

## Prevalence of Congenital Foot Abnormalities in Newborns: (A Descriptive Study on 2025 Newborns in Northern Iran)

### Abstract

**Background:** congenital foot deformities are among the most common congenital abnormalities causing morbidities, disturbing the normal gait and affecting patients' quality of life. The aim of our study was to find out the prevalence of such abnormalities in neonates born at a referral center in northern Iran.

**Methods:** This study was a descriptive cross-sectional study on the neonates born in Imam Khomeini hospital of Sari in a two-year period. The variables considered in our study were gestational age at the time of delivery, medical conditions complicating the pregnancy including diabetes, chronic hypertension, obstetrical complications like oligohydramnios, polyhydramnios, and malpresentations, mothers' age, chronic diabetes, hypertension, mothers' addiction, sex and birth weight of the newborn, history of having a child with congenital limb anomaly and the type of delivery. Photography of newborns' feet was taken on first day of birth to be assessed by an orthopaedic surgeon. In addition, the babies were examined the day after birth by one of the two neonatologists and the suspicious cases were referred to the orthopedic surgeon. Statistical analysis was performed by SPSS software.

**Results:** From 2025 neonates studied, 210(10.4%) calcaneovalgus, 7 (0.3%) clubfoot, 156(7%) cases of "PesVarus", 22 cases of (1.1%) metatarsus adductus, and 1 case of polydactyl were recognized. Among all variables, only mothers' age and cigarette smoking during pregnancy had association with congenital foot abnormalities.

**Conclusion:** The most prevalent congenital abnormalities in our study was Pes Calcaneovalgus and a positional mild "Pes Varus". The low rate of club foot, polydactyly and metatarsus adductus are notable,

**Key words:** clubfoot, Abnormality, Congenital, prevalence, neonates

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### Introduction

Congenital foot abnormality is one of the common paediatric abnormalities<sup>(1)</sup>. Flexible abnormalities are passively treatable and will improve gradually and spontaneously; However, Inflexible abnormalities cannot be corrected without treatment and cause noticeable morbidities<sup>(1-3)</sup>.

Having searched for the incidence of congenital foot anomalies, we found lots of controversies in the literature<sup>(4-10)</sup>. For instance, in 1988 Toruffwidhe et al reported 100 foot deformities in 2401 neonates<sup>(5)</sup>. While, Boo Y N in a study on 8969 Malaysian neonates calculated the prevalence of 1.3 and 4.6 per 1000 for calcaneovalgus and club foot respectively<sup>(6)</sup>. Wallander in 2006 reported the prevalence of club foot in Sweden as 1.4 per 1000 neonates<sup>(7)</sup> and Sarrafan based on a study conducted in Ahwaz, Iran during 1 year presented 30 neonates out of 5087 neonates with upper and/or lower limb anomalies<sup>(8)</sup>.

The lack of consensus over the rate of occurrence of foot anomalies is probably due to variability in research methods. The aim of our study was to determine the prevalence of such abnormalities in neonates born at the main teaching hospital of Sari, north of Iran.

## Methods

This was a descriptive cross-sectional study. All the newborns delivered vaginally or through cesarean section at Imam Khomeini hospital in Sari, Iran from January 2012 to December 2013 were included into this study.

The studied variables include: gestational age and maternal age at the time of delivery, chronic diabetes, gestational diabetes, hypertension, history of cigarette smoking or illicit drug abuse during pregnancy, multiple pregnancies, gravidity, neonatal gender and birth weight, past history of birth defects, oligohydramnios, polyhydramnios, and the type of delivery.

All of the newborns were examined by a neonatologist (Nakhshab M) and digital photography in four views were taken by one of the two designated nurses. Those four Pictures depicted dorsal, plantar, medial and lateral views of newborns foot, each assessed by one orthopedic surgeon (Sajadi M). In addition, suspicious cases in terms of foot deformities (such as club foot, Calcaneovalgus, Metatarsus Adductus, vertical talus, polydactyly and syndactyly) were re-examined in person by the same orthopedic surgeon.

The data was analyzed by SPSS version 20 (Version 20; SPSS Inc., Chicago, IL). To test the qualitative data, Chi-square test and Fisher's exact test was used and for quantitative data independent t-test was used. P value <0.05 was considered statistically significant

## Results

2025 newborns, 1020 females (50.4%) and 1005 males (49.6%) were evaluated in terms of common foot abnormalities. The mean maternal age at the time of delivery was 27.6 with arrange of 14 to 46 years old and the measured birth weight ranged from 600 to 4600 gr with a mean of 2990 gr.

We had 79 cases of multiple pregnancy comprising 76 cases (3.8%) of twin pregnancy and 3 cases (0.1%) triplet pregnancy. 206 (10.2%) mothers developed gestational diabetes and 116 (5.7%) mothers had suffered from gestational hypertension. 15 (0.7%)

women had illicit drug exposure during their pregnancies, and 5(0.2%) were smoking cigarette.

**Table 1. Assessment of abnormality risk factors of foot deformity in mothers**

|                           | positive  | negative   | P value |
|---------------------------|-----------|------------|---------|
| Gestational diabetes      | 206(10.2) | 1819(89.8) | 0.303   |
| Mothers' age              | -         | -          | 0.039   |
| Gestational Hypertension  | 116(5.7)  | 1909(94.3) | 0.123   |
| Mother addiction          | 15(0.7)   | 2010(99.3) | 0.210   |
| Smoking                   | 5(0.2)    | 2020(99.8) | <0.001  |
| Polyhydramnios            | 1         | 2024       | 1       |
| olygohydramnios           | 9(0.4)    | 2016(99.6) | 0.919   |
| Anomaly in previous child | 1         | 2024       | 1       |
| Normal Vaginal Delivery   | 465(0.23) |            | 0.68    |
| Caesarian section         | 1560      |            | 0.667   |
| Twin pregnancies          | 76(3.8)   |            | 0.096   |
| Triplet pregnancies       | 3         | 2021       | 0.221   |

1 case of polyhydramnios and 9 cases (0.4%) of oligohydramnios were recognized prenatally. Past history of having previous children with foot deformities was only positive in one case with an unknown abnormality. The rate of cesarean section among this group was 77% and the main indications were previous caesarean sections, fetal distress or abnormal progression of vaginal deliveries.

We had 759 (37.5%) first babies, 785 second live, 305 (15.1%) of third live, and 176(8.1%) neonates as the fourth or higher ranked newborn babies.



**Figure 1: clubfoot**

In searching foot deformities among the newborns in that period of time, 1628 cases (80.4%) had no abnormalities. 397 cases (19.6%) had some form of foot deformity according to the photographs taken by the nurses. 187 cases were male and 210 were female. 300 babies were born with caesarian

section and 97 cases were born with normal vaginal delivery (NVD). Pes Calcaneovalgus was the most commonly observed foot deformity in our study involving 165 (8,1%) neonates which was bilateral in 116 cases (69%). (Fig2)



Figure2. Hullux varus

The rate of clubfoot was 0.3% (7 cases: 4 females and 3 males) and all of them were bilateral.

A trivial foot deformity, which seemed to be the way the baby held the foot in some inward rotation was seen in 156 cases we called this "Pes Varus". This abnormal shape was bilateral in 102 cases.

Metatarsus Adductus was seen in 1.1% (22 cases) and polydactyly (in one case) There was no significant association between the history of previous abortion and foot deformity ( $p: 1$ ). Mother's age had a significant association is significantly associated with newborn's foot deformity ( $p: 0.039$ ).

Birth weight ( $p: 0.992$ ), twin pregnancy ( $p: 0.09$ ) and triplet pregnancy ( $p: 0.0221$ ) had no significant association with foot deformity in newborns. No significant association was revealed between those mentioned deformities and gestational diabetes ( $p: 0.303$ ) or gestational hypertension ( $p: 0.123$ ) or mother's addiction to illicit drugs ( $p: 0.210$ ), but cigarette smoking showed some correlation with foot deformity, although only 5 mothers had history of cigarette smoking, the total number of smokers were negligible among the pregnant women in our study. The type of delivery, whether vaginal or caesarian section did not have strong association with P values of 0.680 and 0.667, respectively.

## Discussion

The prevalence of foot abnormalities in our study was 19.6%. which is a high rate compared to the similar studies<sup>(4-6)</sup>, probably because we had included all the flexible trivial deformities to the studies that disappear after the first few days of life. The identical aspect of our research was a photographic evaluation to easier assess many cases.

In a study by Shokouhi et al in Hamadan, Iran the prevalence of congenital abnormalities was 2.8% and musculoskeletal abnormalities were only second to urinary system defects in terms of prevalence<sup>(11)</sup>. In the study of Altshuler et al the most common congenital abnormality was musculoskeletal<sup>(12)</sup>.

Swardekar in a study conducted in Oman reported that among 21988 newborns, 541 cases had major limb malformations<sup>(9,13)</sup>.

Walender et al. published the result of large study conducted during two years in Sweden on 103,422 infants born in multiple centers from 1995 to 1996. They reported the incidence of 1.4 per 1000 live birth for clubfoot which were bilateral in 50 per cent of cases<sup>(5,7)</sup>. In our study prevalence of club foot was 3 per 1000 neonates. The population studied by Walendr et al included more regions in comparison to our study<sup>(7)</sup>.

Boo et al in the 1990 article reported an incidence of 4.6 in 1000 live births of clubfoot at a hospital in Malaysia. They reported 1.3 per 1000 for calcaneovalgus, while our study had 106 per 1000 newborns Boo et al study found an association between low birth weight with clubfoot and calcaneovalgus<sup>(6)</sup>.

In the study of Afshar on evaluating the risk factors of polydactyly in Birjand, Iran; consumption of Oral Contraception's (OCP) in first month of pregnancy and family history of polydactyly in pregnant mothers were suggested as the two major risk factors in incidence of polydactyly<sup>(14)</sup>—There was only 1 case of polydactyly in our study and further study of related risk factors was not possible.

In Nunes et al study on 671,494 neonates from southern regions of Africa, the prevalence of calcaneovalgus was only 4.2 per 1000 live births. The patients with Pes Calcaneovalgus

and control group had no difference in intervals between pregnancies and multiparity. However, based on that study breech delivery and first pregnancy seemed to be the major risk factors of neonatal malformations<sup>(15)</sup> As it can be seen in the literature, the most striking difference between various studies is in the rate of Pes Calcaneovalgus.

Based on our findings, there was a significant association between congenital foot abnormalities and mothers' age ( $p=0.039$ ) and smoking ( $p<0.001$ ), whilst there was no significant association between such abnormalities and diabetes of mother ( $p=0.3$ ), caesarian section ( $p=0.66$ ), NVD ( $p=0.68$ ), hypertension of mother ( $p=0.12$ ) and weight of

newborn ( $p=0.9$ ). Limitation of our study was that our study was done in only one center and multiple center studies is suggested. We also did not follow up the cases with anomalies that could have disappeared spontaneously.

## Conclusion

The most prevalent congenital foot abnormalities in our study were Pes Calcaneovalgus and a minor positional foot and leg rotation we named "PesVarus". There was an association between congenital foot abnormalities and mothers' age ( $p=0.039$ ) and possibility with mothers' smoking.



Figure3:Fore foot varus



Figure4:Pes planus

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