Original Research Article

Pediatric Education and Research
Volume 7 Number 3, July - September 2019
DOI: https://dx.doi.org/10.21088/per.2321.1644.7319.3

To Study the Neurosonographic Pattern of Hydrocephalus Among the Under Five Children in Our Institute

Madhura Panditrao[1], Suhas Ghule[2], Sunil Natha Mhaske[3]

[1]Resident, Dept. of Pediatric [2]Associate Professor, Dept. of Radiology [3]Professor and Dean, Dept. of Pediatric, Padmashree Dr. Vithalrao Vikhe Patil Foundation's College, Vilad Ghat, MIDC, Ahmednagar, Maharashtra 414111, India.

How to cite this article:
Madhura Panditrao, Suhas Ghule, Sunil Natha Mhaske. To Study the Neurosonographic Pattern of Hydrocephalus Among the Under Five Children in Our Institute. Pediatr Edu Res. 2019;7(3):97–101.

Abstract

Background: Hydrocephalus is a common condition in Paediatric Neurosurgery. In hydrocephalus there is dilatation of the ventricular system further causing compressive effects on the parenchyma. Hydrocephalus is a common and important process, a mechanical complication of many different pathologic conditions and a disease process itself. The morphologic features are easily recognizable, but the pathophysiology remains incompletely understood. It can be in communicative/non-obstructive or non-communicative/ obstructive forms. Neurosonogram and CT/MRI brain are the main investigations. Ventriculoperitoneal shunt remains the gold standard of treatment. *Objective:* To assess the neurosonographic features of children under 5 years of age with clinical signs of raised intracranial pressure suggestive of hydrocephalus. Therefore, it results in early detection and proper management. *Patients and Methods:* This is a retrospective study of neurosonographic findings in 70 children with signs of raised intracranial pressure suggestive of Hydrocephalus (42 boys and 28 girls) admitted in our department. The mean age of cases was 5.0 ± 4.2 months. Neurosonogram was done when there were clinical indications like congenital hydrocephalus, encephalocele, meningomyelocele, and meningitis. All scans were performed through the anterior fontanelle with a curvilinear probe using frequency transducer of 2–4 MHz. *Results:* Of the study group 57 cases had congenital hydrocephalus (81.3%). Postmeningitic hydrocephalus was seen in 12 cases (17.2%) while only 1 case (1.6%) was due to post-hemorrhagic cause. Of the 57 congenital cases 27 patients (47.3%), had cerebral aqueduct stenosis as their cause. 12 (21.2%) of the congenital cases were due to obstruction at the exit foramina of Luschka and Magendie causing the communicating type of hydrocephalus. *Conclusion:* Hydrocephalus is a common cause of neurological morbidity among infants in developing countries. Most cases have congenital origin and are most commonly due to cerebral aqueduct stenosis. Neurosonogram through the anterior fontanell is cheap, affordable, and more accessible than other imaging modalities. It should serve as the first line investigation of infants with suspected hydrocephalus for early detection and monitoring of progression to determine those cases that would require shunt operation, thereby reducing infant morbidity.

Keywords: Hydrocephalus; Pattern; Sonographic; Under five children; Management; Shunt.

Introduction

Rapid progression is being seen in the technique of cerebral transfontanelle neurosonography over the years.[1] It leads to promptdiagnosis of intracranial conditions. Thus, follow-up of high risk children during the early years of life is easily possible.[2] Expensive radiological modalities such as computerized tomography (CT) and magnetic resonance imaging (MRI) are considered expensive and not readily available in developing countries.

Ultrasonography in the form of neurosonography is non-invasive, simple, ambulatory, and cheap.[3] Computerized Tomography (CT) though more accurate, may require anesthesia for the procedure and transportation to the higher centers that have

Corresponding Author: Madhura Panditrao, Resident, Department of Paediatrics, Padmashree Dr.Vithalrao Vikhe Patil Foundation's College, Vilad Ghat, MIDC, Ahmednagar, Maharashtra 414111, India.

E-mail: madhurapanditrao15@gmail.com

Received on 25.06.2019, **Accepted on** 28.06.2019

the facility. In addition, CT exposes the child to the hazard of ionizing radiation. MRI, which does not have the danger of ionizing radiation, and is the best imaging modality to provide functional and anatomical information,[4] is even more expensive and rarer.

It is evident that a preliminary ultrasound (US) examination may reduce, postpone or even render unnecessary complex and costly examinations and yet achieve, given recent improvements in US technology, a spatial resolution that is now comparatively highly competitive.[5,6] Some of the intracranial pathologies that may be diagnosed include hydrocephalus, intracranial infections, intracranial hemorrhage, periventricular leukomalacia, brain tumors and meningomyelocele.[1,2,7,8] Sonographic monitoring also facilitates the decision on conservative or neurosurgical treatment of hydrocephalus.[2] This study was undertaken to analyze the pattern of hydrocephalus among children < 5 years with a view to suggesting better ways of managing the disease.

Material and Methods

This is a retrospective study of neurosonographic findings in 70 children with signs of raised intracranial pressure suggestive of Hydrocephalus (42 boys and 28 girls) admitted in our department. The mean age of cases was 5.0 ± 4.2 months. Neurosonogram was done when there were clinical indications like congenital hydrocephalus, encephalocele, meningomyelocele, and meningitis. All scans were performed through the anterior fontanelle with a curvilinear probe using frequency transducer of 2–4 MHz.

The gel was then applied over the anterior fontanelles. The child's brain was then scanned in the following planes-sagittal, and/or parasagittal, as well as the straight and, angled coronal planes. Diagnosis of hydrocephalus was made when the diameter of the occipital horn exceeded 16 mm, and that of the body of the lateral ventricle was >3 mm on the sagittal views, whereas the third ventricle should normally measure <2 mm in its widest diameter on coronal views.[9]

Results

Of the study group, 57 cases had congenital hydrocephalus (81.3%). Postmeningitic hydrocephalus was seen in 12 cases (17.2%) while only 1 case (1.6%) was due to post-hemorrhagic cause. Of the 57 congenital cases, 27 patients (47.3%) had cerebral aqueduct stenosis as their cause. 12 (21.2%) of the congenital cases were due to obstruction at the exit foramina of Luschka and Magendie causing the communicating type of hydrocephalus.

There were 70 children with signs of raised intracranial pressure suggestive of Hydrocephalus (42 boys and 28 girls) admitted in our department. The mean age of cases was 5.0 ± 4.2 months. The patients were divided into five groups according to their ages in months; 0–12, 13–24, 25–36, 37–48, and 49–60.

Table 1 shows that an overwhelming number of patients in the study, 67 (95.3%), were in their infancy followed by the 13–24 months age group with 2 patients (3.1%).

Table 1:

Age in months	Number of patients	Percentage
0–12	67	95.3
13–24	2	3.1
25–36	0	0
37–48	1	1.6
49–60	0	0
Total	70	100

Table 2 shows 57 (81.2%) of the patients had hydrocephalus of congenital origin. 12 cases (17.1%) had postmeningitic hydrocephalus while only one case (1.7%) was posthemorrhagic.

Table 2:

Aetiology	Number of patients	Percentage
Congenital	57	81.2
Postmeningitic	12	17.1
Posthemorrhagic	1	1.7
Total	70	100

Table 3 shows 33 cases (48.1%) of the congenital cases were due to cerebral aqueduct of Sylvius stenosis. 15 (21.2%) of the congenital cases were from obstruction at the exit foramina of Luschka and Magendie resulting in communicating hydrocephalus. A detail of the congenital etiological factors is as shown in Table 3.

Table 3:

Anomaly	Number of cases	Percentage
Cerebral aqueduct stenosis	33	48.1
Obstruction of foramina of Luschka and Magendie	15	21.2

Anomaly	Number of cases	Percentage
Foramen of Monro obstruction	12	17.3
Encephalocele	5	6.7
Cranial meningocele	5	6.7

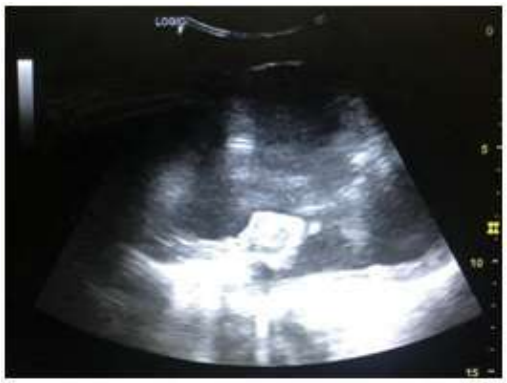

Fig. 1:

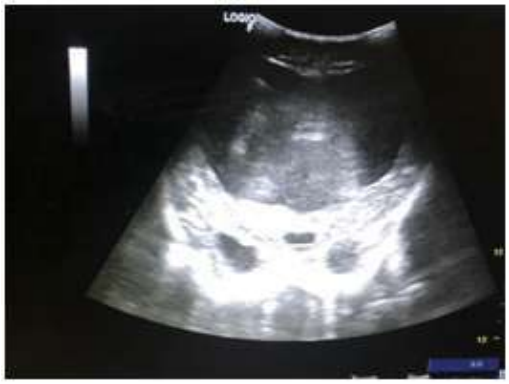

Fig. 2:

Figures 1,2 shows neurosonogram changes in congenital hydrocephalus

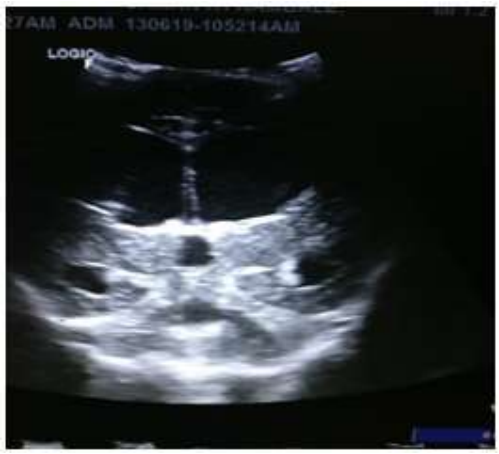

Fig. 3:

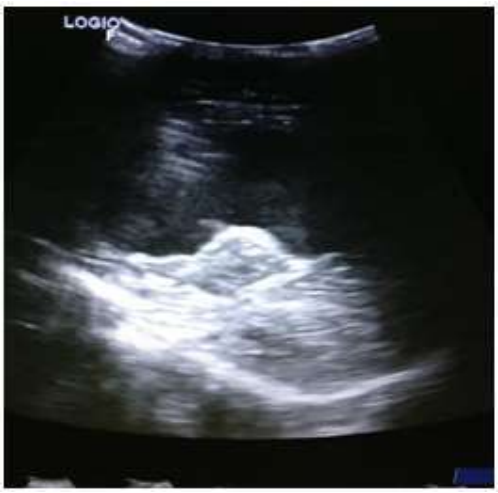

Fig. 4:

Figures 3,4 shows neurosonogram changes in acquired hydrocephalu

Discussion

Hydrocephalus or increased intracranial content of cerebrospinal fluid is one of the most common central nervous system anomalies in children.[9] It may be congenital or acquired. The congenital causes include aqueductal stenosis, agenesis of the corpus callosum, neural tube defect, and chromosomal abnormalities while among the acquired ones are intraventricular hemorrhage and infections such as meningitis.[10,12] Hydrocephalus has an incidence of about 0.3–0.8 cases/1000 live births and other anomalies such as encephalocoeles, Arnold Chiari malformation, arachnoid cysts, and holoprosencephaly are frequently associated with it.[10,12,13] In this study, we found that 6.7% of our patients had associated encephalocoeles and cranial meningoceles as shown in Table 3.

In advanced cases, the cortical mantle may become thinned and in some cases markedly. The attendant neurosurgical complications and sequelae pose a great challenge to the clinician because of their effects on the neurological integrity of the patient.[14] An overwhelming proportion of our patients were below 1 year of age. We believe that this is related to the early suspicion of intracranial pathology in such infants in hospital-based deliveries, with prompt referral for the cranial US.[15] The numbers were noted to be less in older children since some surgical intervention would have been undertaken. Some could have also died at home due to neglection as suggested by Binitie.[16] We found a higher proportion of male

patients than females. This concurs with the study by Bajpai *et al*.[17] Majority (81.3%) of our patients had hydrocephalus of congenital origin followed by the postmeningitic variety. Nzeh *et al*. And Bajpai *et al*.[11,17] also found the congenital variety as the most preponderant in their studies. Only a small percentage of posthemorrhagic cases were found in our study, which we believe may be related to the lower incidence of intracranial hemorrhage in developing countries, attributed to possible environmental and genetic factors.[8] In addition, the lack of a well-established preterm neonatal US screening service in the hospital may be responsible for our rather very low finding of 1.6% for posthemorrhagic hydrocephalus. It is noteworthy, however, that a study in Blantyre, Malawi found a majority of postmeningitic hydrocephalus of 51.5%.[18] Hydrocephalus was also found to be the most common complication of meningitis in other studies in Nigeria.[19] Hydrocephalus secondary to obstruction at the level of the cerebral aqueduct of Sylvius was the predominant type of the congenital group, in our study. This agrees with findings in the literature.[11,12] Congenital communicating hydrocephalus (from foramina of Luschka and Magendie obstruction) was the next in preponderance. Nzeh *et al*.,[12] however, found a higher proportion of encephalocoeles than congenital communicating hydrocephalus. We had a lower percentage of encephalocoeles, and all the cases we found were associated with hydrocephalus, unlike in the former study,[11] where majority of the encephalocoeles occurred alone.

The neurological morbidity and mortality associated with hydrocephalus in infancy or childhood makes it imperative for early diagnosis to be made to effect prompt intervention. In order to significantly influence the perinatal outcome of these intracranial abnormalities, transabdominal and/or transvaginal antenatal or fetal ultrasonography is encouraged. Advancement in the technique with the evolution of three dimensional technologies makes it easier to define the lesions, so that antenatal correction can be undertaken. Otherwise, immediate postnatal intervention may be done after team consultation and preparation for the appropriate mode of delivery. This ensures that the untoward sequelae and complications that would otherwise result are nipped in the bud.

Conclusion

Transfontanelle ultrasonography is a useful technique for the early diagnosis of hydrocephalus in infancy and early childhood. It is radiation free and relatively inexpensive which makes it invaluable in the developing world where MRI is unaffordable and not readily available.

References

1. Jurine N, Allard D, Portafaix M. Transfontanelle cerebral echography. Neurochirurgie. 1986;32:537–46.
2. Dittrich M, Dinkel E, Peters H. Sonographic diagnosis of the central nervous system in the neonate and infant – Pathomorphology, indications and value. Ultraschall Med. 1983;4:174–81.
3. Santa M, Sulla I, Fagul'a J, *et al*. CT scan or two dimensional echoencephalography in neonatal intracranial pathology? Zentralbl Neurochir. 1989;50:78–83.
4. Dinçer A, Özek MM. Radiologic evaluation of pediatric hydrocephalus. Childs Nerv Syst. 2011; 27:1543–62.
5. Marchiano A, Biasi S, Damascelli B. Ultrasonography. In: Damascelli B, (Ed). Basic Concepts in Diagnostic Imaging. New York: Raven Press Ltd.; 1991.pp. 125–30.
6. Malinger G, Ben Sira L, Lev D, *et al*. Fetal brain imaging: A comparison between magnetic resonance imaging and dedicated neurosonography. Ultrasound Obstet Gynecol. 2004;23:333–40.
7. Han BK, Babcock DS, McAdams L. Bacterial meningitis in infants: Sonographic findings. Radiology. 1985;154:645–50.
8. Nzeh DA, Ajayi OA. Sonographic diagnosis of intracranial hemorrhage and periventricular leukomalacia in premature African neonates. Eur J Radiol. 1997;26:77–82.
9. Siegel MJ. Neonatal intracranial problems. In: Sanders RC, Winter T (Eds). Clinical Sonography: A Practical Guide, 4th edition. Philadelphia: Lippincott Williams and Wilkins; 2007.pp.341–64.
10. Grumbach K. Obstetric ultrasound. In: Sutton D, Young JW (Eds). A Concise Textbook of Clinical Imaging, 2nd edition. Missouri: Mosby Year Book Inc.; 1995.pp.714–18.
11. Nzeh DA, Erinle SA, Saidu SA, *et al*. Transfontanelle ultrasonography: An invaluable tool in the assessment of the infant brain. Trop Doct. 2004;34:226–27.
12. Nzeh DA, Saidu SA, Erinle SA, *et al*. Sonographic diagnosis of congenital brain malformations: The Ilorin experience. Niger Postgrad Med J. 2006;13:57–60.
13. Pomschar A, Koerte I, Peraud A, *et al*. Hydrocephalus in childhood: Causes and imaging patterns. Radiologe. 2012;52:813–20.
14. Bazán Camacho AJ, García Almeida E, Jiménez

Valdés ML. A study of the evolution of ventricular dilatations using transfontanellar ultrasonography. Rev Neurol. 2004;39:1109–12.

15. Nzeh DA, Pam SD, Erinle SA, *et al*. Ultrasound diagnosis of hydrocephalus among infants in Nigeria. West Afr J Ultrasound. 2001;2:13–16.
16. Binitie OP. Congenital malformations of the central nervous system at the Jos University Teaching Hospital, Jos Plateau State of Nigeria. West Afr J Med. 1992;11:7–12.
17. Bajpai M, Kataria R, Bhatnagar V, *et al*. Management of hydrocephalus. Indian J Pediatr. 1997;48–56,64–66.
18. Adeloye A, Khare R. Ultrasonographic study of children suspected of hydrocephalus at the Queen Elizabeth Central Hospital in Blantyre, Malawi. East Afr Med J. 1997;74:267–70.
19. Nzeh D, Oyinloye OI, Odebode OT, *et al*. Ultrasound evaluation of brain infections and its complications in Nigerian infants. Trop Doct. 2010;40:178–80.