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# A LONGITUDINAL STUDY TO ESTIMATE THE INCIDENCE AND INFLUENCING FACTORS FOR CONGENITAL KOILONYCHIAS AMONG NEWBORN IN A TERTIARY INSTITUTE

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## ABSTRACT

**Objectives:** 1. The incidence of Koilonychia is not well studied in neonates. Hence we wanted to study the incidence, in this part of the country. 2. To study the influential of factors in neonatal congenital koilonychias. **Methods:** Prospective recruitment of 51 neonates of both sexes consecutively for a period of six months from November 1st 2017 to March 31st 2018 in NICU of Shri Sathya Sai Medical College. The presence of koilonychias was taken as cases. The absence of koilonychias was taken as controls. By univariate analysis, some factors were found to be significant. These factors were again subjected to multivariate logistic regression analysis. The results were tabulated and studied statistically. **Results:** The incidence of koilonychia in our study is 58.8% by univariate analysis Male sex P=0.03*(S) OR 3.8,1.1-12.3, CI, Iron tablets taken partially by antenatal mother P=0.001***(S) OR 133-17-1027,CI Mothers Hb < 11g P=0.05*(S) OR 4.0,1.0-15.8, CI Babys Hb < 11g P=0.03*, Big toe nails P=0.03* were significant influential factors for congenital koilonychia in newborns. By multivariate analysis, male sex P=.02, OR 4.6, 1.2-17.3, CI mothers haemoglobin <11g P=.03, OR 5.2, 1.1-23.7were statistically significant. Conclusion: Congenital Koilonychia was found to be present more in males than females. Mothers should antenatally be given iron and folic acid and it should be continued completely through the antenatal period. In addition, proper diet should be given to the pregnant mother. This is a study with small sample size, hence advised to do large sample multi centred study.

**INDEXTERMS:** Koilonychia, Iron in mother and diet for mother, antenatal mother.

## INTRODUCTION

The nature and frequency of nail abnormalities in infants is not well studied. Nail abnormalities can be a diagnostic clue for the diagnosis of many illnesses.[1] Koilonychia is recognized as a physical finding since the year 1879. The term refers to loss of convexity both longitudinally and transversely in the nails.[2] Acquired koilonychia is mainly due to iron deficiency anaemia. Idiopathic and familial types are also described in literature.[3] As there is not enough literature studies on koilonychia in newborns, we aimed to study the incidence and influencing factors in this part of the country.

## MATERIALS AND METHODS

All inborn babies of this institute were recruited prospectively for this study. Mother details - age, blood group, mode of delivery, haemoglobin, whether born to primi para or multi para, and babies details weight, sex, babies haemoglobin, the presence of koilonychia in both toes and fingers were noted in consecutively and entered in a excel sheet. Gestational age was confirmed by the maternal data and verified by new ballard scoring.[4] Babies with koilonychia were taken as case and those without koilonychia were taken as controls during the same period of recruitment.

**Study period:** Nov 1, 2017 to 31$^{st}$ March, 2018.

**Setting:** NICU, Department of Pediatrics, Shri Sathya Sai Medical College & Research Institute, Kanchipuram District.

**Study Design:** Longitudinal Prospective Observational Case Control Study.

**Inclusion criteria:** Term babies of either sexes with or without koilonychias.

**Exclusion criteria:** Preterm babies, clinically unstable babies, babies with multiple congenital malformations.

**Case:** Those neonates having koilonychias.

**Control:** Those neonates not having koilonychia. Study was approved by institutional human ethical committee.

Mothers gave their informed consent to take part in the study.

**Sample size calculation**

Considering prevalence of koilonychias 32.7% of infants (based on previous study by Chinazzo M et al, 2016).

With a 95% confidence limit and 40% relative precision of estimate, the sample size required was calculated as follows.

$$\text{Formula for sample calculation} = \frac{(z)^2 \times (1 - p)}{(p) \times (e)^2}$$

Sample size (N) = $(1.96)^2$ x (1-0.327)/0 327x $(0.40)^2$ =50.

**Statistical Analysis**

Demographic variables in Categorical/ dichotomous were given in frequencies with their percentages. Koilonychia present or not was given in frequencies with their percentages. Association between status of koilonychias and demographic variables/clinical variables were tested using McNemar Chi square test. Influencing factors for koilonychia present were identified using univariate analysis and it is given with unadjusted odds ratio with 95% confidence interval. The crude odds ratio (or), 95% CI, p value was reported for each predictor. Then logistic regression analysis was performed and adjusted odds ratio with 95% confidence interval were given.

A p-value of ≤0.05 was considered statistically significant, and two-tailed tests were used for significance testing. Statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS, version 16) and STATA (version 12) and Epi info (Version 3.5.1) statistical software.

**RESULTS AND OBSERVATIONS**

Age of the babies 3-12 days with a mean of 7.3**,** Weight of the babies 2.1-3.8 kg with a mean of 2.9. Age of the mother 19- 35 years with a mean of 24. Total numbers of neonates studied were 51. Males were 24 and females were 27. 30 neonates (18 males 12 females) had koilonichiya.

2 neonates were born to mothers who have consumed complete course of iron and folic acid in the antenatal period had koilonychia but 28 neonates had koilonychia whose mothers have

not taken completely iron and folic acid suggesting the koilonychia in these new born babies is due to iron and folic acid deficiency as shown in table 1.

**Table 1: Iron and Folic By Antenatal Mothers Vs Koilonychia.**

| Taken iron and folic acid | | Koilonychia | | | | Chi square test | OR(95%CI) |
|---|---|---|---|---|---|---|---|
| | | Absent | | Present | | | |
| | | n | % | N | % | | |
| | Complete Intake | 19 | 90.4% | 2 | 6.7% | **$\chi$2=51.00 P=0.001***(S)** | **133(17-1027)** |
| | Partial intake | 2 | 9.6% | 28 | 93.3% | | |
| | Total | 21 | 100.0% | 30 | 100.0% | | |

**S= significant ***P<0.001 very high significant**

26 neonates born to mothers with <11g% had koilonychia whereas only 4 babies were born to mothers with haemoglobin > 11g% indicating mothers haemoglobin is very much essential for the newborn as shown in table 2.

**Table 2: Mothzer Hemoglobin vs Koilonychia.**

| Mother 's Haemoglobin | | Koilonychia | | | | Chi square test | OR(95%CI) |
|---|---|---|---|---|---|---|---|
| | | Absent | | Present | | | |
| | | N | % | n | % | | |
| | ≤11 | 13 | 61.9% | 26 | 86.7% | **$\chi$2=4.21 P=0.05*(S)** | **4.0(1.0 -15.8)** |
| | > 11 | 8 | 38.1% | 4 | 13.3% | | |
| | Total | 21 | 100.0% | 30 | 100.0% | | |

**S= significant ***P<0.001 very high significant**

30 neonates had koilonychia with Hb<11g% and whereas no baby had koilonychia with Hb >11g% as shown in Table 3.

**Table 3: Baby Hemoglobin vs Koilonychia.**

| Baby's Haemoglobin | | Koilonychia | | | | Chi square test | OR(95%CI) |
|---|---|---|---|---|---|---|---|
| | | Absent | | Present | | | |
| | | n | % | n | % | | |
| | ≤11 | 5 | 23.8% | 30 | 100.0% | **$\chi$2=33.30 P=0.001***(S)** | - |
| | > 11 | 16 | 76.2% | 0 | 0.0% | | |
| | Total | 21 | 100.0% | 30 | 100.0% | | |

**S= significant ***P<0.001 very high significant**

30 neonates had koilonychia in both big toes and there was no koilonychia in other finger or toe nails indicating koilonychia is common occurrence in the big toe in new born as shown in table 4.

**Table 4: Nail vs Koilonychia.**

| Nail | | Koilonychia | | | | Chi square test | OR(95%CI) |
|---|---|---|---|---|---|---|---|
| | | Absent | | Present | | | |
| | | n | % | n | % | | |
| | Big toes | 1 | 4.8% | 30 | 100.0% | **$\chi 2$=47.00 P=0.001***(S)** | - |
| | Normal | 20 | 95.2% | 0 | 0.0% | | |
| | Total | 21 | 100.0% | 30 | 100.0% | | |

**S= significant ***P<0.001 very high significant**

By univariate analysis we identified male sex, partial intake of iron and folic acid by antenatal mother, babies hb<11g% mothers hb<11g%, number of days iron folic acid taken, bilateral big toe nails are having more KOILONYCHIA PRESENT than others. Unadjusted odds ratio was given with 95% confidence interval as shown in table 5.

**Table 5: Influencing Factors For Koilonychia Using Univariate Analysis.**

| Demographic variables | | Koilonychia | | | | Total | Chi square test | ODDS Ratio (95%CI) |
|---|---|---|---|---|---|---|---|---|
| | | Present | | Absent | | | | |
| | | n | % | N | % | | | |
| Sex | Male | 18 | 75.0% | 6 | 25.0% | 24 | $\chi 2$=4.89 P=0.03*(S) | 3.8 (1.1 -12.3) |
| | Female | 12 | 44.4% | 15 | 55.6% | 27 | | |
| Iron tablets Taken | Partial | 28 | 93.3% | 2 | 6.7% | 30 | $\chi 2$=35.82 P=0.001***(S) | 133 (17-1027) |
| | Complete | 2 | 9.5% | 19 | 90.5% | 21 | | |
| Mother Hb | < 11 | 26 | 66.7% | 13 | 33.3% | 39 | $\chi 2$=4.21 P=0.05*(S) | 4.0(1.0 -15.8) |
| | > 11 | 4 | 33.3% | 8 | 66.7% | 12 | | |
| Baby Hb | < 11 | 30 | 85.7% | 5 | 14.3% | 35 | $\chi 2$=4.53 P=0.03* | - |
| | > 11 | 0 | 0.0% | 16 | 100.0% | 16 | | |
| Nails | Big toes | 30 | 96.8% | 1 | 3.2% | 31 | $\chi 2$=4.96 P=0.03* | - |
| | Normal | 0 | 0.0% | 20 | 100.0% | 20 | | |

By multivariate logistics regression analysis identifies male gender and the mothers with Hb <11gm%, having more chance of koilonychia than others. Adjusted odds ratio was given with 95% confidential as told in table 6

**Table 6: Identification of Influencing Factors for More Koilonychia Present Score Using Multivariate Logistic Regression.**

| | Univariate analysis | | Multivariate analysis | |
|---|---|---|---|---|
| | p-value | Unadjusted OR(95%CI) | p-value | Adjusted OR(95%CI) |
| Sex (Male Vs Female) | 0.05* | 3.8(1.1 -12.3) | 0.02* | 4.6(1.2 – 17.3) |
| Iron tablets (Partial Vs Complete) | 0.05* | 133(17-1027) | | |
| Days of taking Iron (Partial Vs Complete) | 0.02** | 133(17-1027) | | |
| Mother HB (*<11* Vs >11) | 0.02* | 4.0(1.0 -15.8) | 0.03* | 5.2(1.1 -23.7) |
| Baby HB (*<11* Vs *>11))* | 0.05* | - | - | |
| Nails (Big toes Vs Normal) | 0.03* | - | - | |

## DISCUSSION

Koilonychia may be hereditary, acquired or idiopathic. The koilonychia seen in newborns spontaneously regress by 9 years of age.[5] In some cases, nail abnormalities may be used as a key clinching finding in diagnosis of syndromes or hereditary diseases.[6] Koilonychia was observed in 30 neonates out of 51 i.e. 58.8% in our study but in a study by walker J et al.,[5] 32.7% of toenails in other series.[6] seems to be a physiology occurrence during infancy. Koilonychia was more frequent in toenails than finger nails possibly because of the shape of the toes (with more skin and less bone) as compared to fingers. This could also explain why finger nails do not develop ingrown nails. Another reason could be the higher mobility of fingers, even during in utero life than toes. 24 babies had koilonychia with birth weight of >2.5 kg in our study. 19 babies delivered by LSCS had koilonychia in our study. 16 babies (53.3%) were born to mothers <25 years. These findings in our study do not have data available for comparison in literature. 28(93.3%) of babies who were born to mothers who have not taken folic acid completely. This indicates iron and folic acid is needed in order to prevent koilonychia occurrence in newborn. Gastroenteritis, giddiness and hyper emesis gravid arum are common cause of stopping regular intake of iron and folic acid in our study. No literature available for comparison. 26(86.7%) of neonates were born to mother's whose haemoglobin <11g%. 30 neonates with koilonychia had haemoglobin <11g%. So, mothers' haemoglobin should be maintained >11g% to prevent koilonychia. 20 neonates (66.7%) were born to multiparous women indicating they might having low haemoglobin level. So, multiparous women should be given proper adequate diet and drugs to maintain a haemoglobin level of >11g%. In our study, big toe nail bilaterally had koilonychia(58.8%) but study by Gwendolyn R Hogan et al had 17 out of 22 (77.27%) had Koilonychia.[2]

Male babies were more often found with koilonychia in our study. Hereditary or congenital Koilonychia is a rare genetic disease with autosomal dominant type of inheritance with high degree of penetrance.[3] Children younger than 2 years of age should be looked for subungual involvement of scabies in nails.[8] Nails are a potential reservoir and source of reinfection. Hence, during treatment with medication, nails should not be forgotten.[7] Although in some infants it is observed that koilonychia may be associated with a deficiency of cysteine.[9] Other nail findings in newborn are clubbing and onychoschizia. Clubbing: appears to be related to more increased blood flow to the vasodilated plexus of nail unit, altered vagal tone and micro vascular infarcts. Clubbing can rarely manifest in newborn period in cardiac pathologies.[10] Onychoschiziais defined as an absence of lunula. It is noted in big toes and thumbs with splitting of edges.[5,10]

**Limitations of the study**

It is a single centered study with small sample size. Genetic studies, serum iron and serum ferritin levels were not done. All babies were term babies. Preterm babies were not studied.

The observer is a neonatologist, a single person. The study should have included a dermatologist to demarcate koilonychia from other nail disorders.

**Postulation**

Toe nails become spoon shaped as the nail is soft. All babies were term babies and they are living happily in amniotic fluid and as the time comes and labour pain starts the baby tries to come out, piercing the amniotic sac making the toe nails become spoon shaped and the nails were Soft. It is a food for thought as mentioned in the editorial by Dr. Parmanandam.[11]

## CONCLUSION

For better understanding of nails in newborns, data on nails in preterm infants, follow-up of neonates would be of interest. Multicentric study is of utmost importance with large sample size.

**Fig. 1: Neonate with Koilonychia In Big Toes (Case).**

**Fig. 2: Neonates With No Koilonychia (Controls).**

**Ethical Clearance**

**Contributors:** PP Participated in collecting the data & contributed their cases for analyses & will act as guarantors for the paper. PGJ helped in search viewed of literature

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