



CASE REPORT

REVISED A rare variation of hydranencephaly: case report [v3; ref status: indexed, <http://f1000r.es/2x2>]

Buddhika TB Wijerathne^{1,2}, Geetha K Rathnayake^{3,4}, Sisira K Ranaraja¹

¹Obstetrics and Gynaecology Unit, Teaching Hospital Peradeniya, Peradeniya, Sri Lanka

²Current address: Department of Forensic Medicine, Faculty of Medicine and Allied, Rajarata University of Sri Lanka, Saliyapura, Sri Lanka

³Obstetrics and Gynaecology Unit, Castle Street Hospital for Women, Colombo, Sri Lanka

⁴Current address: Teaching Hospital Anuradhapura, Anuradhapura, Sri Lanka

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Abstract

Hydranencephaly is a rare congenital abnormality characterized by the absence and replacement of the cerebral hemispheres with cerebrospinal fluid. Here, we present an ultrasonographic diagnosis of a case of a rare variant of fetal hydranencephaly at 38 weeks of gestation. Obstetric sonography revealed the absence of the cerebral cortex, thalami and basal ganglia with a disrupted falx and preserved posterior fossa structures. This is the first reported case of hydranencephaly with the absence of the thalami and basal ganglia, which was diagnosed prenatally. The diagnosis was confirmed with postnatal computed tomography. The early prenatal diagnosis allowed for prompt obstetric attention at a tertiary care hospital which had specialized pediatric facilities including prenatal counseling and support.

Open Peer Review

Referee Status:

	Invited Referees	
	1	2
REVISED version 3 published 30 Jan 2014	 report	
UPDATED version 2 published 30 Jan 2013	 report	 report
version 1 published 03 Oct 2012	 report	 report

1 Jeffrey Chinsky, Johns Hopkins University School of Medicine USA

2 Athanasios Petridis, University of Schleswig-Holstein Germany

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Corresponding author: Buddhika TB Wijerathne (buddhikatbw@gmail.com)

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REVISED Amendments from Version 2

We would like to thank the reviewers for their valuable time and comments. We have addressed the three points raised in Dr. Chinsky's second report.

See referee reports

Introduction

Hydranencephaly is a rare congenital abnormality characterized by the absence and replacement of the cerebral hemispheres with cerebrospinal fluid. It was first described by Cruveilhier (1892) as "Anencephalie hydrocephalique" or "Hydroanencephalie"¹. Crome and Sylvester then reviewed the disease and defined it as a congenital condition². It is an extremely rare and unique abnormality occurring in less than 1 per 10,000 births worldwide³. It is also said to be present in 0.2% of infant autopsies, and approximately 1% of babies diagnosed clinically as hydrocephalus⁴. It is critical to differentiate between hydranencephaly and extreme hydrocephalus as the latter carries a potentially better prognosis⁵. Here, we report a rare case of hydranencephaly, which was diagnosed in the late third trimester, followed by successful obstetric care and management.

Case presentation

A 28-year-old woman (Gravida 2 and para 1) at 38 weeks of gestation was presented to our obstetrics and gynecology unit with lower abdominal pain. She and her husband were Sinhalese and unrelated, with no family history of genetic or congenital anomalies. The patient didn't smoke, and there was no history that suggested congenital infections or exposure to toxins. In her first pregnancy she delivered a normal healthy male child by an uncomplicated vaginal delivery. In her most recent pregnancy, she didn't attend the local antenatal clinic regularly, and thus was recognized as a noncompliant patient. She had not had a routine dating scan, anomaly scan or growth scan of the fetus during her pregnancy. The clinical obstetric examination at presentation was unremarkable, and the cardiotocography of the fetus was normal.

Upon inspection, the obstetric ultrasound scan showed fluid filled cranial cavity with an absent cerebral cortex, thalami and basal ganglia. The third ventricle appeared to be dilated and the remnants of midbrain structures were present (see [Figure 1](#)). The cerebellum and other posterior fossa structures appeared to be normal. We noticed that the falx cerebri looked like it had been disrupted (see [Figure 2](#)). There was no polyhydramnios present and the umbilical artery doppler studies were normal. Sonographically, it was suggestive of hydranencephaly. The patient's blood group was B positive and an infectious disease antibody test showed negative titers for rubella, HIV, Hepatitis B and toxoplasmosis. We chose to perform a caesarian section to avoid any obstetric complications that may arise from a possible cephalopelvic disproportion. The Pediatric team was informed about the situation and the parents were given advice and counseled with regards to the poor prognosis of the child's abnormality. At week 39 of gestation, an emergency caesarian section was performed due to fetal distress. The newborn was a 2,980g female who had a normal physical appearance. The head of the newborn was of normal size (head circumference = 33.5 cm) but the head itself was particularly transilluminated.

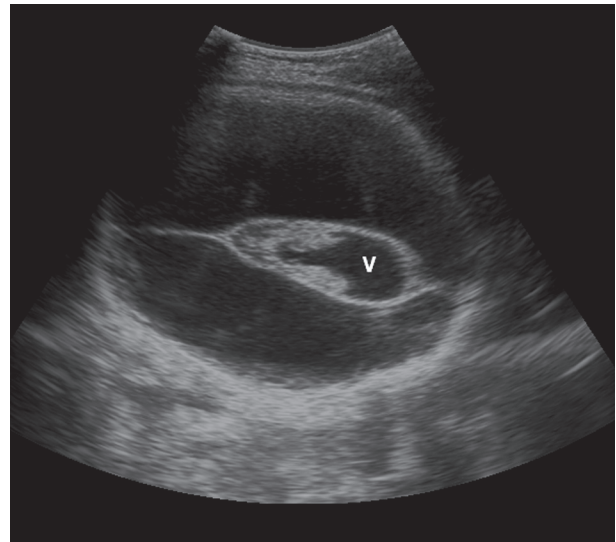


Figure 1. Prenatal ultrasound scans image of the fetus. Transabdominal transverse section of the fetal head at 38 weeks of gestation shows dilated third ventricle (V) with absent thalami and basal ganglia and cerebral cortex.

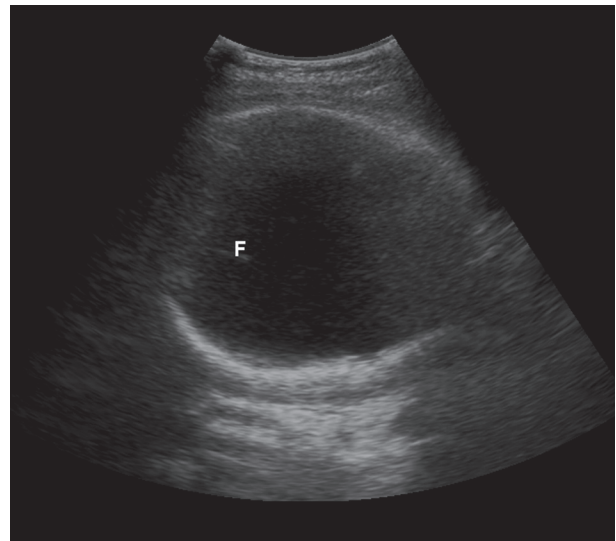


Figure 2. Prenatal ultrasound scans image of the fetus. Transabdominal transverse section of the fetal head shows disrupted falx (F).

The newborn was immediately transferred to the neonatal intensive care unit because of respiratory distress. A non-contrast computed tomography (CT) of the newborn's head was performed two days after the delivery. The CT scan revealed that there was no cerebral cortex, thalami or basal ganglia. The third ventricle looked dilated and remnants of midbrain structures could be seen (see [Figure 3](#)). The cerebellum and other posterior fossa structures were preserved with disrupted falx cerebri (see [Figure 4a, 4b](#)). The CT scan therefore confirmed the prenatal diagnosis hydranencephaly. The baby died two weeks after birth due to cardiac arrest. The parents declined a postmortem examination.

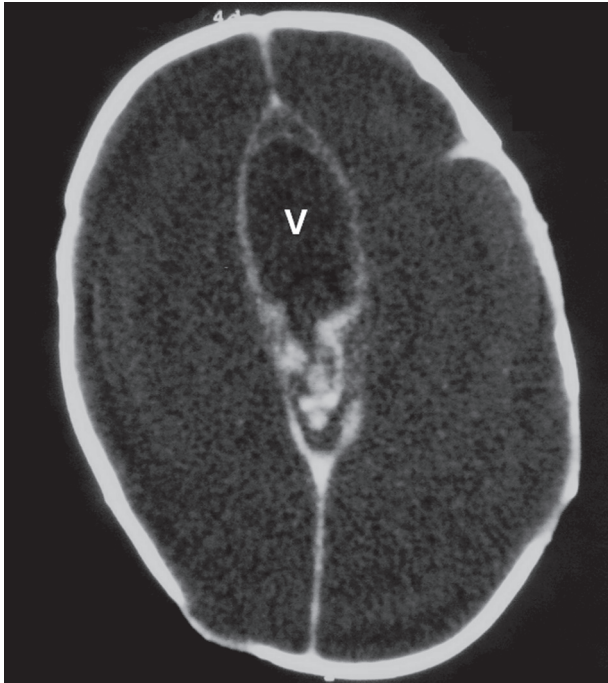


Figure 3. CT image of 2 days old newborns brain. Dilated third ventricle (V) with absent thalami and basal ganglia and cerebral cortex.

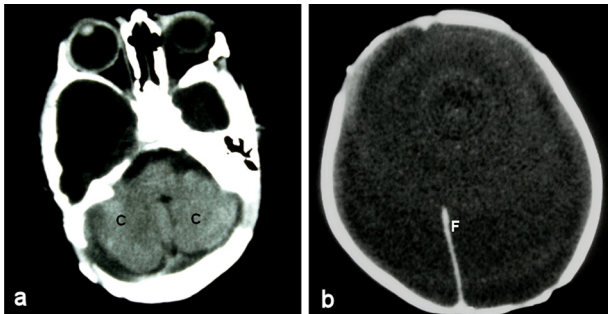


Figure 4. CT images of 2 days old newborns brain. (a) Intact Cerebellum (C) and other posterior fossa structures. (b) Shows disrupted falx cerebri (F).

Discussion

Hydranencephaly is an encephaloclastic abnormality characterized by the absence and replacement of the cerebral hemispheres with cerebrospinal fluid and necrotic debris, covered by leptomeninges. Usually, there is no cerebral cortex but there may be partial preservation of a portion from the occipital lobe⁶. The midbrain, thalamus, basal ganglia, choroids plexus, cerebellum and brain stem are usually preserved and contained within the skull. The falx cerebri is usually present but may be partially or entirely absent and the septum pellucidum may also be absent.

The etiopathogenesis of hydranencephaly is heterogeneous, and so several theories have been postulated for its occurrence. The most common etiology described is the occlusion of the supra-clinoid

segment of the bilateral internal carotid arteries causing ischemic degeneration of structures supplied by them⁷. Myers described the etiology of hydranencephaly by experimenting on laboratory monkeys. In his study, monkey fetuses were subjected to ligation of the bilateral carotid arteries and jugular veins in the neck at different gestational ages. These fetuses were then restored to the uterus, brought to term and subsequently delivered. Examination of the baby monkey brains revealed hydranencephaly, which resulted from a vascular shutdown predominantly when carried out during earlier gestational age⁸.

Some case reports suggest the occlusion of the internal carotid arteries due to a temporary spasm rather than direct occlusion leading to ischemic destruction of certain brain structures⁹. Other etiologies of hydranencephaly include intrauterine infections, which leads to the local destruction of brain tissue e.g. congenital toxoplasmosis¹⁰ or other viral infections (adenovirus, cytomegalovirus, enterovirus, Epstein-Barr virus, herpes simplex virus, parvovirus, and respiratory syncytial viruses)^{3,6,11}. Another etiology that has arisen is the maternal exposure to carbon monoxide or butane gas, which can result in fetal hypoxia which in turn leads to massive tissue necrosis with cavitations, resorption of necrotized tissue and necrotizing vasculitis^{3,12}.

Monozygotic twinning has also been associated with congenital hydranencephaly¹³. It has been revealed that vascular interchanges between monozygotic twinning can result in the transfer of intravascular coagulation materials from the deceased co-twin to the surviving twin causing thromboembolism^{14,15}. Hydranencephaly has also been associated with various congenital anomalies, including Fowler syndrome, arthrogyriposis, renal aplastic dysplasia, poly-valvular heart defect, and trisomy^{17,18}.

The cranial ultrasonographic imaging of hydranencephaly shows a large cystic mass filling the entire intracranial cavity with the absence or discontinuity of the cerebral cortex¹⁹. The appearance of the thalami and brainstem protruding into the cystic cavity was characteristic, together with a midline echo from the remnants of the falx, the tentorium cerebelli and cerebellum^{19,20}. The third ventricle and choroids plexus were often visible and the absence of the septum pellucidum may give rise to a single ventricle in the midline²¹. There is a main difference in the diagnosis of extreme hydrocephaly, alobar holoprosencephaly and porencephaly^{22,23}. In these conditions, the above-mentioned structures will still be surrounded by a rim of cortex; as they carry a better prognosis, it is essential to try and differentiate them in the ultrasonographic imaging of hydranencephaly. In extreme cases of hydrocephalus, the thin cortical layer may be difficult to recognize sonographically, and thus Magnetic resonance imaging (MRI) or intrauterine CT scans can be used to support the diagnosis²⁴.

The majority of cases of hydranencephaly are detected in the second half of a pregnancy¹⁸; however there have been some cases of sonographic diagnosis of fetal hydranencephaly in the first trimester²⁵. Hydranencephaly has a poor prognosis, as the majority of brainstem functions are missing. Affected newborns can die at birth, but most infants die within the first year of their life²⁶. If a child does survive they will inevitably be severely handicapped.

The social and emotional problems that occur after a delivery of a child suffering from hydranencephaly can be terribly depressing for the family²⁷. Counseling the parents regarding the poor prognosis and the potential management options is advised to help them prepare for the potential outcome. Education of the prognosis is a necessary step that allows the family time to prepare and come to terms with the eventualities and can help provide immediate support when required²⁷. Because of the poor prognosis, termination of pregnancy is recommended once a definitive diagnosis has been established²⁴. If macrocrania is identified in late pregnancy then cephalocentesis may be suggested as an option to aid the delivery²⁴.

Conclusion

The ultrasonographic findings that we described, led to the diagnosis of hydranencephaly being the most likely outcome and this was confirmed by postnatal CT of the fetal head. Remnant or preserved midbrain structures were observed in the most reported cases of hydranencephaly^{28,29} with the thalamus or basal ganglia (or both) structures preserved in the majority of cases. This is the first published case of prenatal diagnosed hydranencephaly with the absence of the thalami and basal ganglia along with ruminants of the mid-brain in the same patient. Sonographic assessment is sufficient for the prenatal diagnosis of hydranencephaly in most cases, and MRI or an intrauterine CT should be used to support the sonographic assessment and shouldn't be considered as a first-line diagnostic tool.

Timely diagnosis is crucial in hydranencephaly cases as early treatment options can avoid obstetrics complications, and early diagnosis is particularly useful for anticipating the need to give appropriate counseling to the parents during the pregnancy. An early diagnosis

is also fundamental for preparing the optimal conditions of delivery and allowing for a specialized pediatric delivery unit to be on hand for the delivery.

Consent

Written informed consent obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editors.

Author contributions

SKR and BTBW reviewed the manuscript. BTBW and GKR were involved in drafting the manuscript and reviewing the literature. BTBW was a major contributor in revising the manuscript and getting informed consent from patient. GKR, SKR and BTBW were involved in reviewing the literature. All authors were responsible for the diagnosis, treatment and follow-up of the patient. All authors read and approved the final manuscript.

Competing interests

No competing interests were disclosed.

Grant information

The author(s) declared that no grants were involved in supporting this work.

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Current Referee Status:



Version 3

Referee Report 10 March 2014

doi:10.5256/f1000research.3782.r4020



Jeffrey Chinsky

Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD, USA

There are three typographical errors in the Conclusion -

- Line 1, remove the comma after "...described, ..."
- Line 3, remove "the" in "observed in the most reported..."
- Line 7, the correct spelling is "sonographic", not "sonogrpahcic"

Otherwise, I approve of the latest version.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Competing Interests: No competing interests were disclosed.

Referee Report 31 January 2014

doi:10.5256/f1000research.3782.r3454



Athanasios Petridis

Department of Neurosurgery, University of Schleswig-Holstein, Kiel, Germany

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Competing Interests: No competing interests were disclosed.

Version 2

Referee Report 21 January 2014

doi:10.5256/f1000research.1228.r3215



Jeffrey Chinsky

Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD, USA

This second revision is fine except for the following suggestions/corrections:

1. Reference 6 should read Chinsky JM, not Jeffrey MC.
2. In the introduction I would suggest changing “*significantly higher prognosis*” (line 6) to “potentially better prognosis”.
3. In the Discussion, paragraph 6; remove "really" from "*Hydranencephaly has a really poor prognosis*" so that it simply reads "poor prognosis".

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Competing Interests: No competing interests were disclosed.

Referee Report 04 February 2013

doi:[10.5256/f1000research.1228.r750](https://doi.org/10.5256/f1000research.1228.r750)

**Athanasios Petridis**

Department of Neurosurgery, University of Schleswig-Holstein, Kiel, Germany

The corrections made by the author are very satisfying. I now approve this article.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Competing Interests: No competing interests were disclosed.

Version 1

Referee Report 14 November 2012

doi:[10.5256/f1000research.118.r305](https://doi.org/10.5256/f1000research.118.r305)

**Athanasios Petridis**

Department of Neurosurgery, University of Schleswig-Holstein, Kiel, Germany

This case report is interesting. Except of some grammatical mistakes, I do have one suggestion.

The authors should also discuss the social aspects and the social stress which accompanies families with hydranencephalic children. It is important to induce abortion when possible in such cases since the prognosis is very poor. Early diagnosis is the most important aspect in such cases. The paper of mine, [Petridis et al. \(2011\)](#) deals with the social aspects of hydranencephaly and should be cited by the author.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Competing Interests: No competing interests were disclosed.

Author Response 31 Jan 2013

Buddhika Wijerathne, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka, Sri Lanka, Sri Lanka

We would like to thank Dr Petridis for the valuable time spent reviewing our manuscript and the important comments he has made. We have attempted to address and incorporate most of the concerns that were raised in version 2 of our article.

Competing Interests: No competing interests were disclosed

Referee Report 12 November 2012

doi:10.5256/f1000research.118.r304



Jeffrey Chinsky

Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD, USA

This case report presents an interesting case of apparent hydranencephalic changes, in addition to more extensive developmental brain anomalies (lack of thalamus and basal ganglia). However, including the points made below would make the manuscript much more useful as an educational resource:

The manuscript would be enhanced if the author's did more than just itemize a list of associated etiologies for hydranencephaly. The authors should provide a paragraph explaining how any of these etiologies could specifically produce the anomalies observed (cerebral arterial stroke or spasm of which specific vessels) and perhaps contrast it with any syndromic or associated genomic alterations listings of similar brain findings (or at least provide evidence that they researched this aspect).

I'm not sure all would accept this as a variant of the same processes that cause classic hydranencephaly since it appears to be so much more extensive anomalous formation of the final fetal brain. The authors may have to do a little more research and discussion to support their contention based on how others who have written about hydranencephaly and define the condition.

There are several grammatical errors (e.g. in the Abstract "such that absent cortex" is an incomplete phrase to end the sentence) which should be addressed, and I suggest the article is proof read again to ensure it reads how a published manuscript should do.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Competing Interests: No competing interests were disclosed.

Author Response 31 Jan 2013

Buddhika Wijerathne, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka, Sri Lanka, Sri Lanka

We would like to thank the reviewer, Dr. Chinsky for the valuable time spent reviewing our manuscript and the important comments he has made. We have attempted to address and incorporate most of the concerns that were raised in version 2 of our article.

Competing Interests: No competing interests were disclosed
