

Talipes Equinovarus surgical Management after Failure of Ponseti Technique in Children

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ABSTRACT

Background: Conservative approaches as Ponseti Technique in managing Talipes Equinovarus could lead to various serious consequences, surgical treatment could if necessary.

Objective: The aim of the work was to assess the functional and radiological outcome of surgically treated clubfeet after failure of Ponseti technique in children.

Patients and Methods: Twelve clubfeet in twelve patients were undergoing posterior medial release in this prospective study at the Orthopedic Department, Zagazig University Hospitals during the period from November 2020 to the end of August 2021 and followed up in out-patients clinics, follow-up period from three to six months. The selected cases were thoroughly examined clinically and radiologically pre- and postoperative.

Results: All postoperative cases were plantigrade; with no poor results were noticed. most cases (81.25%) were with excellent to good results while the remaining (18.75%) were fair with plantigrade foot. Lateral talocalcaneal angle was $12.75 \pm 4.65^\circ$ before surgery; and changed after posterior medial release $40.83 \pm 4.37^\circ$. The increase was significant ($P < 0.001$). Anteroposterior talo-first metatarsal angle was also with significant change from pre to after posterior medial release ($P < 0.001$). As regard complications, there were intraoperative bleeding (two patients) as well as postoperative infections (one patient) and plaster sores and dermatitis (four patients).

Conclusion: It could be concluded that in failed Ponseti technique there is adhesion under the skin of the distal tibia and there is adhesion and fibrosis around the incision of the tendon Achilles certain point should be fulfilled to obtain complete reduction and anatomical restoration of the foot after failed Ponseti.

Keywords: Ponseti Technique, Talipes Equinovarus, Surgical

INTRODUCTION

Idiopathic Talipes cause Clubfoot, also known as Equinovarus, is a fibroproliferative condition of the musculoskeletal system. Its cause is currently a mystery. There is a 1 in 1000 chance of having a baby with this birth condition ⁽¹⁾.

Many theories have been put up to explain the pathological changes seen in clubfeet, but the exact cause is still unknown ⁽²⁾. The equinus, varus, adductus, and cavus abnormalities are all present in this three-dimensional deformity. A pain-free, functional plantigrade foot is the goal of all treatment, regardless of its nature. Surgeons used to prefer surgical treatment, which has been shown to be effective in the short term ⁽³⁾. Many abnormalities can be corrected without surgery by utilizing a combination of conservative methods such as massage, stretching, manipulation, and immobilization. Surgical procedures such as posteromedial release (PMR) or complete subtalar release may be required if various manipulation protocols are unable to address the abnormalities fully ⁽⁴⁾.

For the past two decades, conservative treatment for clubfoot has been the primary option. With similar success, the Ponseti method (PM) and the French functional approach (FFM) have been much disputed ⁽⁵⁾. Also, both PM and FFM have early relapse rates of 37 and 29 percent, respectively ⁽⁶⁾. In order to deal with more severe malformations, further therapy may be necessary ⁽⁷⁾.

Some malformations, even when treated by highly skilled and specialized teams, remain resistant to

conservative measures. Bad outcomes are influenced by a variety of factors ^(8,9).

More than 70% of patients were born with a severe deformity (grade III or IV), making non-surgical treatment less effective. Dimeglio score at birth is a prognostic factor for surgery, as Goldstein *et al.* established recently ⁽⁷⁾.

A study by Dunkley *et al.* found that repeat casting was ineffective, with 86% of patients relapsing following the failure of the PM ⁽¹⁰⁾. McKay *et al.* conducted research and found that repeat casting and bracing for late relapses failed in 94% among patients ⁽¹¹⁾. The authors of Richards *et al.* report that certain patients, despite repeated tries, do not react favorably to conservative treatments. As a result, if surgery is required, it should not be avoided ⁽⁶⁾.

The goal of this work was to assess the functional and radiological outcome of surgically treated clubfeet after failure of Ponseti technique in children.

PATIENTS AND METHODS

This prospective study included a total of twelve patients with twelve clubfeet, attending at Orthopedic Department, Zagazig University Hospitals and undergoing posterior medial release. This study was conducted between November 2020 to the end of August 2021.

Ethical Consideration:

Zagazig University's research ethics council approved the study as long as all participants signed informed consent forms and submitted them to ZU-

IRB#6981. We adhered to the Helsinki Declaration, which is the ethical norm for human testing established by the World Medical Association.

Inclusion criteria: Ponseti method fails in children with relapsed or resistant clubfeet, and parents' consent to take part in the research.

Exclusion criteria: Idiopathic clubfoot, such as postural or neuropathic or paralytic clubfoot, that is not congenital, refusal of parents to participate in the experiment, and the Ponseti approach has not before been used in these cases.

12 feet in 12 patients with congenital talipes equinovarus who operated by posterior medial release after failure of Ponseti technique had fulfilled all study criteria 8 right side and 5 left side.

All participants were subjected to:

Full history taking.

Clinical examination: General examination, and local examination.

Radiological investigations: Talo-calcaneal index, and angle of cavus, and adduction of the forefoot.

Operative technique: Excision or release of all contracted soft tissues in the posteromedial part of the foot is the basic idea behind this treatment, which aims to cure the deformity and minimize the talonavicular and subtalar joints while stabilizing them with Kirschner wires.

Anesthesia: An hour before the procedure, a broad-spectrum intravenous antibiotic was administered. All patients were operated under general anesthesia with muscle relaxants.

Positioning:

After anesthetic has been administered, the patient was placed in the supine position. After the proper painting and draping, the limb was placed in external rotation with the tourniquet properly affixed and inflated.

First metatarsal base to tendocalcaneus was cut with a medial incision beyond the medial malleolus and extending for a short distance up to the tendocalcaneus. Using full-thickness flaps, the superficial dissection was performed first, followed by the deep incision of the fascia. Retraction of the neurovascular bundle was accomplished either anteriorly or laterally, a Z-plasty was performed on the tendocalcaneus to lengthen it, and the posterior talofibular, calcaneofibular, and deltoid ligaments were separated with the deltoid ligament's posterior section.

Finally, an incision of the talonavicular joint was made to open up the talonavicular joint, which was done by dividing the tibialis posterior tendon proximally just above the medial malleolus, and its distal portion traced

to reach the talonavicular joint, which was also opened by incising both the navicular attachment of deltoid ligament and the talonavicular capsule, to complete the medial release, the superficial deltoid ligament and other tight soft tissues on the medial side of the foot were divided and excised, as was the distal end of the tibialis posterior. A reduction in joint size was achieved by inserting Kirschner wires into the talonavicular and subtalar joints. Closed in layers, a well-padded plaster cast was put to the knee with the foot at a straight angle.



Figure (1): A) photograph showing incision and field exposure, B) Release of subtalar joint from medial aspect, C) Correction and insertion of K-wire at the time of surgery.

Post-operative management:

After the third postoperative day, the loose cast above the knee was replaced to check for any wounds. When the plaster was removed, X-rays were taken to check for a successful union. The k wires were removed when the connection was confirmed. For three weeks, a lower-knee cast was worn. Orthosis, a type of splint, is used for six weeks.

Outcomes:

After the Ponseti procedure failed, surgeons utilized the Functional Rating System for Clubfeet (FRS) as an outcome metric to evaluate patient foot function. With a maximum of 20 points, this questionnaire asks about the patient's happiness with their treatment, their ability to perform daily tasks, and their level of pain (maximum 30points).

the heel position when standing (maximum 10 points), ankle dorsiflexion, subtalar joint Varus valgus mobility and inversion-eversion foot flexibility (maximum 10 points). In conclusion, the walking pattern is analyzed (maximum 10points). There is a total of 100 possible points. In order to be considered great, an evaluation of 85 to 100 points would be required, while good would be 70-84 points, and fair between 60 and 69 points would be considered fair.

Radiological evaluation:

At least three months after treatment, radiographs of the feet were obtained in standard Anteroposterior and lateral weight-bearing views.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test (χ^2) to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean \pm SD (Standard deviation). Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value $<$ 0.05 was considered significant.

RESULTS

We studied 12 legs of 12 patients suffering from relapsed clubfoot after failure of Ponseti technique. Their mean age was 23.42 \pm 6.16 months; majority of them were males by 58.3% while females 41.7%. Only 33.3% of patients had positive family history (FH) and 40% had congenital anomalies; 7 patients were right sided and other five were left sided (**Table 1**).

Table (1): Age, sex, family history and side of lesion among the studied cases.

Variable	(n=12)	
Age: (months)		
Mean \pm SD	23.42 \pm 6.16	
Range	16-36	
	N	%
Sex:		
Male	7	58.3
Female	5	41.7
Side:		
Right	7	58.3
Left	5	41.7
Family history:		
-ve	8	66.7
+ve	4	33.3

There was a statistical significance increase in anteroposterior talocalcaneal angle post-operative compare to pre-operative where pre-operative it was 12 degree and post-operative became 35.42 degree with percent of increase (195.17%). **Table (2)**.

Table (2): Anteroposterior talocalcaneal angle among the studied cases pre & post-operative.

Antero-posterior talocalcaneal angle	Pre (n=12)	Post (n=12)	t	P	% of Change
Mean \pm SD	12 \pm	35.42	12.02	<0.001	195.17
Range	4.13	\pm 6.22		**	%
	6-18	27-45			

Sd: Standard deviation t: Paired t test **: Highly significant (P<0.001)

There was a statistical significance increase in lateral talocalcaneal angle post-operative compared to pre-operative where pre-operative it was 12.75 degree and post-operative became 40.83 degree with percent of increase (216.7%) (**Table 3**).

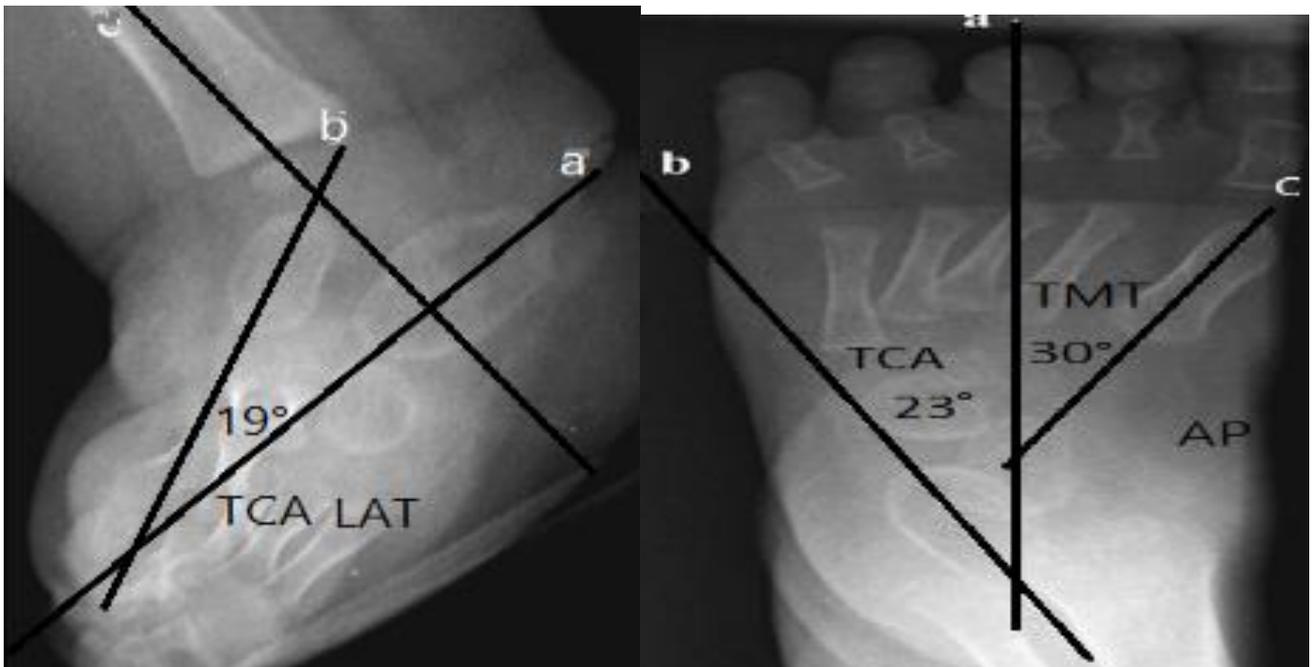
Table (3): Lateral talocalcaneal angle among the studied cases pre & post-operative.

Lateral talocalcaneal angle	Pre (n=12)	Post (n=12)	t	P	% of Change
Mean \pm	12.75	40.83	21.81	<0.001	216.7
SD	\pm 4.65	\pm 4.37		**	%
Range	5-20	32-48			

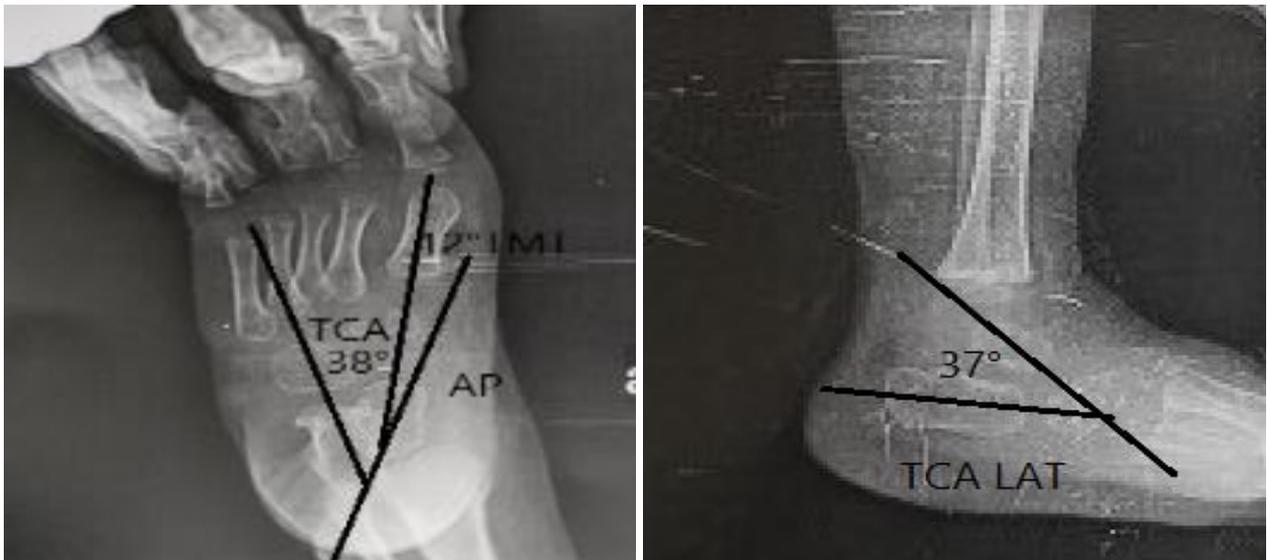
There was a statistical significance decrease in anteroposterior talo-first metatarsal angle post-operative compared to pre-operative where pre-operative it was 39 degree and post-operative became 10.92 degree with percent of reduction (72%) (**Table 4**).

Table (4): Anteroposterior talo-first metatarsal angle among the studied cases pre & post-operative:

Anteroposterior talo-first metatarsal angle	Pre (n=12)	Post (n=12)	t	P	% of Change
Mean ± SD	39±5.54	10.92±3.37	15.16	<0.001	-72%
Range	30-49	6 - 15		**	



(A) Preoperative



(B) Postoperative 8 months

Figure (2): Radiological evaluation of Case (1), (a) Preoperative radiological angles were measured: Anteroposterior talocalcaneal angle: 23°, Lateral talocalcaneal angle: 19°, Talo-first metatarsal angle: 30°, posterior medial release for surgical management of recurrent resistant club foot after failure of Ponseti technique (b) postoperative, Anteroposterior talocalcaneal angle: 38°, Lateral talocalcaneal angle: 37°, Anteroposterior talo-first metatarsal angle: 12.

DISCUSSION

No progress in three months of conservative treatment for the clubfoot indicates that the condition is deemed resistant ⁽¹²⁾. As a result, surgical intervention should be considered all cases have been undergone posterior medial release as a salvage single procedure. Then the cases were followed-up in this study to evaluate the outcome of such recommended surgical technique in Zagazig University Hospitals.

We studied 12 legs of 12 patients suffering from relapsed clubfoot after failure of Ponseti technique. Their mean age was 23.42 ± 6.16 months; majority of them were males by 58.3% while females 41.7%. Only 33.3% of patients had positive family history (FH) and 40% had congenital anomalies; 7 patients were right sided and other five were left sided.

The mothers in our cases didn't smoke or drink alcohol, according to their family history. **Wijayasinghe et al.** ⁽¹³⁾ discovered that just three out of 354 mothers drank alcohol, which is in line with this study's findings ⁽¹³⁾. In contrast **Honein et al.** ⁽¹⁴⁾ found a link between maternal smoking and an increased incidence of clubfoot, particularly during pregnancy.

Only four cases (33.3 percent) were determined to have a good family history, according to **Kruse and colleagues** ⁽¹⁵⁾ it takes more genetic load to influence women than it does on men in this regard. This may explain why males are more likely to have clubfoot than females in this study.

Among the cases that were operated on, 72% were grades III and 28% grade II. **Chacko et al.** ⁽¹⁶⁾ grading's is in line with these results. Club-foot posteromedial release is a contentious topic that has been debated extensively in the literature. In the perspective of most of the authors, early surgery leads to better outcomes ⁽¹⁷⁾.

This study included a scoring system which is both functional and static our results with single stage posteromedial release have been excellent too good in 81.25 percent of cases.

After a minimum of four months of post-operative immobilization in an above-knee plaster cast, **Turco** ⁽¹⁸⁾ had good results. A shorter length of immobilization and the usage of a below-knee cast were anticipated to have poor outcomes ⁽¹⁸⁾. Most of our patients are immobilized for an average of three months in an above-knee cast. This correction was satisfactory.

The big problem of clubfoot management in the developing countries that might yields unpredictable results is the ignorance of parents ⁽¹⁹⁾. This could lead to late presentation of cases as well as loss of regular follow-up. Our 12 cases of clubfoot were operated at Zagazig University; and instructed to come for regular follow-up.

Such follow-up ranged from 6-12 months and included both clinical and radiological assessment.

Radlor et al. ⁽²⁰⁾ examined the angles formed by the talus before and after Ponseti treatment in a radiographic investigation.

In **Lopes et al.** ⁽²¹⁾ study prior to surgery, these angles were measured to ascertain their values in our cases of clubfoot. Using the anteroposterior talocalcaneal angle, heel varus can be determined ⁽²²⁾. 25 to 50 degrees was typical for normal feet ⁽²¹⁾. Varus deformity reduces the angle to under 15° ⁽²³⁾. In addition, the angle of the calcaneo-1st metatarsal in the anteroposterior view determines the degree of forefoot adduction ⁽²⁴⁾.

The current investigation showed that posterior medial release after failure of Ponseti technique could provide satisfactory results. According to Functional Rating System for clubfeet (FRS); most cases (81.25%) were with excellent to good results while the remaining (18.75%) were fair with plantigrade foot.

Postoperative follow-up of our patients with posterior medial release showed a stable plantigrade foot with improved walking ability. This represents a great advantage of posterior medial release procedure in treatment of clubfoot after failure of Ponseti technique.

Regarding the postoperative complications of surgery, it was noticed that the posterior medial release was in general with low incidence of complications.

Only four out of two cases presented dermatitis; and one were with infection. However, intraoperative bleeding was found in two cases; and managed through hemostasis and leaving drainage tube in the wound for 24-48 hours

CONCLUSION

It could be concluded that the posterior medial release might be a single salvage procedure for treatment of clubfoot after failure of Ponseti technique. It should be performed before three years of age to rescue the children from the complications of neglected clubfoot. Such complications include ulceration and osteomyelitis that might lead to amputation. The operation is a single salvage procedure with no major complications; and gives satisfactory results. Follow-up and assessment of cases depend mainly on the clinical examination and the radiological investigation.

This is the first study dealing with the evaluation of posterior medial release after failure of Ponseti technique in management of clubfoot in our institution. However, it carries some limitations including the relatively small number of cases as well as the short-term follow-up. Therefore, future studies with large numbers of cases and long-term follow-up are recommended to ascertain the current conclusions and to exclude the long-run development of any complications.

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