Spectrum of Neonatal Surgical Problems in the Newborn: Incidence, Clinical Course, Immediate Outcome, Follow up Study in a Tertiary Care NICU

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Authors’ contributions

This work was carried out in collaboration among all authors. Authors KGS and KRS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors HR, GP and HB managed the analyses of the study. Author KGS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: A congenital anomaly may be defined in terms of physical structure as a malformation, an abnormality of physical structure or form usually found at birth or during the first few weeks of life. Congenital anomalies affect approximately 1 in 33 infants and result in approximately 3.2 million birth defect-related disabilities every year. Congenital anomalies or birth defects are relatively common, affecting 3% to 5% of live births in the United States (US) and 2.1% in Europe. Congenital anomalies account for 8% to 15% of perinatal deaths and 13% to 16% of neonatal deaths in India.

Objectives: To provide an insight on the burden and types of surgical problems encountered in our NICU of Bapuji Child Health Institute & Research Center, JJM Medical College, Davangere, Karnataka, India and to study the incidence, clinical profile and outcome of surgical condition.

Methodology: A total of 3820 babies were examined over a period of 2 years. The relevant information was documented on a semi-structured proforma and analysed.

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Results: Overall incidence of congenital malformations at birth was 24.8 per 1000 births. The GIT system (51.58%) was most commonly involved followed by respiratory system (26.32%). The incidence of congenital malformation was more in male babies than female babies. Increased frequency was seen in babies born to mothers between 26–30 years & primigravida. The factors which significantly increased the rate of congenital malformations were consanguinity in parents & bad obstetric history. Out of 95 cases, 72% got discharged normally, 18% died in NICU and 10% got discharged against medical advise.

Conclusion: With emphasis on “small family” norms and population control it is necessary to identify malformations so that interventional programmes can be planned. Systematic clinical examination of newborns for early detection of anomalies that may warrant medical or surgical intervention. Accurate antenatal anomaly scan need to be done to identify major malformations and terminate the pregnancy.

Keywords: Congenital anomaly; birth defects; NICU; neonatal deaths.

1. INTRODUCTION

A congenital anomaly is defined as malformation of a physical structure, an abnormality of physical structure or form usually found at birth or during the first few weeks of life; or defined more widely to include functional disturbance as a defect, any irreversible condition existing in a child before birth in which there is sufficient deviation in the usual number, size, shape, location or inherent character of any part, organ, cell or cell constituent to warrant its designation as abnormal. [1] A congenital anomaly is thus any alteration present at birth of normal anatomic structure and has cosmetic, medical or surgical significance. The birth of an infant with major malformations, whether diagnosed antenatally or not, evokes an emotional parental response [2].

Congenital anomalies affect approximately 1 in 33 infants and result in approximately 3.2 million birth defect-related disabilities every year [3]. Congenital anomalies or birth defects are relatively common, affecting 3% to 5% of live births in the United States (US) and 2.1% in Europe [2]. Congenital anomalies account for 8% to 15% of perinatal deaths and 13% to 16% of neonatal deaths in India [4,5].

Although individually rare, birth defects taken together account for a significant proportion of morbidity and mortality among infants and children, particularly where infant mortality due to more common causes has been reduced. With the better mother and child health services and prevention of infections, the congenital malformations are emerging as one of the major worldwide problems.

In the early part of the 19th century, the percentages of deaths from congenital anomalies were relatively low. This was because; preventive medicine, immunology and antibiotics were not in usage. Now, the number of deaths from infection, metabolic and endocrinial disorders has decreased and so birth defects as a cause of Perinatal mortality has come to the forefront [6,7,8].

In this era, where family planning has come to be accepted as a faith by all countries. It is imperative to prevent all avoidable deaths and crippling in infants due to congenital malformations for the successful implementation of family planning programme.

1.1 Objectives

- To provide an insight on the burden and types of surgical problems encountered in our NICU of Bapuji Child Health Institute & Research Center, JJM Medical College, Davangere, Karnataka, India.
- To study the incidence, clinical profile and outcome of the surgical condition.

2. MATERIALS AND METHODS

With a level IV evidence, a descriptive study was performed from 2016 to 2018 in the Department of Paediatric Surgery, JJM Medical College, Davangere, Karnataka, India. The cases for this study were recruited using convenient sampling technique. All 95 patients with previous/suspected surgical conditions attending the outpatient Department of Pediatric Surgery were taken into the study. A pre-structured proforma was used to record the relevant information from individual case selected for the study. All cases were taken into consideration for statistical analysis using IBM SPSS Statistics for Windows, Version 20.0, IBM Corp, Chicago, IL.
After obtaining IEC clearance, all diagnosed babies with congenital anomalies with amenable surgeries and age <28 days were included in the study. The babies with major dysmorphic features and parents who were not willing for surgery were excluded from the study.

All the patients with amenable surgical conditions attending the in & out patient Department of Paediatrics would be consented and included in the study. All patients were assessed clinically and radiologically for congenital malformations. The clinical information were collected in semi-structured proforma for each case with consent of parents. A discrete clinical screening of all new borns was done during hospital stay before discharging the babies from hospital for the evidence of any congenital malformations and were duly recorded. In those babies with malformations, a detailed history as per semi structured proforma were performed.

All mothers were interrogated as per the proforma prepared, which contains the following particulars like maternal age, consanguinity, detailed antenatal history with reference to exposure to teratogens especially during 1st trimester and medical disease complicating pregnancy like diabetes, hypertension, detailed obstetric history with reference to previous abortions and still birth. Routine investigations like blood grouping and Rh typing, VDRL and HIV were done for all cases. Every newborn was subjected to detailed examination from head to toe. The assessment of the newborn includes birth weight, sex, live born, gestational age and details of congenital malformations. All were recorded in a pre-designed proforma. A gavage tube was used to check choanal and oesophageal atresia, anorectal anomaly in suspected cases. The babies with surgical problems were subjected to X-ray chest PA view, USG abdomen, and Echocardiograph and USG cranium. If USG cranium is significant CT brain was done. Other necessary investigations were done wherever required.

3. RESULTS

A total of 95 cases were enrolled in the study and the treatment were instituted as per our study protocol. The descriptive statistics were reported as mean (SD) for continuous variables, frequencies (percentage) for categorical variables. Data were statistically evaluated with IBM SPSS Statistics for Windows, Version 20.0, IBM Corp, Chicago, IL.

The total numbers of births studied were 3820. Among the 3820 consecutive births, 1962 were male babies and 1858 were female babies. Out of 3820 cases, 95 infants had congenital malformations giving an incidence of 24.8% per 1000 births. In 95 malformed babies, 64 (67.4%) were male babies and 31 (32.6%) were female babies.

The maternal age was classified into 4 groups as shown in Fig. 1. It was observed that more number of malformations observed in babies born to mothers in the age group of 26 – 30 years (n=37, 38.9%) followed by 21 – 25 years (n = 27, 28.4%).

Out of 95 babies with congenital anomalies, 43 cases (45.2%) were born for a non consanguineous couple and 52 cases (54.7%) were born for a consanguineous couple. The antenatal risk factors were present in 11 mothers (11.6%). The most common antenatal factors were diabetes (n=5, 5.26%), pre-eclamptic toxemia (n=5, 5.26%) & hypothyroidism (n = 3, 3.16%).

The babies with birth weight <2.5 kg has congenital malformation in 30 cases (31.6%) and the babies with birth weight >2.5 kg has congenital malformation in 65 cases (68.4%). The congenital malformations were seen more in babies weighing more than 2.5 kg. The congenital malformations seen in term babies were 85 cases (89.5%) and in pre-term babies were 10 cases (10.5%). The congenital malformations were more seen in term babies than preterm babies (as shown in Figs. 4 to 11).

Among gastrointestinal tract malformations, anorectal malformation (n=20) constitute for 40.8% followed by malrotation of gut (n=9) constitute for 18.3% (as shown in Fig. 3). Among respiratory tract malformation, most common malformation observed was tracheoesophageal fistula (n=18, 72%) followed by congenital diaphragmatic hernia (n=7, 28%).

Out of 95 cases, 31 babies (32.6%) required ventilator support and 64 babies (67.3%) does not require ventilator support. Out of 31 cases
Fig. 1. Maternal age in relation to congenital malformations

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Fig. 2. System wise distribution of congenital malformations (n=95)

Fig. 3. Gastrointestinal tract malformations
Fig. 4. Lumbosacral meningomyelocele

Fig. 5. Congenital diaphragmatic hernia

Fig. 6. Hirschprung's disease

Fig. 7. Ileal atresia

Fig. 8. Jejunal atresia
who were on ventilator support, 14 babies (45.1%) got discharged normally and 17 babies (54.8%) expired in NICU.

Out of 95 cases, 68 babies (72%) got discharged normally, 18 babies (18%) died in NICU and 10 babies (10%) got discharged against medical advise. A short term follow up following 1st surgery for 68 cases stated 25% re-surgery (n=17), 51% no re-surgery (n=51), 15% death (n=10) and 9% lost follow up (n=6).

4. DISCUSSION

The wide variation in the incidence of malformations between different studies is due to various factors such as population sampled, geographical and racial differences, period of observation, methodology and accuracy with which malformations were recorded. The variation in incidence is because of consanguinity, poor antenatal care, early marriage, educational status of the parents etc.

| Study                  | Number of newborn in the study | Incidence of malformations per 1000 births |
|------------------------|--------------------------------|------------------------------------------|
| Bhat BV, et al. [9]    | 12,797                         | 37                                       |
| Verma M, et al. [10]   | 10,000                         | 36                                       |
| Ronya R, et al. [11]   | 3000                           | 21.1                                     |
| Agarwal SS, et al. [12]| 9405                           | 16                                       |
| Present study          | 3820                           | 24.8                                     |

**Parity:** The incidence of congenital malformations were maximum in primigravida by Bhat BV, et al. [9] and Grover N, et al. [13] as in
the present study. Even the gravida 3 & 4 has been noted to have malformations [14,15] This may be because of previous birth of congenital malformed baby, previous bad obstetrics history, poor antenatal care.

**Consanguinity:** The present study shows 54.7% malformed babies were born of consanguineous marriages. There is a definite increase in the rate of malformations in the offspring of consanguineous marriages. This was corroborated by Kesavan, et al. [16] showed a definite increase in the rate of malformations in the offspring of consanguineous marriages. Sugunabai, et al. [17] reported that consanguineous parents had 3.59% malformed offspring while non consanguineous parents had only 1.69% offspring with malformations. In the global study of congenital malformations the rate of neural tube defect was observed to be higher in the offspring of consanguineous marriages in Alexandria and Egypt [18]. However, the data from India on this aspect are equivocal.

**Sex distribution:** The present study showed increased incidence of malformations in male babies similar study to done by Bhat BV et al. [9] whereas the study done by Swain S, et al. [19] Chaturvedi P, et al. [20] and Verma M, et al. [10] showed no sex predilection.

**Maternal age:** In the present study, incidence of malformations was higher in babies born to mother between 26–30 years. Kulshreshtha et al. [21] also found higher incidence between 25–35 years age group. Whereas other studies like Verma et al. [10] and Sugarubhai et al. [17] found higher after 30 years and 35 years respectively.

**Gestational age:** In the present study incidence of malformations in term babies was higher than that of preterm babies whereas other studies by Verma, et al. [10] and Datta, et al. [22] found higher incidence in preterm babies. High incidence of malformations in term gestation in present study may be due to more number of deliveries at term.

**Antenatal factors:** According to Bhat BV, et al. [9] antenatal infections and ingestion of drugs were not found to be significant factors in the causation of birth defects. According to Chaturvedi P, et al. [20] factors like presence of hydramnios, maternal febrile illness in first trimester, history of abortion and a past history of progesterone intake during pregnancy significantly increased the rate of congenital malformation. According to Verma M, et al. [10] there was a significant correlation between maternal factors like previous abortions, drug intake and fever during first trimester, Diabetes mellitus, pre-eclampsia Toxaemia, ante partum haemorrhage and congenital malformations in the baby. According to Kalra, et al. [14], hydramnios was present in 16.6% of mothers giving birth to abnormal babies. No other maternal complications or etiological factors could be correlated. According to present study there is no significant correlation between maternal factors, like pre-eclampsia, maternal diabetes mellitus and congenital malformation and no significance with maternal toxaemia, maternal febrile illness during first trimester, drugs during first trimester, abortions and previous perinatal death.

**Congenital malformations:** The incidence of CNS malformation was found to be lower in our study than other studies. This may be unsupervised both due to environmental factors, consanguinity, drug intake etc. The incidence of gastrointestinal malformation was found to be 12.8% per 1000 births which are similar to studies done by Chaturvedi P, et al. [20] which showed 13.97% per 1000 births. The incidence of musculoskeletal malformation was found to be lower 0.7% per 1000 births while comparing with Chaturvedi P, et al. [20] (9.69%) and Bhatt BV, et al. [9] (9.7%). The high incidence may be because of multifactorial risk factors like environmental, uterine followed by background genetic factors. The incidence of genitourinary malformation was found to be 2.61% per 1000 births. The study done by Kalra A, et al. [14] showed similar incidence 3.7% per 1000 births.

**Final outcome of surgery:** 72% of the babies were discharged after surgery, 18% succumbed to death due to complications and 10% of them were discharged against medical advice due to financial constraints.

Short term follow up following 1st surgery: Total 68 babies were followed up. In total 68 babies, 25% (17) underwent resurgery, 15% (10) succumbed to death during follow up due to secondary complications, 51% (35) didn’t have any complications and 9% (6) babies lost follow up.

5. **CONCLUSION**

Congenital malformation continues to be a significant factor in morbidity, mortality and risk
factor involved in perinatal care in our area. The overall incidence of congenital malformations was found to be 24.8 per 1000 births. The high incidence of consanguinity with relation to occurrence of malformations observed in the present series is in conformity with the increased practice of inbreeding in this part of country. So, avoiding consanguineous marriages may help in bringing down the incidence of birth defects. Further studies are required with good reliable diagnostic facilities to improve the etiological factors involved in causation of malformations. This helps in predicting the future recurrences so as to undertake prenatal genetic counselling and to prevent fatal congenital malformations.

6. RECOMMENDATIONS

- **Primary prevention**
  - Access to family planning programs that include encouragement of complete reproduction before 35 years of age.
  - Access to adequate prenatal care including nutrition, control of maternal infections and avoidance of teratogens.
  - Periconceptional supplementation of folic acid.
  - Expansion of rubella immunization.
  - Discouraging further reproduction after the birth of a malformed child; after such a birth, the frequency of malformations in subsequent pregnancies is increased by about 10 times.
  - The avoidance of pregnancy in circumstances where malformations are likely to occur e.g., advanced maternal age and Down's syndrome.

- **Secondary prevention**
  - Systematic clinical examination of newborns for early detection of anomalies that may warrant medical or surgical intervention.
  - Medical termination of pregnancy can be done depending on the severity of anomaly.

CONSENT AND ETHICAL APPROVAL

As per university standard guideline consent of participants' parents and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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