



SKELETAL MALFORMATIONS IN PERINATAL AUTOPSY

Dr Rohini Mokhashi	Assistant Professor, Department of Pathology, Mahadevappa Rampure Medical College, Kalaburagi. Karnataka State.
Dr Anita A M	Professor, Department of Pathology, Mahadevappa Rampure Medical College. Kalaburagi, Karnataka State.
Asha Patil	Assistant Professor, Department of Pathology, Mahadevappa Rampure Medical College, Kalaburagi, Karnataka State.
Nabanita Sarma*	Demonstrator, Gauhati Medical College and Hospital. Assam State. *Corresponding Author

ABSTRACT **Introduction:** Congenital malformations are the fifth most common cause of mortality and morbidity in India out of which skeletal malformations constitute about 20%. The present study was conducted to look at various skeletal malformations with associated anomalies and emphasizes on the importance of foetal autopsy for understanding the cause of death and also confirmation of antenatal diagnosis of various congenital skeletal malformations. **Materials And Methods.** We studied 499 fetal autopsies conducted in our institution. This study was done over a period of 5 years. In this study all fetal autopsies with gestational age of 10 weeks to less than 7 days after delivery were studied. **Results:** Out of 499 fetal autopsies 179 cases had congenital anomalies, of which 55 (11%) cases showed skeletal malformations. The most common malformation encountered was Anencephaly 21 cases followed by Anencephaly with spina bifida 9 cases and 6 cases were of spina bifida and cleft palate, other cases encountered were Lemon skull, club foot, Achondroplasia, microcephaly and facial anomaly. Rare cases encountered were Iniencephaly and multiple skeletal anomaly (amorphous fetus). **Conclusion:** Even though antenatal ultrasonography reasonably predicts the skeletal malformations, it lags behind a complete fetal autopsy in accurately diagnosing associated anomalies and cause of fetal death. Understanding of skeletal malformations with associated anomalies can give valuable information that can be further helpful in genetic counselling of the parents.

KEYWORDS : Fetal Autopsy, congenital skeletal malformations, Anencephaly, spina bifida and Iniencephaly.

INTRODUCTION

Congenital malformations remain a common cause of perinatal deaths accounting for 10-15% in developing countries like India and still remain one of the least focused areas of disease surveillance in India compared with communicable and some chronic diseases.¹

The incidence of congenital anomalies has been increasing in recent past, worldwide incidence is estimated to be 3-7%, but actual numbers vary widely due to under reporting of cases in developing countries. Presence of congenital anomalies has an emotional effect not only on the couple but also on the family and there are always concerns about its recurrence risks².

Congenital skeletal malformations are congenital deviations in form and structure. Primary malformations are constitutional developmental failures due to genetic or chromosomal abnormalities. Secondary malformations are due to exogenous causes like malnutrition, cytotoxic drugs, exposure to radiations etc. Though secondary malformations cannot be inherited, some inherited factors can predispose to secondary malformations³.

Common skeletal malformations observed are Anencephaly with spinal defects, Spina bifida, Bilateral club foot, club hand, Cleft palate, Polydactyl, syndactyl, Lemon skull syndrome/sign, Thanatophoric dysplasia and Thoracolumbar scoliosis^{1,5}.

MATERIALS AND METHODS

Present study was done in a tertiary care hospital over a period of 5 years. The study included 55 cases of skeletal malformations. Autopsies were performed after getting consent from parents and Ethical committee clearance was obtained. All clinical data were collected, Ultrasonography, X-rays, CT scans and MRIs were reviewed wherever necessary.

RESULTS

Out of 499 cases autopsied 55 cases showed skeletal malformations. Maximum number of skeletal malformations were seen in male fetuses 33 (60.5%) cases, female fetuses were 21 (38.2%) cases, there was one case of Ambiguous Genitalia (1.8%).

Male to Female ratio in this study is 1.6.

Table.1. Age And Sex Wise Distribution Of Fetal Autopsy Cases

With Skeletal Malformation

Gestational Age	Male		Female		Ambiguous genitalia		Total	
	No	%	No	%	No	%	No	%
<20 wks.	11	33.3	06	28.6	01	100	18	32.6
21-24 wks.	07	21.2	06	28.6	00	00	13	23.5
25-29 wks.	05	15.2	04	19.0	0	00	09	16.4
30-34 wks.	04	12.1	03	14.3	0	00	07	12.6
35-40 wks.	05	15.2	02	9.5	0	00	07	12.6
40-till birth	01	3.0	0	00	0	00	01	2.3
Total	33	100	21	100	01	100	55	100

Common mode of death in fetuses with skeletal malformations in this study was intra uterine death 33 (60%) cases, followed by Termination of pregnancy (38.2%). There was only one case (1.8%) which was born alive and died within few minutes after birth.

Table.2. Spectrum Of Skeletal Malformations Seen In This Study

Sl. No	Skeletal Malformation	No. of cases	Percentage
1	Anencephaly	21	38.2%
2	Anencephaly with Spina bifida	09	16.4%
3	Spina Bifida	06	10.8%
4	Cleft Palate	06	10.8%
5	Achondroplasia	02	03.5%
6	Club Foot	04	07.3%
7	Iniencephaly	01	01.7%
8	Lemon skull	01	01.7%
9	Microcephaly	02	03.6%
10	Facial Anomaly	02	03.6%
11	Multiple skeletal Anomaly	01	01.8%
	Total	55	100%

Table.3. Some Of The Skeletal Malformations With Their Associated Anomalies

	Skeletal malformation	Associated anomalies
1	Cleft palate	Ectopia cardis with dilated chambers and single umbilical artery
	Cleft Palate	Bilateral upper limb anomaly and imperforate anus
2	Bilateral club foot	Hydrocephalus and absent corpus callosum

3	Polydactyl	Encephalocele with Bilateral cystic dysplasia of kidney.
4	Lemon skull	Meningomyelocele
5	Iniencephaly (absence of cervical spine)	Diaphragmatic hernia, polysplenia, hypoplastic cerebellum, cervical meningocele and Single umbilical artery.
6	Facial Anomoly.	Holoprosencephaly and frontal encephalocele.

Anencephaly

Anencephaly is a common and lethal neural tube defect (NTD) which occurs due to the defective closure of rostral pore of neural tube. It is also known by other names like acrania (absence of skull), acephaly (absence of head), Mero crania and meroanencephaly.⁴

The incidence of Anencephaly is 1 per 1000 births and is associated with genetic and environmental risk factors such as maternal diabetes, obesity, toxin exposure, and folate deficiency⁵. Anencephaly can be diagnosed by ultrasound examination (USG) and by elevated maternal alpha feto protein level, but pathological examination of the abortus is needed, as in most of the cases anencephaly is associated with systemic anomalies.

Associated conditions with Anencephaly include hydrocephalus, vertebral deformities, genitourinary and gastrointestinal disorders⁶

Table:4. Anencephaly With Associated Anomalies

Skeletal Malformation	Associated Anomalies	No of Cases
Anencephaly	-	10
Anencephaly	Spina Bifida	05
Anencephaly	Meningocele	01
Anencephaly	Encephalocele	02
Anencephaly	Single umbilical artery and polycystic kidney	01
Anencephaly	Single umbilical artery	02



Anencephaly With Absence Of Calvarium.

SPINA BIFIDA

Spina bifida is a congenital malformation in which the spinal column is split (bifid) as a result of failed closure of the embryonic neural tube, during the fourth week of gestation⁷. Incidence of spina Bifida is 1 per 1000 births worldwide⁸.

Table:5. Spina Bifida With Associated Anomalies.

Skeletal Malformation	Associated Anomalies	No of Cases
Spina Bifida	-	01
Spina Bifida	Chairi -II malformation	01
Spina Bifida	Dandy walker syndrome	01
Spina Bifida	Bilateral club Foot	01
Spina Bifida	Meningocele and right club foot	01
Spina Bifida	Myelomeningocele and Right Lung CCAM-II	01



Spinabifida associated with Chairi-II malformation of brain (Herniation of cerebellum)

Iniencephaly

Iniencephaly is a rare neural tube defect characterized by extreme retroflexion of the head (absence of occipital bone) with the absence of neck (cervical spine) due to spinal deformities. The incidence of iniencephaly was observed to be 1.1% in a study conducted by Pinar et al⁸, the incidence of iniencephaly is reported to be 1 in 65,000 births in India and is more common in female fetuses⁹. In our study, we encountered one case of iniencephaly accounting for 1.8%.

Other associated malformations seen in this anomaly are Cardiovascular disorders, diaphragmatic hernias, and gastrointestinal malformations¹⁰,



Iniencephaly (absence of cervical spine), Associated anomalies were diaphragmatic hernia, polysplenia, hypoplastic cerebellum, cervical meningocele, B/L club foot and Single umbilical artery.

POLYDACTYLY

Polydactyly is one of the most common congenital anomalies of the hands and feet consisting of supernumerary fingers or toes. The extra digit is usually a small piece of soft tissue., occasionally it may contain bone without joints. It can occur as an isolated disorder or as a part of syndrome. There may be associated cleft palate, hearing difficulties, renal anomalies and other limb and vertebral anomalies¹¹.



Polydactyl associated with Bilateral cleft palate.

Other skeletal anomalies encountered were:



Cleft palate, associated with ectopia cardis and single umbilical artery



Lemon skull associated with meningocele.



Bilateral club foot



Facial Anomaly with abnormal position of orbits and absence of nostrils (nose with probosis)

DISCUSSION

The frequency and type of congenital anomalies may vary in different populations due to variations in ethnicity, socio-economic status, nutrition, environmental factors, maternal age and life style among different countries. Congenital malformations have been reported to be a major cause of mortality and morbidity in children in the developed countries.

Significant number of congenital skeletal malformations with other anomalies cannot be determined by antenatal investigations such as ultrasonography or Maternal serum enzyme hormone assays, therefore autopsies are must¹².

Incidence of skeletal malformations in the present study is 11.2% where as study by Kaiser et al¹³ shows 13.19% and Ahuja et al shows 21% and R Kalyani et al shows 17.74%.(Table:6)

Table: 6. Incidence Of Skeletal Malformations Compared With Other Studies

Study	Autopsies	Skeletal malformations	Percentage
Kaiser et al ¹³ (2012)	144	19	13.19%
Ahuja et al ⁷ (2013)	100	21	21%
R Kalyani et al ¹⁴ (2013)	62	11	17.74%
Present study	499	55	11.2%

In our study male to female ratio is 1.6:1 showing male preponderance which closely correlated with studies by k Forci et al(1.2:1)¹⁴ and Sibel Hakverdi et al.(1.5:1)¹⁴.

The most commonest skeletal malformation seen in the present study is anencephaly (38.2%) which is comparable to other studies.(Table: 7)

Table :7 Spectrum Of Skeletal Malformations Compared With Other Studies

Types of Skeletal Malformations	K Farci et al ¹⁵ (245 Autopsies)	Sibel Hakverdi et al ¹⁶ (274 Autopsies)	Present study (599 Autopsies)
Anencephaly	22 (27.5%)	33 (57.9)	21 (38.2%)
Anencephaly with Spina bifida	-	09 (15.8%)	09 (1.4%)
Spina Bifida	17 (21.25%)	07 (12.3%)	06 (10.9%)
Cleft palate	-	-	06 (10.9)
Achondroplasia	10 (12.5)	-	02 (3.6%)
Club Foot	27 (33.75%)	-	04 (7.3%)
Iniencephaly	-	05 (8.8%)	01 (1.8%)
Lemon skull	-	-	01 (1.8%)
Microcephaly	04 (5%)	02 (3.5%)	02 (3.6%)
Facial Anomaly	-	01 (1.8%)	02 (3.6%)
Multiple skeletal Anomaly	-	-	01 (1.8%)
Total	80	57	55

CONCLUSION

In the present study we have studied spectrum of various skeletal malformations with associated anomalies. Rare cases encountered were Iniencephaly and amorphous fetus.

Studying congenital skeletal malformations with associated anomalies are not only of theoretical importance but also of practical significance to clinicians in the form of estimating the risk of recurrence and in genetic counseling.

By improving socioeconomic condition, maternal nutrition, maternal health and health education the incidence of skeletal malformations can be reduced.

Thus fetal autopsy remains gold standard for the confirmation of the antenatal diagnosis and also to arrive at a definitive diagnosis.

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