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Evaluating the Results of Conservative and Operative Methods of Treatment in Congenital Talipes Equinovarus

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SUMMARY

The purpose of the study was to evaluate the results of treatment, both conservative and operative, of Congenital Talipes Equinovarus (CTEV) with the aim of evolving a simple, objective follow-up procedure for uniform comparison of results.

Fifty three patients of CTEV reporting to Orthopaedics Department. Shaikh Zayed Hospital, Lahore, between September 1986 and June 1988, were studied. Out of them 43.4% patients were treated conservatively while the rest (56.6%) were operated upon. The system of follow-up assessment evolved, was based on grading of function, appearance and growth. The system has the advantage of being practical objective and easily reproducible.

INTRODUCTION

Congenital Talipes Equinovarus (CTEV) is the commonest congenital foot deformity. It is a complex deformity, older than the medical knowledge itself with many unanswered questions regarding its etiology, pathogenesis, surgical anatomy and the methods of treatment. Presently the views on the treatment of clubfoot are far from uniform. Questions arise as to the timing, degree of radicality and the choice of operative procedure as well as pre-operative and postoperative management. Sophisticated anaesthetic and operative techniques have tilted the balance more and more in favour of operative treatment, except of course the mild postural type CTEV, which can be adequately treated conservatively.

The principles and the methods for the evaluation of results of treatment employed by various workers are highly variable leading to lack of uniformity in the findings and results of different studies. A need has thus, always been felt to evolve a uniform system of evaluation of results of treatment, which could be simple, pragmatic and easily employed in our socio-economic setup.

SUBJECTS AND METHODS

The patients in this study were the children and young adults of district Lahore and the surrounding communes with deformities of foot, who reported to Shaikh Zayed Hospital Lahore between September 1986 and June 1988. The cases were studied in retrospect from the hospital records, operation notes as well as on their follow-up visits to our out-patients department.

During the study period of 22 months, the total number of patients reporting with congenital deformities of foot was 77 with 115 affected feet. The distribution of deformities is shown in Table 1.

The congenital clubfoot was found to be the commonest foot deformity (70% of the total affected feet). The other foot deformities along with clubfeet of secondary origin like Meningomyelocele as well as acquired deformities like post-polio TEV were excluded from the study.

Two groups of patients were recognised.

Group A or Primary group comprised of the cases reporting early without or minimal attempts at conservative or surgical management.

Group B or Secondary group included the Cases treated else-where previously with ineffective conservative or surgical management. It included cases reporting with recurrent or residual deformities.

A total of 37 cases were treated and followed up in group A making 69.8% of the total number of cases. The group B comprised 16 cases with 23 clubfeet

(30.2%). The two groups were merged for the purpose of analysis (Table 2).

Table 1: Distribution of cases according to the type of deformities.

Type of deformity	*No. of Patients*	*No. of Feet.*
Congenital TEV.	61	89
Cong. Calcaneovalgus	3	5
Syndactyly feet.	3	4
Polydactyly feet.	3	4
Pseudarthrosis tibia with lobster feet.	1	2
Arthrogryposis multiplex congenita.	3	6
Spasmodic pes planus (accessary navicular or tarsal coalition).	3	5
Total	77	**115**

Table 2: Groups of clubfoot cases.

Groups	*Patient*	*Feet*	*Percent*
A	37	56	69.8
B	16	23	30.2

The clubfoot material had accumulated in a natural way, cases reporting to the hospital randomly over the period of study they did not represent any cross section of the population but persons from different parts of the country forming a nonhomogeneous social group.

The characteristics and distribution of clubfeet in the two arbitrary groups at the time of reporting to our department, along with the modalities of treatment used has been shown in Tables 3 and 4.

Table 3: Distribution of cases according to mode of treatment.

No. of patients/feet	*Conservative*	*Operative*
No. of patients	23	30
No. of feet.	35	44
Unilateral	11	16
Bilateral	12	14
Percent	43.4	56.6

The patients who underwent clinical and radiological follow-up examinations were all with idiopathic true or postural clubfeet of various grades of severity. They were treated either conservatively or operated. Out of 61 clubfoot patients one with multiple congenital malformations died 24 hours after birth, another four were lost to follow-up and two patients refused treatment. Fifty three patients with 79 clubfeet were, thus, available for follow-up after appropriate treatment. (Table 5).

Table 4: Surgical procedures.

Procedure	*No. of feet.*
*CPM release[3]	27
Elongation of Tendo Achilles.	2
Combined PM release and cuboidal decancellation	3
Evan's operation for residual adductus deformity.	7
Two stage CPM release & tarsal wedge osteotomy[5]	2
Triple arthrodesis.	2
Tribialis Anterior tendon transfer with CMP* release.	2

* Combined posteromedial

Table 5: Follow-up status of the patients with congenital clubfoot.

Follow-up status	*Patients*	*Feet*
Dead	2	3
Emigrated or lost to follow-up	4	5
Refused treatment	2	3
Follow-up	53	79
Total	**61**	**89**

On first interview patient's biodata was carefully recorded. Possible etiological factors were highlighted by bringing out the genetic family background and maternal factors like drugs, hormones, irradiation, and maternal illnesses during gestation. Any associated anomalies were carefully sought and childhood illnesses were recorded.

According to the severity of their primary appearance the clubfeet were classified into four grades following modified Somppi's classification[1].

Grade I: Mild or postural clubfeet
Grade II: Moderate clubfoot, less rigid than grade III and can be molded at least partially to normal
Grade III: Severe and rigid clubfoot not amenable to manual correction.
Grade IV: Resistant and recurrent clubfoot. Residual deformities were also included in this grade.

The movements of dorsiflexion and plantar flexion were recorded with the normal side in unilateral cases. The length of the foot was measured from the heel to the distal part of the first toe. The circumference of the calf at the mid leg level was measured.

The radiological examination was carried out for some cases selected for operative treatment. Antero posterior (AP) and lateral views of ankle and foot were taken and talocalcaneal angles were calculated along with the talocalcaneal indices to compare with the normal. Difficulty was found in interpreting the radiological findings in very young patients. The patients were photographed and a plan of treatment was recorded on the history sheet.

Forty five feet (43.4%) of feet were treated conservatively while 56.6% of feet were operated upon. Of the 35 feet treated conservatively 5 were treated by manipulation only, two were treated by manipulation and strapping, the remaining were treated by serial castings. None of the cases was treated by manipulation and splinting alone. Nevertheless polythene night splints and Dennis Browne's splints were used as maintenance therapy in the follow-up treatment. In manipulation and strapping the Robert Jones method was followed[1]. Lehman's[4] method of plaster cast application was adopted. These applications were made mostly under sedation with syrup chloral hydrate except in very young patients. In some cases general anaesthesia had to be used. Initially the plaster casts were changed weekly, then fortnightly and finally after every 4 to 6 weeks. The deformity was corrected gradually, the addiction of forefoot along with inversion of heel and foot were corrected first followed by the correction of the equinus deformity. The last two plaster cast applications were made in overcorrected position. Wedging of plaster casts for correction in resistant cases was resorted to as described by Kite[2] in two cases.

Most of the cases in group A and some of the cases in group B were given a trial of conservative treatment in the form of serial plaster casts. In case where no significant improvement occurred surgery was resorted to a maximum period of 3 months was allowed for these applications to be effective. Nevertheless early surgery was resorted to in obviously resistant clubfeet. Grossly neglected, resistant, recurrent cases in older age group who were candidates for bony procedures were also given few plaster casts prior to surgery to reduce the amount of osseous resection per operatively and to reduce the skin tension. In all, 44 feet were operated upon in 30 patients. The details of operative procedures and the age distribution is given in Table 6. All the operations were carried out in Shaikh Zayed Hospital Lahore. The operations were performed under general anaesthesia using a tourniquet.

Table 6: Distribution of cases according to age and surgical procedures.

Age of patients	*No. of cases*	*No. of feet*	*Procedure performed*
4 - 12 wks	6	9	#CPM release
3 - 6 months	8	11	CPM release
6 - 12 months	1	2	CPM release
6 - 12 months	2	2	*ETA
1 - 5 years	4	6	CPM release and cuboidal decancellation
1 - 5 years	1	2	CPM release and Tib Ant. tendon transfer
6 - 12 years	3	4	CPM release and Evan's procedure
6 - 12 years	2	3	Evan's procedure
> 12 years	2	3	Triple arthrodesis
> 12 years	1	2	Two stage CPM release and tarsal wedge osteotomy

#Combined postero medial release; *Elongation of tendo achilles

The youngest patient operated upon was 4 weeks old and the oldest was 26 years of age. Seventeen patients were less than one year old and 9 patients were more than 5 years of age. The mean age at operation was 3.9 years. However. when combined posteromedial release was the only surgical procedure adopted the mean age was 3.75 months. All patients had received conservative treatment prior to surgery which had failed to correct the deformity or there was recurrence of deformities. Two cases were operated upon for residual forefoot adductus deformity. In two cases elongation of tendo Achilles was carried out as a sole procedure for residual tight heel cords following serial plaster casts.

The combined postero-medial release comprising a formal medial, posterior and subtalar release along with elongation of tendo Achilles was carried out in 25 feet. The operative technique described by Turco[3] was mostly followed with Lehman's[4] modification of skin incision, in which a straight incision extending from the base of the first metatarsal to the Achilles tendon under the medial malleolus was used in some cases. Intra operative radiography was not used. However postoperatively radiography was done to confirm the correct talocalcaneal alignment.

Post-operatively the foot was immobilized in a well padded long leg plaster cast without over correction. Plaster cast was removed after 2 to 3 weeks, stitches

moved and the cast reapplied. The K-wires were removed after 6 weeks and the plaster cast immobilization was maintained for 12 weeks.

In the follow-up treatment in patients before walking age Dennis Browne splints were used for immobilization at night for maintenance of correction. Polythene night splints were recommended in two cases. At walking age surgical prewalking shoes with an outflare were advised. All these appliances were prepared by the Orthopaedic workshop Mayo Hospital Lahore and Rehabilitation Centre Lahore. Selection of appliances was made appropriate to the patients after careful assessment.

In two feet with recurrent TEV, marked peroneal muscle weakness was noted with tibialis anterior tendon acting as a dynamic deforming force. The tendon was transferred laterally to the middle cuneiform. In three feet cuboidal decancellation was used to shorten the lateral column along with formal posteromedial release.

A case of grossly neglected bilateral clubfeet was operated upon in two stages as advocated by Herold and Torok[5]. In the first stage Combined posteromedial release was carried out combined with Steindler's[6] plantar release. Four weeks later tarsal wedge osteotomy of the midtarsal region as well as of subtalar joint was carried out and correction maintained by two K-wires. In two cases triple arthrodesis was carried out as a single stage procedure following serial plaster castings for six weeks using Campbell's[7] technique.

Follow-up Examination:

A method of follow-up examination for the assessment of results of treatment was evolved based on clinical data (Table 7). The patient's feet were assessed for the following parameters with a grading system defined below:

1. **Function**

F1. Normal walking with plantigrade foot. No limping or pain.

F2. Slight limping; slight or moderate intoeing; pain after prolonged walking.

F3. Difficulty in walking; marked limping; persistent pain.

2. **Appearance**

A1. Normal shape; plantigrade foot. No limping or pain.

A2. Scarring and rigidity of foot of moderate degree mild varus of heel or forefoot can wear normal shoes but improper wear of shoes.

A3. Rockerbottom foot; markedly rigid and scarred; residual equinus or adductus deformity; planovalgus (overcorrected foot); cannot wear normal shoes.

3. **Growth**

G1. Normal or only 1 cm difference.

G2. No more than 3 cm difference.

G3. Difference more than 3 cm.
Three factors, leg length, foot size and calf circumference were considered for grading,.

Table 7: Follow-up assessment card.

Name:_____ S/D/O:_____

Age:_____ Sex:_____ Address:_____

Date of Op:_____ Date of Visit:_____

	Features	Findings	Grading
Function	Pain/Limp Ankle Movement Intoeing		F
Appearance	Shape Scarring Rigidity		A
Growth	Size foot Calf circum-ference.		G
X-ray	T/C index		

Final scoring: F ..... A ..... G ..... **Results:** Excellent/Good/Poor.

The significance of radiological assessment was recognised in the follow-up analysis, and talocalca-neal index was calculated from anteroposterior and lateral projections, but difficulty was found in interpreting the results in young patients. The assessment sheet final scoring ran as follows:-

Excellent
Score F1 A1 G1.

Good
1. Score F1 A2 G1 (some scarring and rigidity of foot with intoeing).
2. Score F1 A1 G2 (smaller foot with good function and correction).
3. Score F2 A2 G2.

Poor
1. Score F3 with any score in A and G.
2. Score A3 with any score in F and G.
3. Score G3 with any score in F or A.

RESULTS

From 9th September 1986 to 30th June 1988, 2037 live births took place in Shaikh Zayed Hospital Lahore. Four babies had clubfeet making an incidence of 0.196%. Of the 61 cases of clubfeet, 44 were boys (72.14%) and 17 girls (27.86%), a male to female ratio of 2.58:1 was seen. Twenty nine out of sixty one patients had bilateral clubfeet giving a 47.54% incidence. In the bilateral cases 12 were girls (41.4%) and 17 boys (58.6%).

The positive family history was noted in 3.27% cases selected for study. History of consanguineous marriages was recognised in 16 cases (26.22%). Two clubfoot families were encountered during this study. Three brothers had gross clubfeet; the eldest was operated upon many years back at some peripheral hospital, but unfortunately because of vascular trauma a midtarsal amputation of the foot had to be carried out. The other brother was successfully treated many years back. The youngest brother reported to Shaikh Zayed Hospital Lahore at five years of age with gross residual adductus deformity for secondary operation. He was previously operated at the age of one year at another hospital. Two brothers reporting for the first time at the age of 6 and 7 years respectively were successfully treated by surgery.

One or more associated anomalies were found in nine out of 61 cases (living or dead) of idiopathic clubfeet. A 14.76% incidence of associated anomalies was noted 11.49% in males and 3.27% in females. The details of anomalies found is given in Table 8.

The classification of clubfeet included in this study with appropriate treatment given has been summarised in Table 9. The results of treatment were assessed according to the follow-up plan (Table 7).

Table 8: Associated anomalies in nine cases of talipes equinovarus.

Anomaly		*Sex*	*Age#*
1.	TEV Rt. with amniotic strictures calves	Male	7 Months
2.	TEV Lt. with inguinal hernia	Male	9 Months
3.	TEV Lt. with Craniofacial abnormalities & polydactyly hands	Female	Newborn
4.	TEV Rt. with Klippel-Trenanuny Weber syndrome	Male	21 Months
5.	TEV Lt. with syndactyly Lt. foot	Male	26 Years
6.	TEV Rt. with constriction bands 2nd & 3rd toes.	Male	6 Months
7.	Bilat. TEV flexion contractures elbows.	Female	Newborn
8.	Bilat. TEV flexion contractures wrists.	Male	2 Years
9.	Bilat. TEV with haemangioma right thigh.	Male	Newborn

#Age at the time of reporting

Table 9: Summary of treatment.

Severity of deformity	*No. of cases*	*M*	*F*	*Feet*	*Treatment*
Grade I	3	2	1	5	Manipulations
Grade I	2	2	-	3	Manipulations and strapping
Grade I	4	2	2	6	Serial casts
Grade II	14	10	4	21	Serial casts
Grade II	2	2	-	2	Serial casts followed by ETA#
Grade III	9	6	-	13	Serial casts followed by release
Grade III	6	5	1	9	*CPM release
Grade III	4	3	1	6	CPM release and cuboidal decancellation
Grade IV	1	1	-	2	CPM release and tib ant. tendon transfer.
Grade IV	3	3	-	4	release and Evan's
Grade IV	2	2	-	3	Evan's procedure
Grade IV	2	1	1	3	Triple arthrodesis
Grade IV	1	1	-	2	CPM release followed by tarsal wedge osteotomy

*CPM: Combined posteromedial release. #ETA: Elongation of tendon achilles.

Tables 10 and 11 illustrate the results of conservative and operative treatment. Nine cases (13 feet) with postural clubfeet (Grade I) were treated successfully with excellent results. Out of these, 3 cases were managed by manipulation alone. Two of them were born in Shaikh Zayed Hospital and initial manipulations were done by us. Subsequently mothers were educated to carry out the manipulations at home with each feed.

Table 10: Results of conservative treatment.

Grade	*Patients*	*Feet*	*Treatment*	*Score*	*Results*
I	3	5	Manipulations	FIAIGI	Excellent
I	2	3	Manipulations & strapping.	FIAIGI	Excellent
I	4	6	Serial casts	GIAIGI	Excellent
II	10	15	Serial casts	FIAIGI	Excellent
II	4	5	Serial casts	FIA2GI	Good
II	2	2	Serial casts (Persistent equinus)	F2A2GI	Poor
III	4	6	Serial casts	F2A2GI	Poor
III	5	7	Serial casts	F2A3GI	Poor

Table 11: Results of operative treatment.

Grade	*Patients*	*Feet*	*Treatment*	*Score*	*Results*
II	2	2	*ETA	FIAIGI	Excellent
III	4	7	#CPM release	FIAIGI	Excellent
III	9	12	CPM release	FIA2GI	Good
III	4	6	CMP release & cuboidal decancellation	FIAIG2	Good
III	2	3	CPM release	FIA3G2	Poor
IV	1	2	CPM release & tib. ant. tendon transfer.	FIA2GI	Good
IV	3	4	CPM release & Evan's procedure	F2A2GI	Good
IV	2	3	Evan's procedure	FIAIGI	Excellent
IV	2	3	Triple arthrodesis	F2A2G2	Good
IV	1	2	CPM release tarsal wedge osteotomy	FIA2G2	Good

*, Elongation of tendon Achilles; #, Combined posteromedial release.

Two cases were managed by manipulation and strapping. The method was found to be more cumbersome as frequent reapplications were required. There was slight excoriation of skin in one case. Nevertheless results were graded as excellent.

Sixteen cases (21 feet) with Grade II deformity were treated by serial casts. In ten cases(15 feet) moderate intoeing with limitation of ankle movements was noted, though the feet were plantigrade with normal gait. The results were graded as good.

In two cases with unilateral clubfoot deformity, residual tight heel cord was noted with Persistent equinus deformity inspite of regular plaster casts. The results were graded as poor and surgical intervention was resorted to.

All the cases selected for operative treatment were in Somppi's1 grade III and IV, except in two cases which were apparently in grade II but despite conservative treatment by manipulation and plaster castings showed Persistent equinus deformity due to tight heel cord. Excellent results were obtained by elongation of tendo Achilles.

Nineteen cases (28 Feet) with grade III deformities were treated by combined posteromedial release with excellent/good results in 17 cases. In two cases the results were poor because of residual adductus deformity. In 4 cases (6 feet) of this group cuboidal decancellation was combined.

In one case with bilateral Grade IV clubfeet, weakness of peronei with tibialis anterior tendon acting as a dynamic deforming force causing marked metatarsus adductus was noted. Combined posteromedial release with transfer of tibialis anterior tendon to the 3rd cuneiform produced good results.

Three cases with resistant type of CTEV above the age of 5 years were treated with combined posteromedial release along with Dillwyne Evan's procedure[8] to shorten the lateral column of the foot, producing good results.

In two cases (3 feet) about 7 years of age, who presented with residual adductus deformity following conservative treatment in early childhood, Dillwyne Evan's procedure was carried out producing excellent results.

In two cases above 12 years of age triple arthrodesis was carried out after removing a lateral tarsal wedge to shorten the lateral column. Staples were used for fixation.

In one 26 years old patients combined posteromedial release was carried out to lengthen the medial column followed 4 weeks later by lateral wedge tarsectomy and triple arthrodesis[5].

A case of TEV right with bilateral congenital constriction bands calves was operated upon for TEV as well as the release of strictures. Obstruction to lymphatic flow was noted postoperatively, with gross oedema of foot and necrosis of skin flaps. Plaster cast was removed and the wound left open. The wound healed in about 3 weeks time but the foot was deformed and rigid. With repeated plaster casts applications, the deformity was corrected with good functional results but the foot was smaller in size along with scarring and rigidity. The final results were graded as good.

Superficial wound infections occurred in two cases. Appropriate antibiotics were given after culture and sensitivity tests. It did not affect the prognosis.

In one foot deep wound infection occurred due to pin tract infection. The K-wires were removed after 3 weeks and appropriate antibiotics started. The infection cleared up in 3 weeks without any recurrence of deformity. No such problem with K-wires was noted in any other case except for superficial infections in 3 cases which cleared up after removal of K-wires.

DISCUSSION

The follow-up procedure evolved was simple with main emphasis on clinical examination. Radiological assessment using talocalcaneal angles and tralocalcaneal index was also used but was not included in the final grading.

The follow-up period varied from 17 months to 25 months, with an average of 21 months.

There was some correlation between age of the patient at the time of surgery and the final results. Excellent results were obtained in patients operated upon early. The final results seemed to improve with time in young children with growth of feet.

Mean et al[9] described a method based clinical criteria for comparison of results in the follow-up. The method was less objective with ambiguity in application.

Excellent
Normal function and appearance.
Good
Normal function with a plantigrade foot; no fixed deformity.
Poor
Activity limited in any way; residual deformity.

Main and Crider[10] laid stress on radiological assessment determining the talo-Ist metatarsal angle, talonavicular angle and talocalcaneal index. Simon[11] laid emphasis on peroperative radiography for perfect realignment of tarsal bones and stressed on radiological parameters mainly for evaluation of results. Ryoppy and Sairanen[12] were of the opinion that the final results did not so much depend on the radiological parameters but mainly on clinical features. Turco[3] believed that a follow-up period of two years was necessary for final assessment of results as the recurrence occurred within the first or second year after surgery.

Wynne-Davies[13] described a scoring system for the clinical assessment of results. There were a total of 12 points, four each for Function, Appearance and Movements. Results were graded as excellent, good and poor. Gali et al[14] added two points to the scoring system of Wynne-Davies, including the radiological parameters. Two points were given for talocalcaneal index of over 40 degrees and one point for T/C index between 20 and 40 degrees. No point was given if the talocalcaneal index was less than 20 degrees.

The importance of radiographic assessment was stressed by Heywood[15], who studied the X-ray films of Kite[2] and showed that what was defined by Kite as corrected feet were often uncorrected radiographically.

James L. LeNoir[16] described a complicated segmental classification system for clubfeet based on elaborate radiographic assessment. The postoperative follow-up was based on the same criteria.

Porat et al[17] described a comprehensive clinical and radiological follow-up system taking into account mobility, gait, shape of foot, growth and Talocalcaneal index. Our follow-up procedure is a simplified version of their method.

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