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An observational study on congenital talipes equinovarus.

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Abstract:

Introduction: Clubfoot or Congenital Talipes Equinovarus (CTEV) is a congenital abnormality characterized by the permanent foot morphological alteration, consequently individual is unable to lean the foot properly on the floor in an appropriate physiological manner.

Objective: To execute an observational study on Congenital Talipes Equinovarus (CTEV) in the Orthopedic Department of Indus Medical College Hospital, Tando Muhammad Khan.

Methodology: Study conducted from Jan 2018 to Jan 2019 at Orthopedic Department of Indus Medical College Hospital, Tando Muhammad Khan. Medial Crease (MC), Curved Lateral Border (CLB), and Lateral Head of Talus (LHT) assessed based on the Mid Foot Contracture Score (MFCS). Also, an assessment of the Posterior Crease (PC), Empty Heel (EH) and Right Equinus (RE) made as part of the Hind-foot Contracture Score (HFCS). Data collected from 100 participants through convenience sampling technique and quantitative analysis performed.

Results: Of all participants, Pirani score was calculated from 0 to 1. Scoring is based on the average values. It has been found that the incidence of curved lateral border was 30%, medial crease as 55% and lateral head of talus as 15%. Additionally, it has been found that the empty heel incidence is 35%, posterior crease is 60% and rigid Equinus as 15%. These results reveal that there is a high incidence of CTAV in the given sample.

Conclusion: The study revealed that the exact cause (s) of CTEV are still unknown.

Keywords: Congenital Talipes Equinovarus (CTEV), Pirani score, Pediatric Orthopedic

Introduction:

Clubfoot or Congenital Talipes Equinovarus (CTEV) is a congenital abnormality characterized by the permanent foot morphology alteration, due to which the individual is unable to lean the foot properly on the floor in an appropriate physiological manner.^{1,2} As this deformity of foot is in association to the leg, therefore, it demands the treatment of forefoot Varus, Cavus, Equinus and hind foot varus.³ The treatment is to restore the physiological function and morphology of the affected foot and allow proper gait and plantigrade.⁴ Notably, if this condition is identified at the time of birth, then there is an opportunity to treat this disease non-surgically.⁵ Masse et al⁶ explained the functional taping or manipulation

techniques and Ponseti et al explained serial casting and manipulation⁷ techniques for the toddlers or newborns. These techniques are deemed fruitful in reducing the deformities related to clubfoot.⁶ Percutaneous Achilles is another form of treatment of the tendon section that is often deemed fruitful for Equinus deformity correction.⁸ Unfortunately, if the deformity is diagnosed in the later stages, the non-surgical treatments have less implications.⁹ Then comes the need for the surgical treatment due to the joint stiffness, bony alterations and soft-tissue retractions, which makes the situation complicated in contrast to the early childhood years.⁹ Arguably, this disease needs to be treated at the earliest, as the neglected deformity enforces the child to walk

with the deform foot, while leaning on the lateral side.¹⁰ There are different clinical types of congenital talipes equinovarus. It is critical for the orthopedic physician to examine the patient carefully during the first visit and check for severity of deformation and the possible treatments. Dimeglio's¹¹ four-point characterization classifies the deformities based on the composition and order of two words; "stiff" and "soft". The four types of Alain Dimeglio's foot deformities are: Type I (soft-soft-soft foot), Type II (Soft-stiff-soft-stiff), Type III (Stiff-soft-harder-foot) and Type IV (stiff-stiff-hard foot).¹¹

The Pirani scoring system was described by Mejabi et al¹² which is a reliable system in analyzing the severity of clubfoot, along with the monitoring of the treatment process of the disease. The Pirani score has been tested by Mejabi et al¹² and found significant correlation between hindfoot score, Pirani score, midfoot score, as well as the casts number to accomplish correction at $p < 0.001$.

Likewise, Shaheen et al¹³ analyzed the Pirani score Interobserver reliability in between Physiotherapy assistants and Pediatric orthopedic surgeons, who had previous training in clubfoot management. For different Pirani score components¹⁴⁻¹⁷, an average percentage score of 83% was confirmed for the agreement of both observers. The physiotherapy assistants who were properly trained revealed a higher efficiency in analyzing the clubfoot severity degree.¹⁸ Pirani scores has its implications in the assessment of the clubfoot.

Objective:

To execute an observational study on Congenital Talipes Equinovarus (CTEV) in the Orthopedic Department of Indus Medical Hospital, Tando Muhamad Khan.

Methodology:

Study conducted from Jan 2018 to Jan 2019. There are six clinical signs on the basis of which the classification of club foot is presented by Pirani system of classification.¹⁸ The scoring exists between the range of 0 to 1, with scores of 1 for severely abnormal, 0.5 for partially abnormal and 0 for normal. There are three signs in Mid foot and remaining in Hind foot.

For this study, Medial Crease (MC), Curved Lateral Border (CLB), and Lateral Head of Talus (LHT) assessed on the basis of the Mid Foot Contracture Score (MFCS). Also, an assessment of the Posterior Crease (PC), Empty Heel (EH) and Right Equinus (RE) has been made as part of the Hind-foot Contracture Score (HFCS).

A quantitative analysis performed for the data collected from 100 participants through convenience sampling technique. The age range of selected individuals was between aged between 1 month to 40 years. Both male and female participants were part of research.

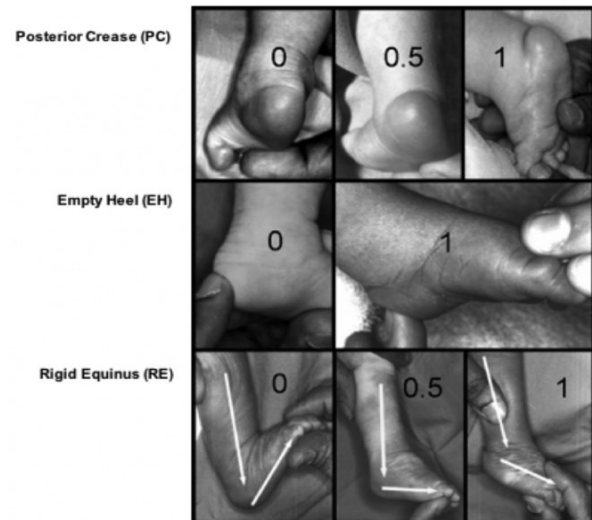
Scoring Technique:

The Pirani score is helpful in assessment and consequent treatment of club foot.¹⁸ There is no technical equipment needed for the process and the foot can be assessed in less than a minute. The clubfoot disease was assessed by Pirani, in Malawi and Uganda.¹⁸ Through the Pirani scoring, the current status of the disease can be assessed. For instance; a decision can be made whether the deformity is correcting, or the patient is still having a problem. In 2006 Dyer et al¹⁹ argued that Pirani scores are positively and significantly associated to the casts number, necessary in treating the treating clubfoot deformity. The greater

the Pirani score, the greater is the risk to get tentomy.²⁰

A Mid foot scoring

Level of Club Foot	Severely Abnormal	Partially Abnormal	Normal
Scoring	1.0	0.5	0

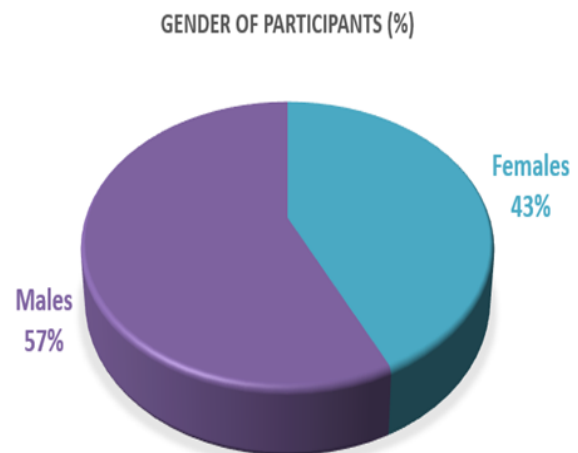


During the Pirani scoring procedure, the assessment of six signs takes place and scored based on their severity. However, on the basis of total scoring sum of Hindfoot and Midfoot, the score reaches between 0 to 6.¹⁹

Results:

This observational study carried out for period of one year. During this period patients presented with isolated CTEV were selected. During period of study 80 patients diagnosed with CTEV also has other associated orthopedics problems like Hallux Vulgus, Genu Vulgus, Hip Dislocation, T.A tightening, elbow contracture, knee contracture, adducture and foot contracture were excluded. Finally data of 100 patients with CTEV were studied. The gender distribution is shown in fig 2.

Fig No 2: Gender Distribution



During the collection of data, the Pirani score was calculated from 0 to 1. However the observed Pirani scoring is based on the average values based on mid foot and hind foot observation. It has been found that the incidence of curved lateral border

was 30%, medial crease as 55% and lateral head of talus as 15%. Additionally, it has been found that the empty heel incidence is 35%, posterior crease is 60% and rigid Equinus as 15%. These results reveal that there is a high incidence of CTAV in the given sample. Assessment of all patients with respect to Pirani score is shown in table no 1

Table No 1: Pirani Score (n=100)

Side	Right/Left
Curved lateral Border (CLB)	30% (1)
Medial Crease (MC)	55% (1)
Lateral Head of Talus (LHT)	15% (1)
MID FOOT CONTRATURE SCORE (MFCS)	3
Empty Heel (EH)	35% (1)
Posterior Crease (PC)	60% (1)
Rigid Equinus (RE)	15% (1)
HIND FOOT CONTRATURE SCORE (MFCS)	3
TOTAL SCORE (TS)	6

The male were 57% and female were 43%. All patients were offered treatment, the characteristics of the children who completed manipulation and casting is shown in table no 2.

Table No 2: Manipulation & Casting

Characteristics of the children who completed manipulation and casting (N=100)	
Characteristics	N (%)
Previous Treatment	
None	50%
Long leg cast	18%
Short leg cast and surgery	7%
Strapping	25%
Side of Clubfoot	
Bilateral	80%
Unilateral	20%
Birth Order	
First order	46%
Second order	30%
Third order	24%
Previous Family History	
Yes	20%
No	80%

Discussion:

Evidence has shown that congenital talipes equinovarus is deemed as the second common and most occurring limb deformity. It has affected nearly 135000 newborns across the globe.²⁰ Out of 1000 live births in Europe, one to two newborns

are diagnosed with this disease. However, in China, the case is different, the incidence rate of this deformity is 0.3 per every 1000 births.²¹ A huge number of newborns are affected. Arguably, it has been found that gender is affected differently with this deformity, with boys are diagnosed more than girls, but the intensity of deformity is higher in girls than boys. Research conducted by Ostrowski's clubfoot analysis during the time horizon of 1970 to 1999 revealed that out of 1041 children who were hospitalized, there were 68% boys and 32% girls affected with the deformity.²² A similar research was carried out by Khan et al., in 2017.¹⁶ The results of their study revealed the Pirani scoring, however, the scoring was based after the treatment. The study reported the Pirani scoring conducted during the casting and manipulation phase as 1.2 in the left foot and 1.1 in the right foot. The study showed that the feet of the patients were pain free and were corrected clinically along with good mobility.¹⁷ Unfortunately, the reasons behind the CTAV is still unknown, regardless of the fact that multitude of scholars have spent years' in investigating the types, causes and treatment measures of this disease.²³ Some of the factors causing congenital talipes equinovarus that have been identified by prior researchers are inclusive of; tobacco exposure connected to inheritance, tobacco environmental exposure, genetic disorders, viral or seasonal infections, etc.²³ Alternatively, osseous system or soft tissue modifications is considered another cause of this disease. The clinical differences in the clubfoot picture can be useful in recognizing its etiology. An association between benign clinical types and mechanical factors of external origin is visualized. For example, during pregnancy, the child's foot position inside the uterus is inappropriate or there is a small quantity of amniotic fluid. Nevertheless, there are some research scholars that claim that clubfoot cannot be named as an embryonic deformity. This is because, this disease initially develops itself and become equinovarus at the time of second trimester stage. Therefore, the CTAV is deemed as a developmental abnormality.²⁴ CTAV appear as a syndrome or an isolated defect. In situation when CTAV is deemed as a syndrome, then its etiology is connected with the inheritance. However, when taking CTAV as an isolated disease, then it is critical to understand its cause. It has been found that clubfoot or CTAV has been associated to inheritance with a percentage of 24% probability

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drome, then its etiology is connected with the inheritance. However, when taking CTAV as an isolated disease, then it is critical to understand its cause. It has been found that clubfoot or CTAV has been associated to inheritance with a percentage of 24% probability.

Limitation:

The research has limited scope as the data is collected from one healthcare setting due to time and budgetary constraints. Additionally, the data collected from the participants aged between one month to forty years. This may include research bias.

Conclusion:

The study revealed that the causes of CTEV are still unknown. There was a high Pirani score revealed based on the assessment of the CTEV observation. There is a need to conduct educational programs on Congenital Talipes Equinovarus (CTEV) and create awareness regarding the treatment procedures of CTEV, so that the incidence of the disease could be reduced.

References:

1. Eastwood DM, Sanghrajka AP. Guided growth: recent advances in a deep-rooted concept. *The Journal of bone and joint surgery. British volume.* 2011;93(1):12-8.
2. Faldini C, Traina F, Nanni M, Sanzarello I, Borghi R, Perna F. Congenital idiopathic talipes equinovarus before and after walking age: observations and strategy of treatment from a series of 88 cases. *Journal of Orthopaedics and Traumatology.* 2016;17(1):81-7.
3. Gourdine-Shaw MC, Lamm BM, Herzenberg JE, Bhave A. Equinus deformity in the pediatric patient: causes, evaluation, and management. *Clinics in podiatric medicine and surgery.* 2010;27(1):25-42.
4. Chandrashekar G. Clinical Study of soft tissue release for congenital talipes equinovarus by cincinnati approach. Doctoral dissertation, Rajiv Gandhi University of Health Sciences, Karnataka. 2010.
5. Benjamin D. Roye, Joshua Hyman, David P. Roye. Congenital idiopathic talipes equinovarus. *Pediatrics in review.* 2004;25(4):124-30.
6. Seringe R, Atia R. Idiopathic congenital club foot: results of functional treatment (269 feet). *Rev Chir Orthop Reparatrice Appar Mot.* 1990; 76(7):490-501.
7. Faulks S, Richards BS. Clubfoot treatment: Ponseti and French functional methods are equally effective. *Clin Orthop Relat Res.* 2009; 467(5): 1278–1282.
8. Cretnik A, Zlajpah L, Smrkolj V, Kosanovic M. The strength of percutaneous methods of repair of the Achilles tendon: a biomechanical study. *Med Sci Sports Exerc.* 2000;32(1):16-20.
9. Dobbs MB, Gurnett CA. Update on clubfoot: etiology and treatment. *Clin Orthop Relat Res.* 2009; 467(5): 1146–1153.
10. Theologis TN, Harrington ME, Thompson N, Benson MK. Dynamic foot movement in children treated for congenital talipes equinovarus. *J Bone Joint Surg Br.* 2003;85(4):572-7.
11. Dimeglio A, Bensahel H, Souchet PH, Mazeau PH, Bonnet F. Classification of clubfoot. *J Pediatr Orthop B.* 1995;4(2):129-36.
12. Mejabi JO, Esan O, Adegbehingbe OO, Orimolade EA, Asuquo J, Badmus HD, Anipole AO. The Pirani Scoring System is Effective in Assessing Severity and Monitoring Treatment of Clubfeet in Children. *British Journal of Medicine & Medical Research.* 2016;17 (4) 1-9.
13. Shaheen S, Jaiballa H, Pirani S. Interobserver reliability in Pirani clubfoot severity scoring between a paediatric orthopaedic surgeon and a physiotherapy assistant. *J Pediatr Orthop B.* 2012;21(4):366-8.
14. Alok Aggarwal, Neha Gupta. The Role of Pirani Scoring System in the Management and Outcome of Idiopathic Club Foot by Ponseti Method. *International Journal of Science and Research.* 2016; 5 (6). 1284-87.
15. Gao R, Tomlinson M, Walker C. Correlation of Pirani and Dimeglio scores with number of Ponseti casts required for clubfoot correction. *J Pediatr Orthop.* 2014 Sep;34(6):639-42 .
16. Goriainov V, Judd J, Uglow M. Does the Pirani score predict relapse in clubfoot?. *J Child Orthop.* 2010 Oct;4(5):439-44.
17. Khan MA, Chinoy MA, Moosa R, Ahmed SK. Significance of Pirani score at bracing-implications for recognizing a corrected clubfoot. *Iowa Orthop J.* 2017; 37: 151–156.
18. Smythe, TH (2018) Evidence to improve clubfoot services in Africa with Zimbabwe as a case study. PhD (research paper style) thesis, London School of Hygiene & Tropical Medicine. DOI: <https://doi.org/10.17037/PUBS.04649940>.
19. P. J. Dyer, N Davis. The role of the Pirani scoring system in the management of club foot by the Ponseti method. *The Journal of bone and joint surgery.* 2006;88-B (8):1082-4.
20. Lampasi M, Abati CN, Bettuzzi C, Stilli S, Trisolino G. Comparison of Dimeglio and Pirani score in predicting number of casts and need for tenotomy in clubfoot correction using the Ponseti method. *Int Orthop.* 2018;42(10):2429-2436.
21. Bacino CA, Hecht JT. Etiopathogenesis of equinovarus foot malformations. *Eur J Med Genet.* 2014;57(8):473-9.
22. Shah MQ, Khan A, Zardad MS, Iqbal R, Ahmed S. Ponseti technique for management of congenital idiopathic club foot. *J Ayub Med Coll Abbottabad.* 2017;29(2):246-249.
23. Wallace JJ. Using Foot Pressure Analysis to Predict Reoccurrence of Deformity for Children with Unilateral Clubfoot. Doctoral Dissertation for PhD. University of Kentucky. 2018.
24. Okoński P, Misztal-Okońska P, Okoński M, Książek P, Goniiewicz M. Frequency of hospitalization in patients diagnosed with congenital talipes equinovarus (CTEV). *Polish Journal of Public Health.* 2015;125(4):219-22.