Case Report

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# Discordant exencephaly in case of a twin delivery: a case report

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**Introduction and importance:** Neural tube defect occurs as a result of failure of spontaneous closure of the neural tube between the third and fourth weeks of foetal life. Exencephaly is a rare malformation of the neural tube characterized by a large amount of protruding brain tissue in the absence of the calvarium.

**Case presentation:** The authors report a 29-year-old female, non-compliant to iron, calcium and folic acid tablets due to nauseating and itchy sensation after intake for 2 weeks, was admitted in ward Obstetrics ward in view of twin pregnancy. After proper counselling, she was advised for caesarean section, which revealed gross malformation in the form of cleft lip, cleft palate and exposed brain tissue covered by thin layer of membrane with incompletely formed cranial vault and multiple-haematoma and ulcerations in the exposed brain tissue suggestive of Exencephaly. The deformed baby survived for 2 days after birth while the other baby was grossly healthy.

**Clinical discussion:** Exencephaly is said to be the embryological precursor anomaly of anencephaly. Exencephaly is a type of cranial malformation that characteristically involves a large disorganized mass of brain tissue. The flat bones of calvaria are absent and the brain mass is left uncovered. This condition is incompatible with life.

**Conclusion:** Each and every pregnant lady must be advised to undergo ultrasonography in every trimester, especially second trimester scan (anomaly scan) to diagnose any gross congenital malformations. Each pregnant lady is suggested to take the necessary vitamins (like folic acid) to avoid any Neural tube defects.

**Keywords:** anencephaly, anomaly scan, exencephaly, folic acid, neural tube defect

## Introduction

Neural tube defect (NTD) occurs as a result of failure of spontaneous closure of the neural tube between the third and fourth weeks of foetal life. Acrania-exencephaly-anencephaly sequence is a rare malformation with an incidence of 3.6–5.4 for 10 000 live births[1]. Exencephaly is a rare malformation of the neural tube characterized by a large amount of protruding brain tissue in the absence of the calvarium. It is considered to be an embryological precursor of anencephaly where the facial structures and the base of brain are always present and most cases are stillborn[2]. Acrania is a cranial vault defect characterized by the partial or total absence of the cranial bones and the covering skin, with complete but abnormal development of the chondrocranium and the presence of brain tissue that is exposed[3]. The progression from exencephaly to anencephaly was first described by Wilkins-Haug *et al.*[4]. A standardized protocol in the sonographic evaluation of the developing foetus is necessary for an early prenatal diagnosis of congenital malformations[3]. Hereby, we report a case of acrania-exencephaly in one of the twins born at term that died on second of life with good outcome of the other twin. Our article has been reported in line with SCARE criteria 2020[5].

### HIGHLIGHTS

- Exencephaly is a rare malformation of the neural tube characterized by a large amount of protruding brain tissue in the absence of the calvarium.
- It is considered to be an embryological precursor of anencephaly.
- Most of the babies with exencephaly are stillborn.
- Ultrasonography remains one of the screening methods to identify exencephaly in early stages of pregnancy.
- It is the first case report of its kind to be reported from Nepal.

### *Case presentation*

A 29-year-old female Gravida 2 Parity 1 Living 1 came to outpatient department of obstetrics and gynaecology at 36 weeks 5 days period of gestation (POG) for admission till delivery in

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view of twin pregnancy. Her last child birth was 4 years back via emergency cesarian section for meconium-stained liquor (MSL), the delivered baby being alive and healthy with birth weight of 3.17 kgs without any bad outcomes. She confirmed her current pregnancy using the urine pregnancy test (UPT) kit after 1.5 months of missed period. She was told to be having twins in current pregnancy at local hospital ultrasonography (USG) done at 10 weeks period of gestation. However, she did not do second trimester USG scan (anomaly scan). Her past, menstrual, family and medical history was non-significant except for her non-compliance with intake of iron, calcium and folic acid tablets during her current pregnancy as she usually felt nauseating and itchy sensation after the intake of these tablets for about 2 weeks. On examination, her general condition was fair, vitals were stable and systemic examinations were normal. On abdominal examination, uterus was term size, multiple foetal parts were palpable and presence of foetal heart sounds which were regular on both sides of abdomen. She was sent for obstetrics USG scan which confirmed twin pregnancy with monochorionic diamniotic placenta. Twin A was under cephalic presentation with heart rate of 138 beats per min and estimated foetal weight of 2427 g and twin B had heart rate of 140 beats per min but the estimated foetal weight cannot be evaluated due to acrania. Liquor volume as reported by USG was adequate (14.9 cm). After explaining the outcomes of possible malformation and prognosis of one of the foetuses to the mother and father, she was planned for elective cesarian section 5 days back. Her laboratory reports were non-significant. By the operation, two babies were delivered with twin A being alive and healthy female (as shown in Fig. 1) with weight of 2543 g and Apgar score of 8, 9 and 9 in 1, 5 and 10 min, respectively. However, twin B had gross malformation with cleft lip, cleft palate and exposed brain tissue covered by thin layer of membrane with incompletely formed cranial vault and multiple-haematoma and ulcerations in the exposed brain tissue (as shown in Fig. 2). The vitals of twin A include a heart rate of 146 beats per min, respiratory rate of 46 breaths per min, oxygen saturation of 98% under room air. Whereas, the vitals of twin B include a heart rate of 110 beats per min, respiratory rate of 66 breaths per min and oxygen saturation of 94% under room air. The deformed baby had birth weight of 2160 g with Apgar score of 6, 7 and 8 in 1, 5 and 10 min, respectively, and survived for 2 days after birth. The mother was discharged with genetic counselling and importance of medications like iron, calcium and folic acid with their natural sources and the necessity of anomaly scan during antenatal period. On follow-up after 7 and 1 month, there was no abnormality in the living baby.

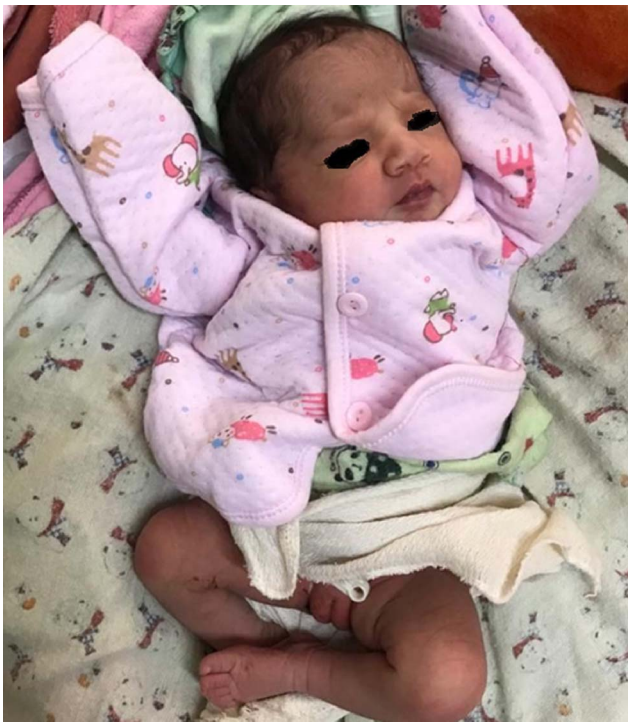

**Figure 1.** Alive and healthy female with no gross malformation.

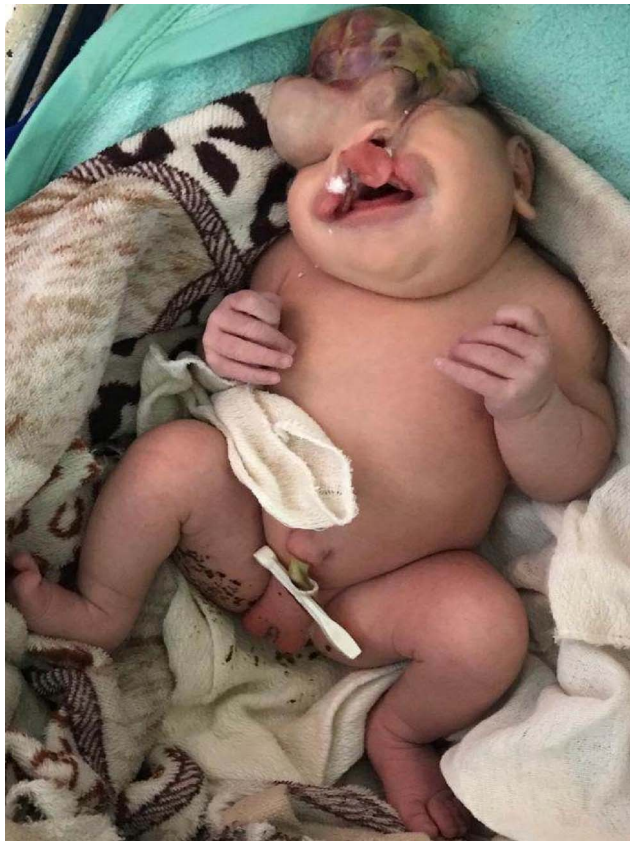

**Figure 2.** Gross malformation with cleft lip, cleft palate and exposed brain tissue covered by thin layer of membrane with incompletely formed cranial vault and multiple-haematoma in the exposed brain tissue.

## Discussion

Most NTD occur sporadically and are multifactorial in origin[6]. NTD is a developmental sequence of events that leads to anencephaly consisting of three phases:[1] dysraphia, or a failure of the neural groove to close in the rostral region;[2] exencephaly, or well-developed brain outside the skull during the embryonic period; and[3] disintegration of the exposed brain during the foetal period, resulting in anencephaly[7]. The progression from exencephaly to anencephaly was first described by Wilkins-Haug *et al.*[4]. Hegazy and Hegazy suggested that the developments of

the brain and the cranial vault are closely interrelated. Therefore, the developing brain can be affected by internal factors including the growth of the brain or external factors that compress or prevent the proper development of the skull[8]. Exencephaly is a type of cranial malformation that characteristically involves a large disorganized mass of brain tissue. The flat bones of calvaria are absent and the brain mass is left uncovered. This condition is incompatible with life[9]. Exencephaly being a type of NTD, the most common cause for its occurrence is deficiency of folic acid. However, there are other causes which include irradiation, hypervitaminosis A, colchicine, cyclophosphamide, arsenate etc. but these are proposed to be the causative factors in several rodents and there has been no study in humans[10]. Most of the cases are newborn. Physical examination reveals a lack of cranial vault and brain[11]. Liveborn neonates with exencephaly live less than 1 or 2 months at most[6]. In our case as well, the patient was a newborn twin female which survived for 2 days after the delivery. In exencephaly, there is only a vascular layer of epithelium covering the brain tissue, which is slowly degraded during gestation by the amniotic fluid and degenerates into anencephaly[12]. Due to this pattern of progression, anencephaly is considered relatively more common than exencephaly[13]. These anomalies are well detected on ultrasonography. The transvaginal approach can detect acrania-exencephaly-anencephaly sequence at an early stage of foetal development, with the earliest at the 10–13 weeks[3]. In the first trimester, on ultrasonography the findings noted are echogenic amniotic fluid, absent of calcification of the cranial bones, lateral widening of the cerebral hemispheres -the "Mickey Mouse" sign. At 12 weeks acrania is suspected by absence of the normally ossified skull and distortion of the brain (exencephaly). At more than 16 weeks the brain is destroyed (anencephaly)[14]. As foetal cranial ossification starts and accelerates after 9 weeks, prenatal US allows diagnosing acrania from the 11th week of pregnancy[15]. This could be the reason why the obstetric scan done in our case in 10$^{th}$ week of gestation showed no any malformation in cranium of the twins. Congenital abnormalities of the central nervous system (CNS) include anencephaly and exencephaly. Exencephaly is a precursor to anencephaly. These cases are commonly associated with excess amniotic fluid called polyhydramnios. Therefore, evaluation of the amniotic fluid volume during gestation by US can help detect such CNS anomalies[16]. Hendricks and colleagues showed that the exencephalic brain is noted to be covered by a highly vascular epithelial layer, the gyri and sulci are shallow, flattened, and disorganized. The remaining central nervous system tissue is dysplastic, with little or no neuronal differentiation, and very little normal cortex[9]. Usually being associated with conditions like meningoencephalocele, amniotic bands, limb–body wall complex, acalvaria, and osteogenesis imperfect type II etc., these conditions should also be taken care of while clinically and radiologically assessing the patient[17]. In our case, it was associated with cleft lip and cleft palate. Folic acid supplementation before, and around the time of conception may reduce the risk of occurrence and recurrence of NTDs by two-thirds[18]. The pharmaceutical folates are known to contain mono-glutamates which exhaust the body's capacity for methylation and reduction to 5-ethyltetrahydrofolate and hence present an abnormally high concentration of mono-glutamates to the plasma, facilitating a hypersensitivity reaction and thus causing intolerance. Whereas the naturally obtained folates contain polyglutamates which are not known to cause intolerance. So natural products containing folates can be advised to pregnant women if they are intolerant to pharmaceutical folic acid[19]. However, in our case, the patient was non-compliant with intake of folic acids supplements as she felt nauseous and slight itchy sensation after the intake of the folic acid tablets for about 2 weeks. The limitations of our article include the non-availability of US showing the picture of twin pregnancy with discordant exencephaly and the lack of follow-up of the patient in her second trimester.

## Conclusion

Exencephaly is a rare occurrence and is incompatible with the survival of the baby. USG remains one of the screening methods to identify Exencephaly in early stages of pregnancy. So, each and every pregnant lady must be advised to undergo USG in every trimester, especially second trimester scan (anomaly scan) to diagnose any gross congenital malformations and plan the pregnancy accordingly. Each pregnant lady is suggested to take the necessary vitamins (like folic acid) to avoid any NTDs.

## Ethical approval

The study is exempt from ethical approval in our institution.

## Consent

Written informed consent was obtained from the patient's parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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## Author contribution

A.B.: literature review, follow-up the patient, writing the manuscript, and final approval of the manuscript. M.S.: literature review, follow-up the patient, writing the manuscript, and final approval of the manuscript. A.R.: literature review, follow-up the patient, writing the manuscript, and final approval of the manuscript. M.B.: literature review, surgery of the patient and final approval of the manuscript. A.D.: Supervisor, literature review, surgery of the patient and final approval of the manuscript.

## Conflicts of interest disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Research registration unique identifying number (UIN)

Not done (no any new surgical technique or new equipment/technology used).

## Guarantor

Amrit Bhusal.

## Data availability statement

Yes, the data analyzed during current study are publicly available, available upon reasonable request, or if data sharing is not applicable to this article.

## Provenance and peer review

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