

Role of Talectomy in Severe Resistant Clubfoot in Children

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ABSTRACT

Despite of the global attention paid to talectomy in management of severe, rigid, and resistant deformities of clubfoot, no evaluation of this procedure has been done before in our institution. The aim of work was to evaluate the outcome of surgical removal of talus in these patients. Seventeen severe, rigid, and resistant clubfeet in 10 patients undergoing talectomy were evaluated pre- and postoperative at the Department of Orthopedic Surgery, Zagazig University hospitals, Al-Sharkia, Egypt. The collected data were statistically analyzed. Out of the 10 investigated cases, there were seven males and three females. Seven (70%) cases were bilaterally affected; only three (30%) were one-sided affected. They were one left-sided in two cases and the other was right-sided. Their age ranged 1–5 years with a mean of 30.2 ± 13.3 months. There were good results in 11 (65%) cases out of the 17 operated. Fair results were found in 6 (35%) cases. Three from the 6 feet with fair results following talectomy showed residual cavus; and the others were noticed with residual hindfoot varus with slight inversion and adduction of the forefoot. All cases were with stable and plantigrade foot. In general, patients of both good and fair results were being able to wear shoes and to walk independently with pain free movements. Talectomy could be considered as a single salvage procedure for cases of clubfoot suffering from rigid, resistant and severe deformities. It is a safe procedure with no major complications; and gives satisfactory results.

Keywords: Children, Foot, Talectomy, Talipes equinovarus, Talus.

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INTRODUCTION

Clubfoot, also called talipes equinovarus, is a birth defect in which the foot is fixed in inversion and plantar flexion.¹ This case represents one of the most common congenital orthopedic deformities. It affects 1–2/1,000 live births all over the world. It involves both feet in about half of the reported cases. In the other unilateral cases, the clubfoot slightly more affects the right side than the left. Its incidence is different in both sexes, affecting males more than females. One of the nonoperative lines of management is the Ponseti method that has been widely used to treat cases of clubfoot. The Ponseti method necessitates long-term follow-up periods that might not be available for all patients particularly in the developing countries.²

Moreover, such conservative methods are often futile for rigid foot deformity. Despite the early serial casting, most of cases of clubfoot especially in patients of age between 3 months and 1 year mostly end in surgical releases.³

Cases of severe rigid equinovarus deformity represent a challenging problem. This is because the conservative management is not effective. The surgical options for such cases include release of soft tissues creating the deforming forces, triple arthrodesis, Ilizarov correction using an external fixator, and talectomy.⁴

Talectomy was first performed for management of cases of paralytic calcaneovalgus deformity. Nowadays, it is seldom considered for such purpose but most often used as the salvage procedure for treatment of severe resistant cases of clubfoot deformities.⁵

The decision to remove the talus as a single-stage procedure in severe resistant cases might be crucial to correct the deformity and to increase the patients' walking ability. Talectomy is considered as a salvage procedure for recurrent cases and might be the primary option for treatment of severe, resistant, and rigid clubfoot deformity.⁶

Despite of the vast attention paid to talectomy, no evaluation of its outcome in Zagazig University Hospitals has been previously

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done. Therefore, this study was held in our hospitals on patients who underwent surgery of talectomy in cases of severe resistant clubfoot. The aim of this work was to evaluate the results of the clinical and functional outcome after surgical removal of talus in patients with severe resistant clubfoot. Moreover, the study aimed to record the surgical techniques approved in our department for management of such cases.

PATIENTS AND METHODS

Patients

Seventeen resistant feet in ten patients were investigated at the Department of Orthopedic Surgery, Zagazig University Hospitals, in the period from November 2017 to November 2018.

The inclusion criteria in this study were patients with rigid and severe clubfoot, resistant to conservative measures and surgically fit patients. The cases were excluded when there were infections and in patients with insufficient or lost follow-up data.

Approval was achieved from Zagazig University Institution of Review Board (IRB); a written consent was also obtained from subjects and/or their parents who participated in this study.

METHODS

The selected cases were thoroughly examined clinically and radiologically. The cases were examined to check presence for any other congenital anomaly. Then, the operation for talectomy was recorded for its technique and any modification done. Talectomy was performed by Prof Hossam M Khairy; and assisted by other authors.

Surgical Technique

All patients were given prophylactic preoperative antibiotics. The operative technique used was similar to that mentioned by Menelaus.⁷ The operation was done under general anesthesia with a mid-thigh tourniquet.

Position of Patient

It was the supine position, with a small sandbag under the buttock of the side to be operated. The affected foot was prepped and draped with antiseptic solution "betadine and alcohol" up to the knee.

Skin Incision

In all cases, it was a curved anterolateral incision in the line of subtalar and talonavicular joints performed at the ankle and extended to the navicular level to expose the talus (Fig. 1).

Talectomy

The talus was completely removed after exposing its head and neck. In one case, a piece of the bone was broken and removed using a bone nibbler. Satisfactory alignment of the calcaneus in the mortise was ensured. In two cases where the calcaneus was unstable in the mortise, it was stabilized by a Kirschner wire passing from the sole into the calcaneus and tibia. In general, the postoperative field of the operation was bloodless (Fig. 2). However, in some cases, there was some bleeding; therefore, drainage suction was done before closing the wound (Fig. 3).

A plaster above the knee and including the foot was done to keep the operated foot in the corrected position. The plaster was changed after 3 weeks, at which the wire was removed. The position was maintained in the cast for 3 months. The patients were allowed to bear weight through the postoperative follow-up.

In cases with bilateral clubfoot, surgery was done for the second deformed foot after releasing the cast of the first operated one.

Postoperative follow-up was done for 6–12 months. This included clinical assessment of the appearance of foot, the residual deformity, the level of activity, the tolerance of walking, and ability to wear shoes.

Then, the results were graded according to that of Legaspi et al.⁸ and Mirzayan et al.,⁹ as follows:

- Excellent: Plantigrade, painless with unlimited ambulation and without residual deformity.
- Good: Plantigrade of $\leq 15^\circ$ of equinus, mild residual hindfoot deformity requiring no further surgery, painless on walking.
- Fair: More than 15° or residual hindfoot deformity requiring further surgery, painless on walking.
- Poor: More than 15° or residual hindfoot deformity requiring further surgery, pain on walking causing its limitation.

Also, the cases were scored according to Dimeglio scale.¹⁰ We assessed four main deformities including equinus, hind foot varus, midfoot rotation (horizontal plane) and forefoot adduction (on hindfoot). Each one was scored as angulation from one to four points as follows: Score 1 ($<0^\circ$), Score 2 ($<0^\circ$ – $<20^\circ$), Score 3 (20° – $<45^\circ$) and Score 4 (45° – 90°). Other associated features named posterior and medial creases, pes cavus and abnormal musculature were also checked. The score was added by one point in presence of one of them. Then, the feet were classified into four grades; the first "the least in deformity" (1 – <5), the second (5 – <10), the third (10 – <15) and the fourth grade "very severe deformity" (15 – 20). All selected cases of the study were of the fourth degree.

Moreover, radiological assessment of anterolateral and lateral radiographs of the ankle and foot was performed at follow-up. The tibiocalcaneal angle measurements on lateral view were recorded with assessment of presence or absence of tibiocalcaneal arthritis or fusion. The position of calcaneus in relation to the long axis of tibia on lateral radiographs was assessed.

Statistical Analysis

The retrieved data were statistically analyzed using the SPSS 22.0 software (SPSS Inc, IBM, Chicago, IL). A *p* value of less than 0.05 was documented as a significant value.

RESULTS

We studied 17 legs of 10 patients suffering from severe resistant and rigid clubfoot (Fig. 4). Out of the 10 investigated cases, seven



Fig 1: Photograph showing the enucleation of talus



Fig. 2: A bloodless field of the wound after talectomy



Fig. 3: A drainage tube passing through the wound

were males and three females. Their ages ranged from 1 to 5 years with a mean 30.2 ± 13.3 months (Table 1).

Seven (70%) cases were bilaterally affected; only three (30%) were one-sided affected. They were one left-sided in two cases and the other was right-sided.

Past history of preoperative treatment was found in 82.4% of cases (14 feet). They were managed conservatively in the form of serial casts and manipulations in five cases; however, the other three cases were managed operatively; two were with history of Achilles tenotomy and other one had undergone partial talectomy "lateral wedge resection" and follow-up for 6 months, but with recurrence.

The shortest onset of postnatal conservative treatment was 2 months and the longest was 7 months (Table 2). Its period ranged from 3 to 5 months. Two patients were with rigid equinus, severe plantar flexion of metatarsals and transverse creases at the sole and above the heel as well as showing severe rigidity for manipulation. The calf muscles were found to be small; and the tendocalcaneus was very tight, pulling the heel into severe equinus so causing the deep crease above it.

Only four of the 10 patients revealed other congenital anomalies, represented by thoracolumbar spina bifida in one case and a moderate degree of genu valgum in another case. The other two cases were with developmental dysplastic hip (DDH) bilateral

Table 1: Distribution of cases according to their ages

Age	Number of cases
1 year to 1½ years	1
>1½–2 years	2
>2–3 years	4
>3 years	3

Table 2: Past history of the conservative measures and their onset

<i>Patients with past history of conservative treatment</i>	<i>Type of conservative treatment</i>	<i>Onset of conservative postnatal treatment</i>
Patient 1	Manipulations and plaster cast for 2 weeks interval	3 months
Patient 2	Manipulations and plaster cast for 2 weeks interval	2 months
Patient 3	Manipulations and plaster cast for 2 weeks interval	Since birth
Patient 4	Manipulations and plaster cast for 2 weeks interval	Since birth
Patient 5	Manipulations and plaster cast for 2 weeks interval	7 months
Patient 6	Manipulations and plaster cast for 6 weeks interval	5 months
Patient 7	Manipulations and plaster cast for 7 weeks interval	4 months
Patient 8	Manipulations and plaster cast for 5 weeks interval	3 months

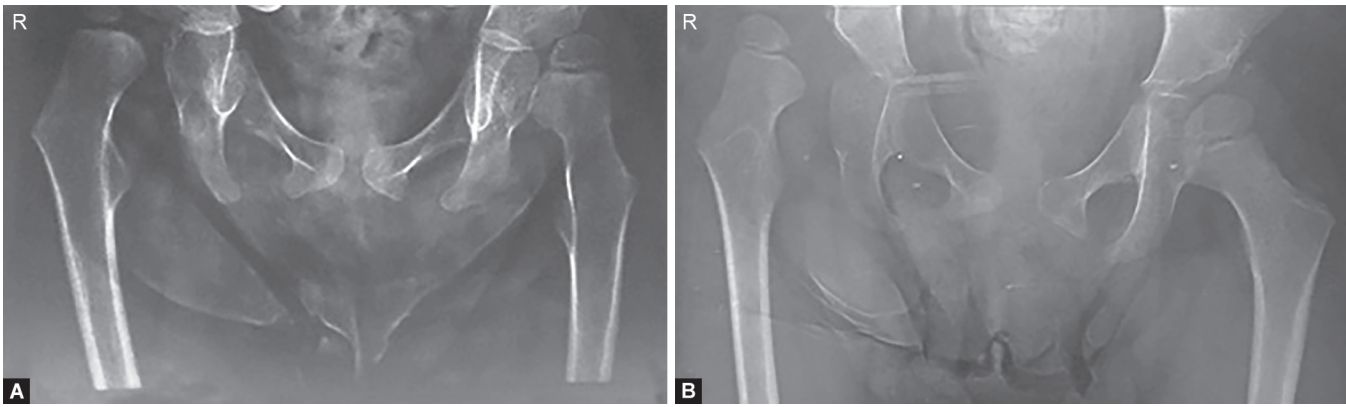
in one case and unilateral in the other patient (Figs 5 and 6; Table 3). No tibial torsion was detected in our cases.

Postoperative Evaluation

Each foot was evaluated as a separate case. Clinically, all postoperative cases were plantigrade; no poor results were noticed in our cases. There were good results in 11 (65%) cases out of the 17 operated. Fair results were found in 6 (35%) cases (Table 4). Three from the 6 feet with fair results showed residual caves; and the others were noticed with residual hindfoot Varus with slight inversion and adduction of the forefoot (Figs 7 and 8). All cases were with stable and plantigrade foot.



Figs 4A to C: Clubfoot: (A) Bilateral; (B) Anterior view of unilateral; (C) Posterior view of unilateral cases



Figs 5A and B: Photographs of cases of developmental dysplastic hip: (A) Bilateral affection; (B) Unilateral "right-side" developmental dysplastic hip

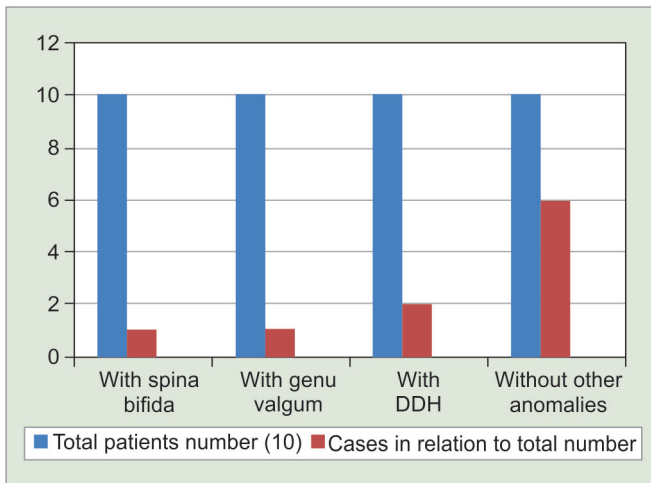


Fig 6: Columns showing the cases with and without other congenital anomalies in relation to the total number of patients

Table 3: Cases with other associated congenital anomalies

Congenital anomalies	Previous management of anomalies	Number of cases	Percentage
Spina bifida	Surgically repaired soon after birth	1	10
Genu valgus	None	1	10
DDH	None	2	20
Total		4	40

Table 4: Results of the operated cases by talectomy

Results	Number of cases	Percentage
Excellent	—	0
Good	11	65
Fair	6	35
Poor	—	0
Total	17	100

According to the Dimeglio score,¹⁰ all cases showed marked improvement from grade VI 'mean 17.29 ± 1.76 ' to grade II with a mean of 5.94 ± 3.42 following talectomy (Table 5).

In comparison between the subjective grading with Dimeglio scale in evaluation of outcomes; we found that the good results according to the subjective score were 58.8% (10 out of 17 feet) while according to the Dimeglio score were 64.7% (11 out of 17

feet) with significant association and agreement between two scores (Table 6).

In general, patients of both good and fair results were being able to wear shoes and to walk independently with pain free movements.

Radiologically, there were no noticed cases with tibiocalcaneal ankylosis during the follow-up period.

There was nearly parallelism of the calcaneus and talus noticed on both views in cases of clubfoot (Fig. 9). The talocalcaneal index for the clubfoot in the study was of a mean $15.88 \pm 8.67^\circ$. The mean of the anteroposterior tibiocalcaneal angle was $129.88 \pm 9.46^\circ$ in our cases of clubfoot and $157.17 \pm 14.2^\circ$ after talectomy showing a significant change ($p = 0.00$). On the other hand, lateral tibiocalcaneal angle was measured $65.58 \pm 4.63^\circ$ before the surgery and not greatly changed after talectomy measuring $79.41 \pm 7.04^\circ$. The increase was not significant ($p = 0.00$). Calcaneo-fifth metatarsal angle was the one to be greatly changed among the other measurements ($p = 0.00$) (Tables 7 and 8; Figs 9 to 16).

Operative Complications

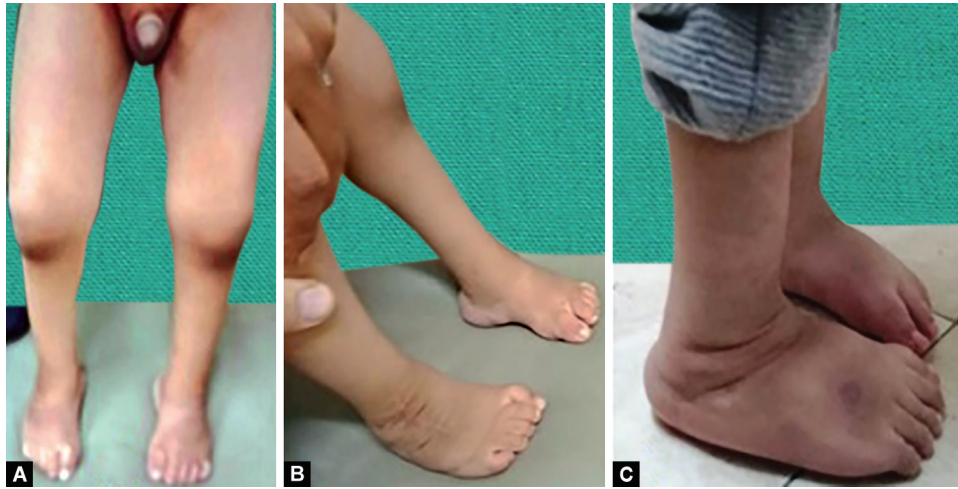
The talectomy operation was complicated by bleeding in 4 feet out of 17 (23.53%), two of them belong to one patient. They managed by posterior slap with compression by creeping bandage and drainage tube left in the wound for 24–48 hours.

As regard the postoperative complications, infection was noticed in 2 feet out of 17 (11.76%) in one patient. The infection was resolved after surgical irrigation and debridement as well as using the appropriate antibiotics and anti-inflammatory therapeutics; then the wound healed without further complications. Plaster sores and dermatitis were found in 4 feet out of 17 (23.53%) in two patients, one of them who had bilateral bleeding as mentioned above. In such cases, plaster was removed and the skin conditions were treated. Then, the plaster cast was re-done without tightness after improvement of skin conditions.

Avascular necrosis of other foot bones and injury of the neurovascular bundles were not documented in our cases. Moreover, hematoma and wound dehiscence were not noticed in any of our cases (Table 9 and Fig. 17).

DISCUSSION

Management of severe, rigid, and resistant deformities of clubfoot is still a big orthopedic challenge.¹¹ In such cases, the conservative treatment is frequently ineffective. Meanwhile, the surgical options are little.¹² Fourteen (82.4%) of our cases were not responding to the protocol of standard techniques. Out of these cases, two patients



Figs 7A to C: Cases of surgically corrected bilateral clubfoot by talectomy with good results: (A) Anterior; (B) Lateral oblique; (C) Lateral views



Figs 8A and B: Surgically corrected bilateral clubfeet by talectomy: (A) Good; (B) Fair results

were with rigid equinus, severe plantar flexion of metatarsals, and transverse creases at the sole and above the heel as well as showing severe rigidity for manipulation—and diagnosed as cases of severe rigid clubfoot.¹³

About 50% of cases were reported to have involvement of deformities in both feet; and the other cases were with unilateral clubfoot mainly affecting the right side.¹⁴ Similarly, Wallander stated that bilateral cases were identified in about 46% of 280 cases.¹⁵ This is in contrast to the current study where the bilateral cases of clubfeet were the most ones representing 70% of our investigated patients. On the other hand, the unilateral cases were two on the left and only one on the right side. Regarding the gender, there were 70% males and 30% females. This finding is in general agreement with that of Wijayasinghe et al. who investigated a total number of 354 patients and found the ratio of 2.7:1 regarding males and females, respectively.¹⁴ However, Wallander found no gender differences detected regarding the incidence of clubfoot.¹⁵

Family history of our cases indicated that their mothers were not smoking or drinking. This might match with the findings of Wijayasinghe et al. who found that only 3 out of 354 mothers were consuming alcohols.¹⁴ On the other hand, Skelly et al. reported that there was an increasing risk of clubfoot with maternal smoking

especially during pregnancy.¹⁶ Only two cases (20%) were found to have one of their relatives with clubfoot but treated conservatively without surgical interference. Honein et al.¹⁶ stated that there is an increasing risk in parents or relatives with clubfoot.¹⁷ Engell et al. also postulated that the incidence of clubfoot in a monozygotic twin is more than 30% if one of them is affected.¹⁸ They attributed their findings to the genetic component. In this aspect, females, on the contrary of males, need more genetic load to be affected.¹⁹ The last suggestion might explain the higher incidence of clubfoot in males than females found in this study.

On investigating our cases of clubfoot for other deformities, it was found that there was a large proportion (40%) associated with other congenital anomalies in the form of DDH, spina bifida, and genu valgum. Determination of such associated anomalies is essential as it might affect the line and outcome of the management. Other authors reported that other congenital anomalies were identified in 20% of cases of clubfoot. These anomalies include myotonic dystrophy, distal arthrogryposis, myelomeningocele, or other genetic syndromes, e.g., chromosome 22q11 deletion and trisomy 18.^{20,21}

Past history of previous measures was found in 8 of the 10 investigated cases. Its onset ranged from 0 to 7 months postnatally. This depended on the progress and condition of the cases. With such methods, no correction progress was achieved; and the clubfeet were resistant to treatment. The clubfoot is considered a resistant case when no improvement could be achieved within 3 months of conservative treatment.²² Then, surgical interference was inevitable. Talectomy was performed as salvage for eight patients and procedure for other cases. Age of our cases ranged from 6 months to 5 years with a mean of 2.5 ± 0.58 years. There is a general consensus that the delay of surgical interference in the case of rigid resistant clubfoot is insignificant.²³ Osterman and Merikanto recommended such interference to be performed at the age of 2–5 months in order to allow the remodeling potential of the foot.²⁴

The technique of talectomy in this work was performed according to the main lines adopted by Menelaus.⁷ Anterolateral incision was done to avoid injury of the neurovascular bundles of the foot that pass in such direction. The bone was removed completely. Any remained or broken piece was removed. The presence of talus bone remnant might interfere with the proper position of the calcaneus within the ankle socket and lead to recurrence of the deformity.⁸ Other procedures were not being

Table 5: Pre- and post-talectomy cases' characteristics with Dimeglio Scoring

Patient's No.	Gender (male 'M' or female 'F')	Age (months)	Unilateral or bilateral																	P value	Significance
				Equinus		Hind foot Varus		Midfoot rotation (horizontal plane)		Forefoot adduction (on hindfoot)		Other associated									
				Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Posterior crease	Medial crease	Cavus	Abnormal musculature	Preoperative	Postoperative		
1	F	37	Bilateral	4	2	4	2	3	1	4	2	1	1	1	1	1	0	1	1	0.0148	SS
				3	1	4	1	4	0	3	1	1	0	0	0	1	0	0	0	0.0138	SS
2	M	25	Unilateral 'Right'	3	0	3	1	4	1	4	1	0	0	1	0	1	0	0	0	0.0096	VSS
3	M	40	Bilateral	4	1	4	1	4	0	3	1	1	0	1	0	0	0	1	1	0.0127	SS
				4	2	4	2	4	2	4	1	1	1	1	1	1	1	1	1	0.0379	SS
4	M	34	Unilateral 'Left'	4	1	4	1	3	1	4	1	0	0	1	0	1	0	0	0	0.0096	VSS
5	F	17	Bilateral	4	1	4	1	4	1	4	1	0	0	0	0	1	0	0	0	0.0185	SS
				4	1	4	1	4	0	3	0	1	0	0	0	1	1	0	0	0.0209	SS
6	F	25	Bilateral	4	2	4	2	4	1	4	2	1	1	1	1	1	1	0	0	0.0379	SS
				3	1	3	1	3	1	3	0	0	0	0	0	1	0	0	0	0.0190	SS
7	M	26	Bilateral	4	1	4	2	4	1	4	1	1	0	0	0	1	0	0	0	0.0096	VSS
				4	1	3	1	4	1	4	1	1	0	1	0	0	0	0	0	0.0096	SS
8	M	60	Unilateral 'Left'	4	2	4	2	4	2	3	2	1	1	0	0	1	1	1	1	0.0412	SS
9	M	24	Bilateral	3	2	4	2	4	1	4	2	1	0	1	1	1	1	1	1	0.0256	SS
				4	1	3	1	3	0	3	1	1	1	1	0	0	0	0	0	0.0203	SS
10	M	14	Bilateral	4	1	3	0	3	0	4	1	1	0	1	0	0	0	0	0	0.0092	VSS
				4	2	4	2	4	2	3	1	1	1	1	1	1	0	1	1	0.0148	SS

SS, Statistically significant; VSS, Very statistically significant

Table 6: Significant association and agreement between subjective and Dimeglio scores

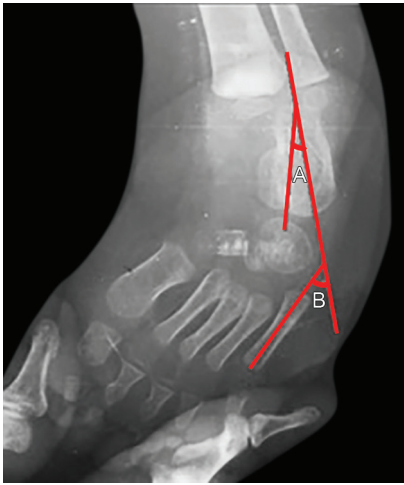
			Dimeglio score			X ²	p	Kappa agreement
			Fair	Good	Total			
Subjective	Fair	N	6	1	7	13.24	0.00*	0.87
		%	100.0%	9.1%	41.2%			
	Good	N	0	10	10			
		%	0.0%	90.9%	58.8%			
Total	N	6	11	17				

*Highly significant

done with talectomy in the current cases. Gursu et al. stated that such additional procedures might include Achilles tenotomy and plantar fasciectomy.¹²

Regarding the radiological investigation, Radler et al.²⁴ measured some angles including that formed by the talus before and after Ponseti treatment.²⁵ In this study where the talus was removed, we measured these angles preoperatively to determine their values in our cases of clubfoot. The talocalcaneal angles help to determine the angle of varus.²⁶ At the same time, the degree of forefoot adduction is determined by the calcaneo-first metatarsal angle in the anteroposterior view.²⁷

There were discrepancies between the values of angles measured radiologically between the different studies including the current one (Tables 10 and 11). This might agree the conclusion of Munshi et al. and Kamath and Austine stating that the radiological assessment of clubfoot isn't a reliable method as it carries significant variability.^{28,29} We might add that it is difficult to put standard measures to be global values for the angles of clubfoot in children due to the differences in positioning the infants and toddlers. Any change in position or even movement of the child could yield different measures. However, the radiological examination could be used in the same center by the same professional to follow-up



Figs 9A and B: Anteroposterior X-ray view showing talocalcaneal (A) and talon-fifth metatarsal (B) angles in a case of clubfoot

Table 7: Mean values (M) in degrees \pm standard deviation (SD) of radiological evaluation of talocalcaneal angles and index in our cases before talectomy

Angle (No = 17 feet)	M	\pm SD
Anteroposterior talocalcaneal angle	8.00°	4.06°
Lateral talocalcaneal angle	7.88°	5.79°
Talocalcaneal index	15.88	8.67

Table 8: Mean values (M) in degrees \pm standard deviation (SD) of radiological evaluation of rigid severe clubfoot before and after talectomy

	Pre	Post	Paired t	p
Anteroposterior tibio-calcaneal angle	129.88 \pm 9.46°	157.17 \pm 14.2°	-6.810	0.00**
Lateral tibio-calcaneal angle	65.58 \pm 4.63°	79.41 \pm 7.04°	-9.495	0.00**
Calcaneo-first metatarsal angle	66.05 \pm 5.39°	49.11 \pm 9.22°	8.522	0.00**
Calcaneo-fifth metatarsal angle	65.47 \pm 3.35°	17.94 \pm 5.6°	32.265	0.00**

**Significant change

his cases. In regard to the lateral tibio-calcaneal angle, there was significant change ($p = 0.00^{**}$). This result comes in general agreement with the results of Legaspi et al. who found the angle measuring 77° (50–128); and no relation to lateral tibio-calcaneal angle and the final outcome was detected.⁸ However, this is in contrast to the study of El-Sherbini and Omeran, which noticed marked change ($p < 0.001$).⁴ This discrepancy might be due to the change occurring with the long-term follow-up advocated in the previous study. The talocalcaneal index which is the summation of the anteroposterior and lateral talocalcaneal angles was nearly similar to that obtained by Kumar et al.³⁰ This index has been suggested by Beatson and Pearson who stated that values greater than 40 are indicating a normal foot.³¹ They added that talocalcaneal index of clubfoot is with lower measures than 40°.

The current investigation showed that talectomy in severe, rigid resistant cases of clubfoot could provide satisfactory results. Most cases (65%) were with good results while the others were fair with plantigrade foot.¹⁰ These results are similar to that reported

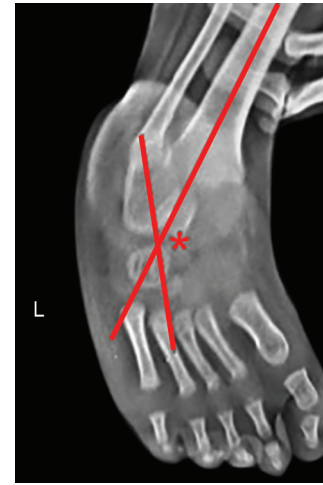


Fig. 10: Anteroposterior X-ray view showing tibio-calcaneal angle (*) in a preoperative case of clubfoot



Fig. 11: Anteroposterior X-ray view showing tibio-calcaneal angle (A) in a preoperative case of clubfoot

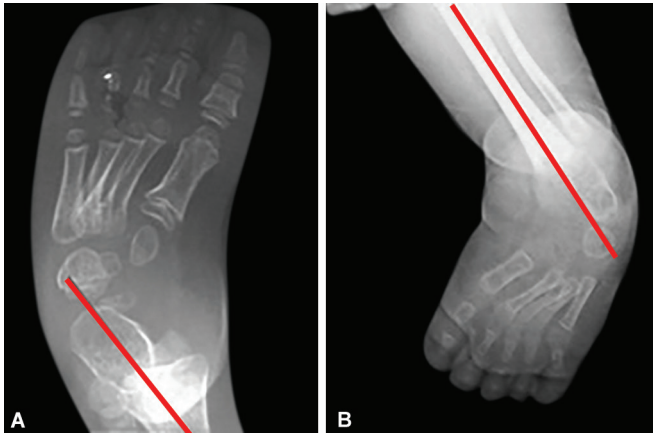
by El-Sherbini and Omeran who found no patients were of poor results.⁴ Also, Menelaus⁹ noticed good results in 79% following surgery.⁷ The author added that the rigidity of the newly formed joint between tibia and calcaneus was not greater than the rigidity of the ankle joint prior to surgery. Legaspi et al. reported that most (75%) of their patients with long-term follow-up were ranged between good and fair results without needing further surgery.⁸ Osteoarthritic changes were noticed after 8–10 years of talectomy. We did not notice such changes in our cases, perhaps due to the relatively short-term follow-up. Cooper and Capello stated the longest follow-up period extending up to 20 years after talectomy in patients suffering from poliomyelitis and calcaneovalgus deformity.³³ They reported satisfactory outcome in their cases with average ages of 10 years at the operation. They added there's no ideal age for talectomy. However, Menelaus⁹ stated that talectomy is a useful operation especially for children between 1 year and 5 years of age.⁷ Joseph et al. concluded that talectomy is mainly a pediatric procedure and demonstrates a good outcome with long-term evaluations.⁵ Pirpiris et al. compared the outcome of talectomy alone in 14 cases with talectomy accompanied with calcaneocuboid fusion in another 17 patients with average follow-up of 9.7 years.³⁴ They concluded that the last procedure associated



Fig. 12: Anteroposterior X-ray view showing calcaneal-first metatarsal angle (A) in a preoperative case of clubfoot



Fig. 13: Anteroposterior X-ray view showing tibio-calcaneal angle (large *) and calcaneal-first metatarsal angle (small*) postoperative case of clubfoot



Figs 14A and B: Anteroposterior X-ray view showing nearly absence of tibio-calcaneal angle in a postoperative case of clubfoot; the long axis of tibia nearly passing through that of calcaneus (A) or parallel to it (B)



Fig. 15: Lateral X-ray view showing tibio-calcaneal angle in a preoperative case of clubfoot



Fig. 16: Lateral X-ray view showing tibio-calcaneal angle (*) in a postoperative case of clubfoot

with calcaneocuboid fusions gives better results as this fusion prevents the recurrence of the deformities and supports the foot.

Table 9: Operative complications

		No. of cases	%
Bleeding	No	13	76.47
	Yes	4	23.53
Infection	No	15	88.42
	Yes	2	11.76
Plaster sores and dermatitis	No	13	76.47
	Yes	4	23.53
Avascular necrosis of foot bones	No	17	100.0
	Yes	0	0.0
Injury of the neurovascular bundles	No	17	100.0
	Yes	0	0.0
Hematoma and wound dehiscence	No	17	100.0
	Yes	0	0.0
Total		17	100.0

Postoperative follow-up of our patients with talectomy showed a stable plantigrade foot with improved walking ability. This represents a great advantage in clubfoot cases especially with severe, rigid, and resistant deformities. The newly formed joint was

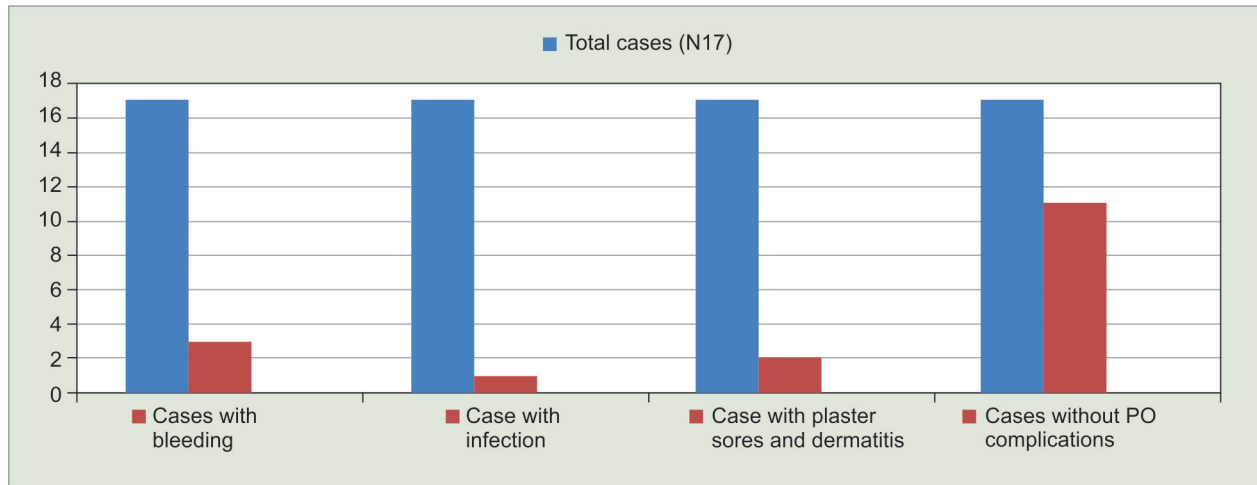


Fig. 17: Columns showing cases with and without operative complications

Table 10: Comparison of values of talocalcaneal angles of feet before correction in the previous researches and current study

Angle	Radler et al. ²⁵	Kumar et al. ³⁰	Current study	Ranges of angles in normal foot
Anteroposterior talocalcaneal	29.06° (±11.89°)	12°	8.00° (±4.06°)	20–40° (Kamath and Austine ²⁹); 18–23° (Ippolito et al. ³²)
Lateral talocalcaneal angle	35.17° (±8.27°)	20°	7.88° (±5.79°)	35–55° (Kamath and Austine ²⁹)
Talocalcaneal index	64.23 (±20.16°)	32°	15.88 (±8.67°)	40–85° (Beatson and Pearson ³¹)

Table 11: Comparison of changes of some radiologically-measured angles in the previous researches and current study

Angle	Study	Before management	After management	Change	Significance (p value)
Anteroposterior tibiocalcaneal angle	Current study	129.88 (±9.46)	157.17 (±14.2)	27.29 (±16.53)	(p < 0.001)
Lateral tibiocalcaneal angle	Radler et al with Ponseti method ²⁵	84.69 (±12.58°)	68.85 (±11.91°)	15.85 (±11.67°)	(p < 0.01)
	El-Sherbini et al with talectomy ⁴	130 (±20.5°)	88 (±27.5°)	41 (±93.0°)	(p > 0.001)
	Current study	65.58 (±4.63°)	79.41 (±7.04°)	13.82 (±6.00°)	(p < 0.001)
Calcaneo-1st metatarsal angle	Current study	66.05 (±5.39)	49.11 (±9.22)	16.94 (±8.20)	(p < 0.001)

stable without osteoarthritis and pain. However, the disadvantage is that the disturbance of the normal anatomy with nonphysiological movement as well as tibiocalcaneal fusion might occur.⁷ Józwiak et al. suggested performing wedge resection of the calcaneocuboid joint with talectomy.³⁵ They mentioned that this procedure makes the surgery easier and improve the position of the forefoot.

Regarding the postoperative complications of surgery, it was noticed that the talectomy was in general with low incidence of complications. Only four out of 17 cases presented dermatitis; and two with infection. All these cases were managed with proper treatment with complete recovery. However, intraoperative bleeding was found in four cases; and managed through leaving drainage tube in the wound for some hours. Meanwhile, skin necrosis was noticed in one out of 7 patients in another study.⁹ On the other hand, some authors reported a relatively high incidence of long-term complication associated with the surgery represented by pain associated with severe arthritis.⁸

CONCLUSION

The present study confirmed that the talectomy might be a single salvage procedure for cases of clubfoot suffering from rigid, resistant, and severe deformities. It should be performed without lateness

once the cases are recognized 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 safe procedure with no major complications and gives satisfactory results. Follow-up and assessment of cases depend mainly on the clinical examination and to less degree on the radiological investigation. The radiological follow-up to be more valuable should be performed by the same centers and same personals as there are big variations in the measures of the angles mentioned in the previous studies without presence of standard values.

Strength and Limitations of the Study

This is the first study dealing with the evaluation of talectomy in management of cases of clubfoot with severe, resistant, and rigid deformities in our institution. However, it carries some limitations including the relative small number of cases as well as the short-term follow-up.

Recommendations

Future studies with large numbers of cases and long-term follow-up are recommended to ascertain the current conclusion and to

exclude the long-run development of any complications. Moreover, future radiological evaluations of the normal foot could be useful to establish a standard data of measures. This might facilitate the evaluation of cases with foot deformities and their long-run follow-up.

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