocomposites.com
2. Sumit Basu – Regional Sales Manager (Eastern & Northern India)
   Mobile: 0-98369 39575 Email: sumb@biocomposites.com

Biocomposites®
The Next Regeneration®

Keele Science Park, Keele, Staffordshire, England ST5 5NL www.biocomposites.com

With the Best Compliments From

Corions India Private Limited

5, Sri Krishna Nagar Annexe
Maduravoyal, Chennai – 600095
Telefax: 91-44-23782705
Marketing: 9677011060, Admin - 9677011062
E-Mail: corionsmed@gmail.com

We represent the following principals in India

ORTHOFIX Srl, ITALY –External Fixation Systems

- Adult Limb Reconstruction System Advanced
- Paediatric Limb Reconstruction System
- Pelvic Fixator
- Pertrochanteric Fixator
- Elbow Fixator
- Pennig Dynamic Wrist Fixator
- Multi Planar Mini Rail System for club hand deformities.
- Mini rail Lengthener for Carpal, Meta-carpal,Ulna Bones.
- Eight Plates

KASIOS, GERMANY– Synthetic Bone Substitutes

- Jectos Paste
- TCP Granules

HEBU GmbH, Germany – Plaster Cast Cutter for cutting Synthetic & plaster cast material

ALKANTIS, FRANCE – Sterile Cold Therapy System