**ORIGINAL ARTICLE**

# Evaluation of Turco's One Stage Postero-Medial Release for The Correction of The (Idiopathic) Congenital Talipes Equinovaus

AMAN-ULLAH KHAN, QAZI MASOOD, SALEH TAREEN (LATE), IQBAL KHATTAK, KHALID HASSAN BALOCH

## ABSTRACT

**Aim of the Study**: The aim o the study was to find out the result of the procedure, so that the procedure can be used more safely for the correction of the clubfoot patients in the future.

**Place and Duration of Study**: This study was conducted in the Department of Orthopedic Surgery, Sandeman Provincial Hospital, Quetta from November 1998 to December 2000.

**Study Design:** It is prospective study.

**Material and Method:** In this study, 32 patient (47 feet) with idiopathic CTEV, of moderate type (13 feet) and severe type (34 feet) as classified by Harrold and Walker, age ranged from 6 to 36 months (average age 15 months) were included. The patients with club feet secondary to other causes such as Polio, Spina bifida, arthrogryposis etc. were excluded. All patients were operated by Turco's one stage PMR with internal fixation of talo-calcaneal and talo-navicular joints with K-wires. All patients were assessed cosmetically, functionally and radiologically before and after the procedure, and the results were rated according to Turco's criteria. The period of follow-up was on average 7 months (ranged from 6 months to 24 months).

**Results:** Out of total 32 patients (47 club feet), 23 were male (boys) and 9 were female (girls); 15 patients (48.87%) had bilateral and 17 patients (53.125%) had Unilateral clubfoot deformities. All patients were operated under general endotracheal anaesthesia, using pneumatic tourniquet at upper thigh. The results using Turco's criteria were excellent in 24 feet (51.063%), good in 12 feet (25.531%), both excellent & good in 36 feet (76.594%), and failure was recorded in 6 feet (12.765). The bad results were due to complete recurrence of all components of the deformity in 5 feet (10.638%) and surgical over correction with severe planovalgus in one foot (2.127%).

**Conclusion:** After the evaluation of the Turco's one-stage PMR on short term follow-up (6 months to 24 months) average 7 months, it has been concluded that this procedure is safe and has low failure rate (12.765%). With this procedure, a plantigrade, functionally and cosmetically acceptable foot can be achieved in about 76.594% to 80% of cases in the earlier age (6 months to 36 months) group of the patients.

**Key words:** Idiopathic CTEV moderate & severe grade, Turco's one-stage PMR with internal fixation, results.

## INTRODUCTION

The idiopathic congenital talipes equino varus (CTEV) is a common congenital deformity of one or both feet. The incidence is about 1 to 2 per 1000 live births (1,2,11). The etiology of the clubfoot is still unknown [9,10]. It is characterized by three distinct manifestations. The foot is in an equinus; heel is in varus; and the entire fore foot is supinated and adducted [10,11].

Correspondence: Dr. Aman-ullah Khan, Bolan Medical College, Quetta

Regarding the treatment of the clubfoot all authors [1,2,3,4,9,10,14,17,19] agree that non-operative treatment should be attempted before considering surgery. However the surgical correction is indicated in cases, when the deformity has not been responding to conservative treatment. The type of surgery (operation) indicated will depend upon the age of the patient and the type and severity of the specific deformity (7,11,21). In children under the age of 5 years (under 8 years in selected cases), the operation should be chiefly confined to soft tissue structures (7,11). Lorenz (1782) (10,11) was the first to perform sub-

cutaneous tenotomy of the Achilles tendon in Frank fort. Since then, many methods have been recommended for the surgical correction of the resistant clubfoot. These have included, the soft tissue release (posterior, medial, plantar), tendon lengthening, tendon transfers and bony operations [1, 11,27]. Turco (1971) [10], described a one-stage postero medial release of the soft-tissue and to maintain the surgical correction, he used percutaneous K-wires by transfixing the talo-navicular and talo-calcaneal joints [11]. The objective of the procedure was to obtain a pliable, planti grade and cosmetically acceptable foot in one-stage operation[11]. Since Turco's [10, 11]. One-stage PMR with internal fixation is commonly used surgical procedure for the correction of the resistant clubfoot. This procedure has been performed in the Orthopedic Department of the Sandeman Provincial Hospital, Quetta on 47 resistant idiopathic clubfeet and results are presented here.

## PATIENTS AND METHODS

A prospective study was conducted to know the results of the Turco's (1971) [10] one-stage PMR with internal fixation in the Department of Orthopaedic Surgery, Sandeman Provincial Hospital, Quetta from November 1998 to the December 2000.

**Inclusion Criteria:**

In this study, 32 patients (47 clubfeet) with the idiopathic CTEV, of grade II (13 feet) and grade III (34 feet) as classified by Harrold and Walker (1983) (8), age ranged from 6 months to 36 months, attending the out patient Department of the Orthopaedic surgery were included.

**Exclusion Criteria:**

In our study, the patients having clubfoot secondary to other causes such as polio, spina bifida, meningomyelocoele, cerebral palsy, arthrogryphosis etc; were excluded. Patients having age less than 6 months & more than 36 months were also excluded from the study. All grade I and grade II clubfeet responding to conservative treatment were also excluded from the study.

All 32 patients (47 feet) or their parents reported to the O.P.D of the Orthopaedic Department over a period of two years. They represent patients from the different parts of the country forming a non homogeneous social group. On the first visit, history, general physical examination and local examination of the clubfoot was carried out to grade severity of the deformity into mild or grade I, moderate or grade II and severe or grade III according to Akhtar, N.M. (1970) [12] and Harrold and Walker (1983) (8). All mild (grade I) deformities were offered serial plaster cast treatment and were excluded from the study. All moderate (grade II) feet were exposed to serial manipulation and plaster cast treatment for 4 to 6 weeks and those resistant to respond to such treatment (13 feet), were included in the study. All severe (grade III) feet (34 feet) were straight subjected to surgery. All 32 patients were admitted one day before the surgery after being worked up in out patient bases. The Turco's [10] procedure was performed under general endotracheal anesthesia. At completion of the procedure, the tourniquet was released and hamostasis was secured under direct vision. The wound was closed in standard way with interrupted sutures. Post operatively an above the-knee, well padded plaster cast was applied with the knee flexed at about 90° and ankle in slight plantar flexion (under corrected) in order to reduce stress on blood vessels and wound. Prophylactic antibiotic. (First generation cephalosporin 15 to 25 mg/kg body wt/8hrs) I/V was given ½ hrs before the surgery and then the same antibiotic was continued for 48 hrs after the surgery in all children. Syp Paracetamol was used for analgesia in all 32 cases. On 2$^{nd}$ post-operative day, the patients were discharged. Follow-up examination of the patient included both clinical & radiologic assessment. At the first follow-up visit after 02 weeks, the plaster cast was changed under sedation and skin sutures were removed. After skin care, a new above-the-knee plaster cast was applied, with foot in more dorsiflexion. The K-wires were removed at 6 weeks. After removal of the K-wire, another above the knee plaster cast was applied. The total period of immobilization in the cast was 3 months. After 3 months, plaster cast was removed, both clinical and radiological assessment of the foot was made. Those with no improvement were advised further manipulation and plaster casts. Those who improved were offered open-toe tarsopronator shoes attached with Denis Browne (D-B) bar (25 cm long in 10° external rotation). This was used for three months full time. Straight last shoes were used for walking. At 6 weeks, each foot was evaluated cosmetically, functionally and radiologically and the results were

rated according to Turco's (1979) [11] criteria as follow; Excellent; when there is complete correction of all components of the deformity. Good; when there were one or more mild, cosmetically acceptable residua; such as asymmetric foot size, pes planus, calf atrophy. Fair; when there was over correction or some loss of initial correction and Failure; when correction was lost and the deformity recurred.

## RESULTS

A total of 32 patients with 47 clubfeet of grade II (13 feet) and grade III (34 feet) of the Harrold and Walker (1983) [8] were operated by Turco's (10) procedure and were followed-up for minimum period of 6 months (ranged from 6 months to 24 months). Out of 32 patients, 23 were male (boys) and 9 were female (girls), with male to female ratic of 2.55: 1.00. (Table. I).

**Table 1:** Idiopathic congenital clubfoot Summary of the results

| | | |
|---|---|---|
| Total number of the patients operated and followed-up | 32 | |
| Total number of the feet | 47 | |
| Male cases | 23 | 71.875 |
| Female cases | 09 | 28.125 |
| Bilateral cases | 15 | 46.875 |
| Unilateral cases | 17 | 53.125 |
| Right foot deformity in unilateral cases | 09 | 52.941 |
| Left foot deformity in unilate all cases | 08 | 47.058 |

- Sex ratio: Male: Female = 2.55:1.00
- Right to left side ratio = 1.04 right to 1.00 left.

**Table 2:** Idiopathic congenital clubfoot Severity of the deformity

| **TYPE O THE DEFORMITY** Akhtar N.M (1970) (12) & Harrold & Walker (1983) (8) | **NUMBER OF THE FEET** | **PERCENTAGE** |
|---|---|---|
| Mild (grade I) | (not included in the study) | |
| Moderate (grade II) | 13 | 27.659 |
| Severe (grade III) | 34 | 72.340 |
| Total | 47 | 99.999 |

**Table 3:** Turco's one-stage PMR with internal fixation Post-operative complication

| **S. NO** | **COMPLICATION** | **n = 32** | **n = 47** | **PERCENTAGE** |
|---|---|---|---|---|
| 1 | Complication of anaesthesia (immediate) | 0 | 0 | 0 |
| 2 | Tourniquet palsy/blister | 0 | 0 | 0 |
| 3 | Fever (raise of temperature up to $100^{oF}$ on first post operative day) | 06 | - | 18.75 |
| 4 | Chest infection | 03 | - | 9.375 |
| 5 | Wound infection | - | 06 | 12.765 |
| a) | Superficial wound infection | - | 04 | 8.51 |
| b) | Deep wound infection | - | 02 | 4.255 |
| c) | Chronic discharge or osteomyelitis | - | - | - |
| 6 | Skin sloughing | - | 02 | 4.255 |
| 7 | Wound dehiscence | - | 02 | 4.255 |
| 8 | Stitch abscess (infection) | - | 06 | 12.765 |
| 9 | Pin tract infection | - | 07 | 14.893 |

n = 32 (number of patient)
n = 47 (number of feet)

**Table 4:** Idiopathic congenital clubfoot Turco's one-stage PMR with internal fixation Results using Turco's criteria

| TURCO'S CRITERIA | NUMBER OF FEET n = 47 | PERCENTAGE |
|---|---|---|
| Excellent | 24 | 51.063 |
| Good | 12 | 25.531 |
| Excellent & good | 36 | 76.594 |
| Fair | 05 | 10.638 |
| Failure | 06 | 12.765 |
| Total | 47 | 99.997 |

**Table 5:** Turco's one-stage PMR with internal fixation Type of the deformity (residual/recurrent) present at 6 months follow-up

| S. NO | TYPE OF DEFORMITY | NUMBER OF FEET n = 47 | PERCENTAGE |
|---|---|---|---|
| 1 | Calf muscle atrophy & weakness | 12 | 25.531 |
| 2 | Complete recurrence of all components of the deformity | 05 | 10.638 |
| 3 | Asymmetric foot size | 05 | 10.638 |
| 4 | Equinus (hind foot) | 03 | 6.382 |
| 5 | Fore-foot adduction (mild) | 03 | 6.382 |
| 6 | Pes planus | 02 | 4.255 |
| 7 | Severe Planovaglus (over-correction) | 01 | 2.127 |
| 8 | Residual heel varus | 01 | 2.127 |
| 9 | Pes cavus (under-correction) | 01 | 2.127 |

**Table 6:** Turco's one-stage PMR with internal fixation Comparison of the results of different workers

| S. NO | Name of the study | Excellent % | Good% | Fair% | Failure% | Both exc: & good |
|---|---|---|---|---|---|---|
| 1 | Turco (1979) (11) | 40.9 | 42.9 | 10.8 | 5.4 | 83.8 |
| 2 | Thompson et al (1982) (27) | 50.00 | 33.00 | 12.00 | 5.00 | 83.00 |
| 3 | Levin et al (1989) (23) | 38.9 | 26.9 | 15.6 | 18.6 | 65.8 |
| 4 | Chaudhry R A et al (1992) (25) | 37.61 | 48.80 | 5.98 | 7.69 | 86.32 |
| 5 | Ahmed R et al (1992) (24) | 54.75 | 27.5 | 6.25 | 12.5 | 83.25 |
| 6 | Mr. Ismatullah (1994) (27) | 21.74 | 65.22 | | 13.05 | 86.96 |
| 7 | Hussain FN et al (2001) (27) | 10 | 60 | 25 | 5 | 70 |
| 8 | Present Study | 51.063 | 25.531 | 10.638 | 12.403 | 76.594 |

15 patients (48.875%) had bilateral and 17 patients (53.125%) had unilateral deformities. Average age at presentation was about 15 months (ranged from 6 months to 36 months). Out of 32 patients (47 clubfeet), treated by Turco's [10] procedure under general endotracheal anaesthesia and pneumatic tourniquet, non of the patient had complication of the anaesthesia or tourniquet. Wound infection was a common post-operative hazard in our Department. Total 6 patient (6 feet) or (12.765%) had wound infection in our series, which was superficial in 4 cases (8.51%) and deep wound

infection in 2 cases (4.255%). With proper wound care and oral antibiotic administration, the infection was controlled in all 6 cases. Skin sloughing (localized skin flap necrosis) in 2 cases (4.255%) and wound dehiscence in another 2 cases (4.255%) was noted. All the four feet had severe or grade III deformity in children more than 24 months of age. Immobilization in plaster cast was continued as routinely, wound care was done through window in the cast and wound was allowed to heal by secondary intension. The ultimate results were satisfactory. No loss of correction due to scarring was noted. At the final evaluation, using the criteria of Turco, V.J. (1979) [11], the over all results were excellent in 24 cases (51. 063%), good in 12 cases (25.531%), both excellent and good in 36 cases (76.594%) and failure was recorded in 6 cases (12.765%). (Table. IV). Out of the 24 feet, which showed excellent result, 12 were in the age group of 6-12 months, and 4 were in the age group of 26 to 36 months. Of 11 cases which scored poor (Fair & failure) results with this procedure, 4 feet were in the age group of 6-12 months, 2 feet were in the age group of 13 to 24 months and 5 feet were in the age group of 25 to 36 months. Out of 24 feet (51.063%), which showed excellent results, 9 feet had grade II deformity, while 15 feet had grade III deformity. In 11 feet (23.31%) poor results were obtained in our series; out of these I feet had grade II severity and 10 feet had grade III severity. The common residual deformities noted in our series were; asymmetric foot size found in 5 cases (10.638%) in unilateral cases, mild fore foot adduction in 3 cases (6.382%), and recurrence of equinus deformity noted in 3 cases (6.382%). Calf muscle atrophy and weakness was recorded in 12 cases (25.53%). Failure was recorded in 6 cases (12.765%). In 5 cases (10.638%), the failure was due to complete re-currence of all components of the deformity. Over-correction with severe plano valgus was recorded in I case (2.127%). (Table. V).

## DISCUSSION

Idiopathic clubfoot is a non-syndromal congenital anomaly of one or both feet. Incidence is 1 to 2 per 1000 live births [1,2,10,11], which now can be diagnosed pre-natally on routine ultrasound scan at 20 weeks of gestation[15] . The hind foot is in an equinus, heel in varus and fore foot adducted and supinated[10,11]. The etiology of this problem remain unknown [1,9,11]. There are still controversies regarding the surgical treatment of this crippling deformity [10,11,13,20]. The approach of the surgeon to treat club feet differs in different centres. Most of the authors, however, agree that a fair trial of conservative (stretching, manipulations, serial plaster cast) treatment should be given in every case of club foot before considering the surgical treatment [16,17,20]. This is good practice and can differenciate the pliable cases responding favourably to only conservative measure from resistant cases which require surgery [7,10,14]. In the literature [18], the surgery of the club foot has been done in neonates with mean age of 12 days, but even these surgeons do not recommend operation at this early age. Mc Cauley [1,10] has reported optimum age for soft tissue release between 3 ½ to 5 years, Attenborough recommended [13] 2 to 4 months, and Haddidi [11] 4 to 6 months. According to Turco [10,11], the optimum age for the soft tissue surgery is considered between 1 to 2 years (ranged from 6 months to 8 years). However, beyond 2 years of age, the number of excellent result diminishes as the age increases. The surgery in resistant club foot is indicated if the deformity persists or does not respond after 3 to 6 months of continuous conservative treatment [10,11,14]. In the past, many operative methods have been recommended for the surgical correction of the resistant club foot. These includsoft tissue release, tendon lengthening, tendon transfers and bony operation [2,6,8,10]. The great difficulty arises in comparing the results of the surgical procedures performed at different centres because of the many pre operative variables. These include the age of the patient, the severity and components of the deformity, personal surgical skills, sterilization and facilities in the operation theatre and post operative follow-up care. All of the above factors affect the final results of the surgery.

Turco in 1979 [11] reviewed 273 resistant club feet treated surgically by one-stage PMR with internal fixation with a post-operative follow-up of 2 to 16 years. His results were excellent and good in 86 percent and failure in 5 percent. The age of the patient ranged from 6 months to 8 years. The children who were operated between 1 to 2 years of age showed best results with least incidence of complication. (Table.VI). We performed Turco's one-stage PMR with internal fixation on 32 patients with 47 club feet. All of them were resistant to conservative treatment. In our study, two main pre-operative variables were age of the patient (ranged

from 6 months to 36 months) and grade of the severity of the club foot, 13 feet (27.659%) were of grade II and 34 feet (72.34%) were of grade III of the Harrold and Walker (8). (Table.11). Our result were excellent in 24 cases (51.063%), good in 12 cases (25.531%), both excellent and good in 36 cass (76.594%) and failure was recorded in 6 cases (12.765%). (Table. IV). The best results were achieved in children who were 6 to 12 months old. We reviewed a much shorter series of patients (32 patients with 47 club feet), and more over the period of follow-up was also much shorter in our study (6 months to 24 months) average 7 month as compared to Turco's [11]study. The more recent literature [22] favours the results of our study. Best results are now achieved by surgical treatment below one year of age as reported by Huang YT, Lei W, Zhao L Wang T. 1999 [22]. These authors have reported the results of 111 patient with 159 club feet with mean follow-up period of 11 years and 10 months (ranged 6 years to 36 years). In their study, excellent and good results were obtained in 91.8%. They advise early surgery after the age of 6 months [22]. In 1989, Levin et al [23], commenced a retrospective study of 18 children with 26 club feet treated by Turco's one-stage PMR. The average follow-up was 8.2 years. Their results were both excellent and good in 65.80% and failure was reposted in 18.6% of cases (Table. VI). After the evaluation of the results on short term follow-up (average 7 months), our results of Turco's one-stage PMR were comparable with the results of the same procedure performed by Turco 1979 [11], Thompson et al 1982 [27] . Levin et al 1989 [23], Ahmad R et al 1992 [24] and others[25, 27]. (Table.VI). Our results were also comparable with results of Brougham and Nicaol 1988 complete sub-talar release performed through Cincinnati-Crawford incision [26,27].

Most of the fair results (10.638%) in our series were due to mild fore foot adduction in 3 cases [6.382] and over-corrected flat feet (pes-planus) in 2 cases (4.255%) (Table.V). Simbak N. and Razak M. (1998) [19] have reported metatarsal adduction to be the commonest residnal deformity (63.9%), following surgical treatment of CTEV to be due to in-adequacy of the primary surgery. Recession of the origin of the abductor hallucis, release of the short plantar muscle and fascia at time of PMR was recommended. Some surgeons advise the release of tarso-metatarsal joints, as described by Heyman and Herndon. (26). The failure 6 cases (12.765), except one was due to loss of the correction and the recurrence of all components of the deformity in 5 cases (10.638%); one case (2.127%) was cosmetically unacceptable due to over-correction with severe plano-valgus. (Table.V). The loss of the surgical correction during the post-operative case was often the main cause of failure. A review of the post-operative management in our series revealed that most of the failure was due to failure to maintain the surgical correction in cast after internal fixation (K-wires) were removed. All failure were reported in severe (grade III) deformity, in the older age (more than 2 years) group. In 3 cases (6.382%), no cast was applied after internal fixation was removed at 6 weeks, Failure of below the knee cast to hold the desired correction after removal of the K-wires was noted in 2 cases (4.255%) and cast loosening was noted in 1 case (2.127%). Our results were excellent and good in 76.594% of patients on short term bases. Calf muscle atrophy was noted in 25.53% and a symmetric foot size in 10.638% of unilateral cases. In the above cases, good function was present. The literature [1,2,11,12] reveals that weakness and atrophy gradually improves with time as the muscle power increases with the return of normal function. We noted one case of over correction (severe plano-valgus), complete transaction of the talo-calcaneal inter-osseous ligament and division of the deep part of the deltoid ligament will produce a severe pes planus and valgus angulations of the heel and should be avoided. Pes cavus, one case, in our series was failure to detect and correct the cavus component of the club foot primarily and was not considered a failure of the Turco's procedure. In our series, wound breakdown was noted in 2 cases (4.255%), in children of age more than 2 years having grade III clubfeet. The rate of the relapse in our series was only 12.765% (6 cases), which is much less than that of the Uglow MG. and Clarke N.M. [26]; where the rate of relapse was 20.4% in grade III feet. Thus two-stage surgery for the treatment of clubfoot seems to be effective in reduction of wound problem but does not oppear to give significantly better results of relapse when performed for more severe defomities Hussain FN etal (2001) [27] conducted study by comparing two groups of 40 cases of the club foot, who were operated by using a modified (Services Hospital Modified Postero-Medial Incision-SH-MPMI) or traditional incision. The group operated using

modified (SH-MPMI) incision showed less skin complications [27].

The post-operative wound infection rate was quite higher in our series than that reported by Uglow MG. and Clarke NM in 2000 (26). We encountered this complication in 6 cases (12.765%) (Table.III); where as these authors have reported it only in one foot out of 91 feet. Nathar and Bose in 1987 [25] have found wound infection in 2 feet out of 73 feet treated surgically. One local study [27] has reported wound infection in 5 feet out of 32 feet treated surgically by combination of procedures. This difference may be because of the operation theatre environment, as in our part of the World there are not up to the mark in contrast to those of the developed World. More over, duration of the procedure, poor handling of the soft tissue, personal skills, and extensive dissection may act as pre-disposing factors for wound infection in our series.

## CONCLUSION

After the evaluation of the Turco's one-stage PMR on short term follow-up, it has been concluded that, this procedure is safe, reliable, time saving, one-stage procedure intended to correct all components of the clubfoot in one setting, with low failure rate (12.765%). With this procedure pliable, plante grade, cosmetically and functionally acceptable foot can be achieved in about 76.594% to 80% of cases in earlier age (6 months to 36 months) group of the patients.

## REFERENCE


1. Blakeslee T J.: Congenital idiopathic talipes equinovarus. Current concepts. Cline Podiatr Med surg 1997 Jan, 14 (i): 9-56.
2. Raymond T. Mossissy stuart L. Weinstein. Lovell and Winters paediatric orthopedic. 4th edition, Vol.II, New York: Lippincott-Raven, 1996
3. Niedzielski KR, Matecki K, Kosinska M, Lipc 24KZ. Early results of congenital clubfoot using ponseti method. Chir Narzadow Ruchu Ortop Pol. 2011 Sep: 93 (9): 1160-40
4. Dime olio A:, canavese F.: the French Functional Physical therapy method for the treatement of congenital clubfoot. J. pediatr orthop B. 2012 Jan, 21 (1): 28-29.
5. Alexander M, Achman JD, Kuo KN.: Congenital Idiopathic clubfoot. Orthop Nurs 1999 Jul-Aug: 18(4): 47-55.
6. Matos MA, de Oliveira LA. Comparison between Ponsetis and Kite's Clubfoot treatment a meta-analysis. J Foot Ankle Surg. 2010 Jul-Aug. 49(4): 395-7.
7. Marteixs,chapvis M, Fraisse B, et al Idiopathic clubfoot treated with the ponseti method. Clinical and sonographic evaluation of Achilles tendon tenotomy. A review of 22 clubfeet. Orthop Traumatal Surg Res. 2012 June. 98 (4 Suppl) S 73-6.
8. Harrold, A J, Walker, C J. Treatment and prognosis in congenital clubfoot. Journal of Bone & Joint surgery, 65-B:8-12 1983.
9. Dobbs MB, Garrett CA. update an clubfoot: etiology and treatment Clin orthop repat Res. 2009 May. 467 (5) 1146-53.
10. Turco, V.J. Surgical correction of the resistant clubfoot. One-stage poster medial release with internal fixation A Preliminary report. J. Bone joint Surg. 53-A: 477.1971
11. Turco, V.J. Resistant congenital clubfoot one-stage poster medial releae with internal fixation. A follow-up report of a fifteen year experience. J. Bone Joint Surg. 61-A: 805-814, 1979.
12. A khtar NM. Congenital talipes equinovarus in Pakistan. J. Western Pecifice orthop. Arros. Vol. VII, June 1970.
13. Attenborough, C.G. Congential talies equinovarus J. Bone & Joint Surgery, 48-13: 31-39, 1966.
14. Jowett CR, Morcvende JA ramachandran M. Management of congenital talipes equino varus using the ponseti method a systematic review. J Bone Joint surg Br 2011 Sep. 93 (9): 1160-40
15. Tillet RI, Fisk NM. Murphy K, hunt DM. Clinical out come of congenital talipes equinovarus diagnosed antenatally by ultrasound. J. Bone & Joint surg Br 2000 Aug. 82 (6) 876-80.
16. Lovell Me, Morcuende JA Patient Location Strategies for pediatric Long tern Follow-up studies. I owa orthop J. 2006. 26: 91-5.
17. Haft GF, walker CG, Crawford HA. Early clubfoot recurrence after use of the Ponseti method in a Newzealand Population J. Bone Joint srgy Am. 2007 Mar. 89(3). 487-93
18. Pous G.J. Dimegho A Neo-natal surgery in clubfoot Orthopedic clinic of north America, 9 233-240, 1978.
19. Singh BI, Vaishnavi AJ. Modified Turco's procedure for treatment of idiopathic clubfoot. Clin Orthop Relat Res. 2005 Sep. 438: 209-14.

20. Kite J.H: Non-operative treatment of congenital clubfoot. Clm orthop, 1972; 84: 29-38.
21. Mc kay D.W.: new concept of and approach to clubfoot treatment-II. J Pediatr orthop 3:10:,1983.
22. Huang YT, Leiw, zhao L, wang J.: The treatment of congenital clubfoot by operation to correct deformity and achieve dynamic muscle balance. J Bonl Joint surg Br 1999 Sep: 81(5): 838-62.
23. Leyin NM; Kao KN: Haris GF., Matesi D.V: PMR for indiopathic CTEV. A long term follow-up study. Clin orthop; 1989 may (242): 265-8.
24. Ahmed R et al.: Turco's one stage PMR in idiopathic CTEV. J Pakistan orthop Assoc. 1992, 2(5): 67-76.
25. Chaudhry R.A. et al.: Evaluation of modified Attenborough surgical procedure in the treatment of congenital TEV deformity in children. J Pakistan orthop Assoc. 1992; 2(5) 77-83.
26. Uglon MG, Clarke NM.: Relapse in one stage surgery for congenital talipes equinovarus. J Bone Joint surg Br 2000 Jul; 83(2): 308-9.
27. Hussain FN, Arshad M, Ahmad A.: Modified incision for the operative correction of idiopathic clubfoot: A four year follow up of 40 cases. J Pak othop Assoc. 2001; Aug; vol.13,No.2:140-146.