Case report

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Transfontanelar ultrasound diagnosis of brain abscesses in two neonates

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Abstract

We report two cases of brain abscesses in neonates diagnosed by transfontanelar ultrasound and cranial MRI. In the first case 2 separate abscesses developed and in the second case the abscess had intraventricular communication. CT scan in the early phase of abscess formation did not offer any supplementary information compared to transfontanelar ultrasound. Serial transfontanelar scans proved to have a higher diagnostic value when used dynamically. Both infants were initially managed conservatively but then surgical intervention was required.

Key words: brain abscess, transfontanelar ultrasound, neonates.

Rezumat

Prezentăm două cazuri de nou născuți cu abcese cerebrale diagnosticate prin ecografie transfontanelară şi rezonanță magnetică. In primul caz s-au dezvoltat două abcese separate iar în al doilea caz abcesul prezenta comunicare intraventriculară. Tomografia computerizată efectuată în faza precoce de formare a abceselor nu a oferit nici o data suplimentară comparativ cu ecografia transfontanelară. Secțiunile ecografice seriate s-au dovedit a avea o valoare diagnostică mai crescută atunci când au fost efectuate dinamic. Ambii nou născuți au fost inițial tratați conservativ apoi chirurgical.

Cuvinte cheie: abces cerebral, ecografie transfontanelară, nou născut

Cerebral abscess is rare in newborns and infants under 6 months of age but usually is associated with high mortality and morbidity rates [1,2]. We report two cases of cerebral abscesses admitted to the Institute of Mother and Child Care, Bucharest (IOMC) during 2009 in which the imaging diagnosis was first made by serial ultrasound examinations.

Case 1: Full term male newborn vaginally delivered in a county maternity, at 38 gestational weeks after an apparently uneventful and followed-up pregnancy. Ruptured membrane 10 hours prior to delivery with normal amniotic fluid were recorded in his medical file. At birth the baby was 3000 g, 50 cm with an Apgar score of 8/1min. Immediately after birth the evolution was marked by progressive respiratory distress beginning at 4 hours of age, followed by altered neurological state, generalized hypotonia, fever, intense polypneea. Empirical antibiotic therapy (Ampicillin + Gentamicin) was started during the first 24 hours after birth. Respiratory abnormalities and apnea necessitated a transfer to IOMC on the 5th day of life. On admission the baby was in poor condition, lethargic, with a Glasgow score of 10-11/15, generalized hypotonia, bugling anterior fontanel, but hemodynamically stable, with an O_2 saturation of 100 in atmosphere. The first ultrasound scan was performed on the 5th day of life (fig 1-3).

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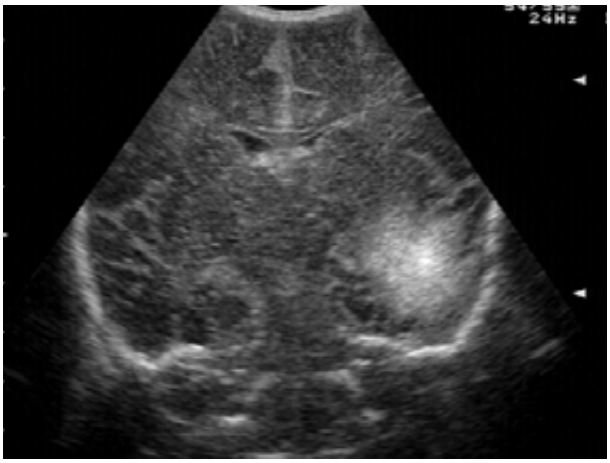


Fig 1. Coronal section at the left ventricles anterior horn level: an oval shaped hyperechoic area in the left temporal lobe vaguely separated from the cerebral parenchyma by a hypoechoic border. The left lateral ventricle is slightly compressed by the lesion.

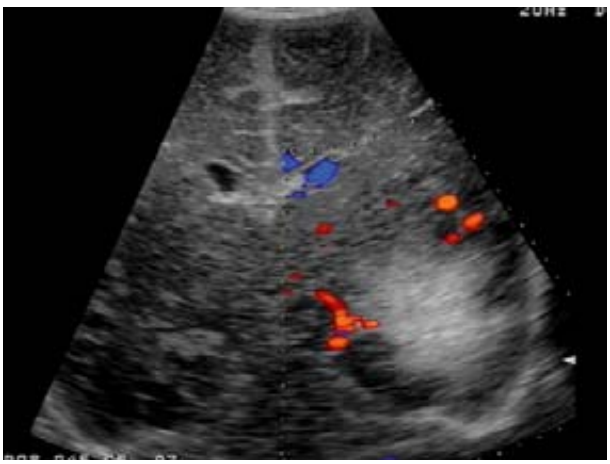


Fig 2. The same section as in fig 1. The color Doppler flow is absent inside the lesion and present in the surrounding parenchyma.

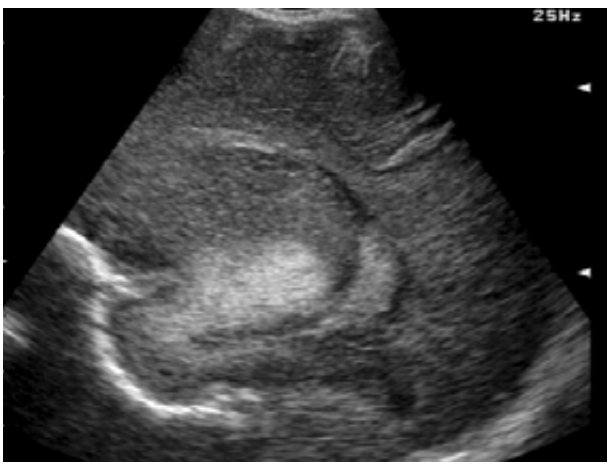


Fig 3. Sagital section with transducer angulated to the left reveals the same temporally located lesion.

Based on the transfontanelar (TF) ultrasound data, a suspicion of cerebral abscess was raised. This first TF ultrasound imposed the differential diagnosis with a cerebral ischemic lesion, taking into account that a similar picture might be associated with a cerebral infarct. Both lesions had the same common location in the medium cerebral artery territory [3,4]. Aside from the clinical presentation, the differential diagnosis was extremely difficult because both lesions initially presented as a focal parenchymal increased ecogenicity, with peri lesional edema, absent flow inside the lesion on Doppler interrogation, and with an increased Doppler signal surrounding the lesion.

The cerebral CT performed 7 days after admission in IOMC was not helpful: diffuse hypo densities in the peri ventricular white matter and discrete diffuse hypo density at the left temporal level. No CT sign of cerebral abscess was found and the cerebral ventricular system was normal.

Based on the clinical data and the TF ultrasound result and in spite of the equivocal CT result, a neurosurgery consultation was performed. At this stage, the neurosurgeon's recommendation was conservative treatment.

The ultrasound follow-up revealed important dynamic changes (fig 4, fig 5). On the following days the above described lesion became inhomogeneous, with rather irregular shape, hypoechogenic center, surrounded by an echogenic periphery and a transonic halo towards the normal parenchyma.

A second lesion of 16/16 mm was identified in the right frontal lobe. This smaller round shaped lesion with echogenic center and transonic periphery surrounded by an echogenic area of peripheral edema was suggestive of a new septic dissemination in the right frontal lobe (fig 6).

The sepsis work-up confirmed the bacterial infection suspicion. A complete blood count revealed a hemoglobin level 10.8 g/dl, hematocrit 21%, white blood cell count (WBC) 21340/mm^3 with 67.6 % neutrophils, 127 000 /mm^3 thrombocites. The first CRP value was 53.96 mg/dl. A spinal tap was performed with cerebrospinal fluid (CSF) of turbid appearance, leukocyte count 380/mm^3 glucose concentration 0.10 g/l, protein > 10 g/l, and positive cultures for ESBL *Klebsiella pneumoniae*. Blood cultures also were positive for ESBL *Klebsiella pneumoniae* with identical antibiotic susceptibility as that isolated from the CSF. According to microbiological data a combined antibiotic treatment with Ertapenem + Netilmicin was started.

The MRI examination on the 21st admission day revealed a 50/40/70 mm intaraxial heterogeneous structure occupying almost entirely the left temporal lobe, with

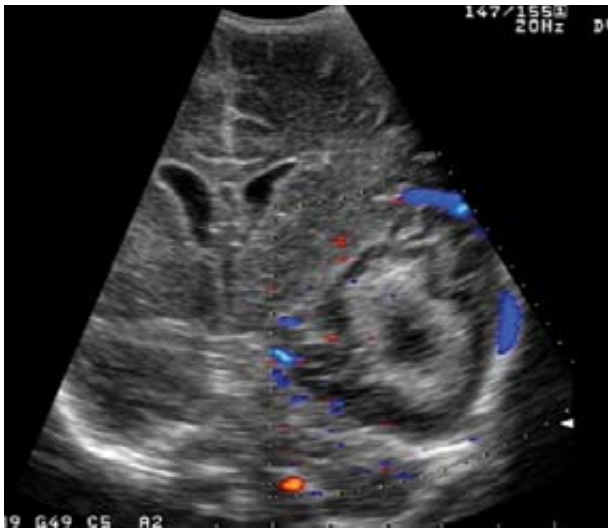


Fig 4. On coronal section the left temporal lesion became inhomogeneous, irregular shaped, with hypoechoic center, surrounded by an echogenic periphery and a transonic halo. Absent color wave Doppler flow inside the lesion.



Fig 5. Left transtemporal approach: the lesion is well visualized occupying 2/3 of the temporal lobe. Absent power Doppler flow inside the lesion.



Fig 6. The second lesion located in the right frontal lobe is round shaped with echogenic center, transonic periphery surrounded by an echogenic area.

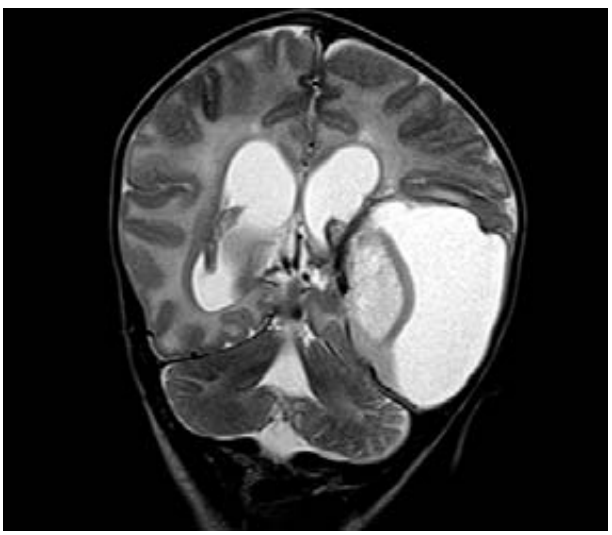


Fig 7. MRI, the 21th admission day

liquid content in hypersignal T1 and T2 compared to CSF, lined by a 3 mm smooth gadolinophyl wall. The 10 mm interrupted internal wall by the left temporal horn suggested a possible intraventricular communication. A minimal peri lesional edema and a mass effect with medial displacement of the lateral ventricle were also noticed (fig 7). A second lesion of 15 mm diameter with similar signal as the temporal lesion, but without sediment or mass effect was described in the right frontal lobe.

Following the MRI result a second neurosurgery consultation resulted in the decision of drainage of the left temporal abscess. On the 10th day after surgery the baby was discharge with normal sized lateral ventricles and a residual left temporal cavity post abscess evacuation. One month later, active hydrocephalus was diagnosed, leading to ventricular shunt insertion. On the last TF examination 1 month after surgery, stabilized hydrocephalus was indicated with persistent left temporal cavity of 33/27 mm diameter (fig 8, fig 9).

The infant, developmentally retarded, has now been admitted to a multidisciplinary rehabilitation programme.



Fig 8. Coronal section: ventriculomegaly with dilated frontal horns. The shunting device is observed in the right lateral ventricle. Post abscess evacuation a 33/27 mm left temporal cavity is observed. Absent Doppler color flow inside the cavity.

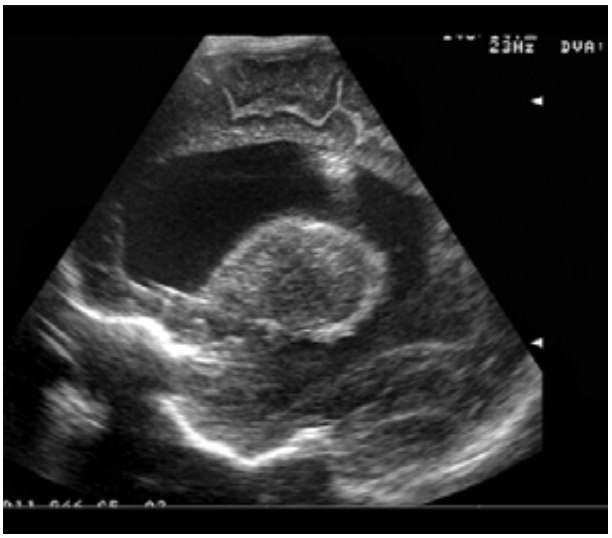


Fig 9. Sagital section of the dilated lateral ventricle with visible shunt inside the ventricular body.

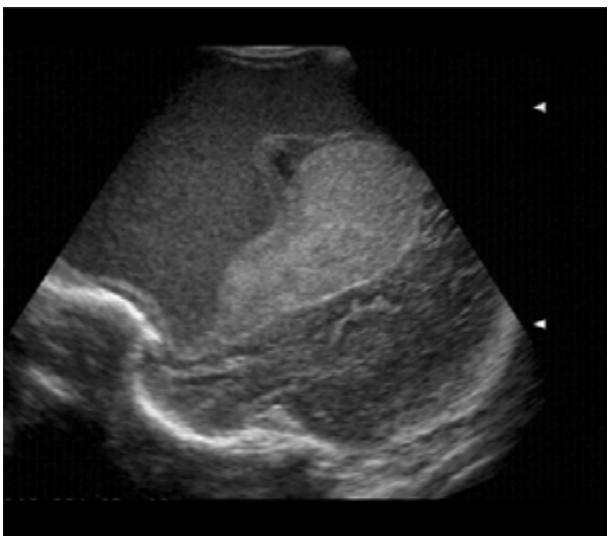


Fig 10. Transfontanelar examination in the 21 postnatal day



Fig 11. Transfontanelar examination in the 21 postnatal day

Case 2: A 21 day old male was referred from a county maternity unit to IOMC for TF ultrasound. His medical history revealed: ruptured membrane 7 h before birth, followed by a cesarean section at 36 weeks GA with a 2900 g birth weight and an Apgar score of 8. The mother 31 years, I gesta, I para, with tyroidectomy 2 years before, under chronic substitution with levothyroxinum developed moderate arterial hypertension during the last pregnancy trimester (140/80 mm Hg). Soon after birth the baby developed intermittent seizure episodes for 48 hours, with rapid deterioration, fever and signs of sepsis. No blood cultures or spinal tap were performed at this stage but for the suspected sepsis, antibiotic treatment (Meropenem + Gentamicin) was started for a 14 day period. Seven days after the antibiotic was stopped signs of intracranial hypertension were noticed and the baby was referred for TF ultrasound at IOMC.

Both lateral ventricles were dilated and filled with impure material (fig 10, fig 11). A 62/54/70 mm oval shaped collection with an echogenic 2 mm wall, occupying more than 2/3 of the left fronto-parieto-temporal region was observed in the coronal and sagital sections. Its inhomogeneous content consisted of an impure transonic material with echogenic sediment. The left lateral ventricle

was medially displaced and compressed by the collection (fig 12). Absent Doppler flow was evidenced inside the left hemisphere lesion.

It was concluded that the described lesions suggested complicated bacterial meningitis probably a cerebral abscess communicating with the dilated ventricular system. With a diagnosis of suspected bacterial ventriculitis with cerebral abscess the child was immediately referred to the National Infectious Disease Institute Matei Bals, Bucharest for further treatment.

The first MRI examination revealed a parenchymal collection 85/65/50 mm with a 2-3 mm wall and inhomogeneous content and mass effect on the left lateral ventricle which appeared displaced to the right. A 2 cm communication orifice between the abscess and the frontal horn of the lateral ventricle was also described. Small necrotic areas in the close proximity of the right ventricle frontal horn were also observed (fig 13).

The spinal tap confirmed the meningeal infection with *Stenotrophomonas maltophilia* and antibiotic treatment with Meropenem and Vancomicyn was initiated. After 28 days of antibiotic cure, a surgical drainage of the left hemisphere abscess was performed.

Two weeks post surgery, progressive altered general condition, irritability along with a firm, buggling anterior fontanele were noticed. A cerebral CT examination descibed internal active hydrocephalus. External ventricular drainage was installed, along with systematic CSF analisys until normalisation. Complete symptom recovery was achieved 7 days after surgery followed by ventriculo-peritoneal shunt placement. The CT scan performed immediately after, revealed efficent internal hydrocephalus drainage.

The second MRI examination described important hydrocephalus, an intraventricular shunt emerging transventricularly to the right thalamic region. A 45 mm diameter frontal cystic lesion apparently communicating with the left anterior horn of the lateral ventricle was also described. Small cystic lesions of 5-10 mm in the right frontal lobe non-communicating with the ventricular system were found, whereas no suggestive images for cerebral abscesses were noticed (fig 14).



Fig 12. Transfontanelar examination in the 21 postnatal day.

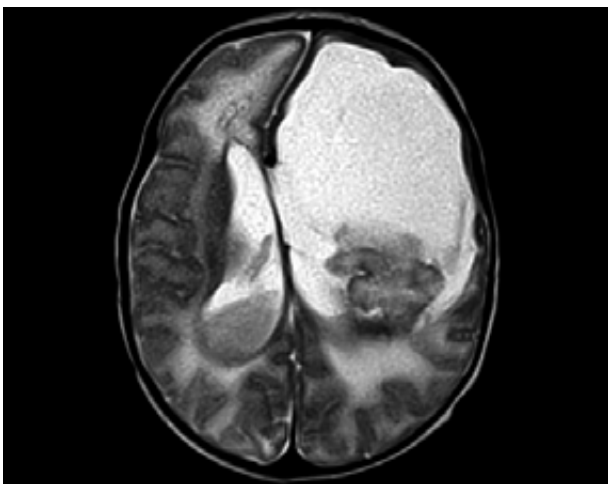


Fig 13. A parenchymal collection 85/65/50 mm with inhomogeneous content and mass effect in the left lateral ventricle. A 2 cm orifice explains the communication between the collection and the left frontal horn.

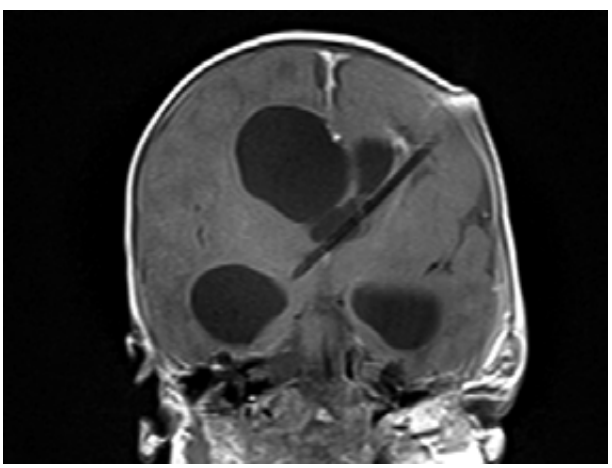


Fig 14. Internal hydrocephalus with intraventricular shunt emerging transventricularly to the right thalamic region.

Discussions

Neonatal cerebral abscesses usually occur as a complication of bacterial meningitis or septicemia. They are most often caused by gram-negative organisms, and mortality and morbidity are still significant in this age group in spite of new antibiotics and modern surgical techniques [1,2]. Although mortality associated with cerebral abscess in infancy has improved, morbidity remains high.

Both cases are typical for early onset neonatal sepsis. In the first case TF ultrasound raised the cerebral abscess suspicion, but the equivocal CT scan result determined the surgeon to postpone the intervention. In the second case, although antibiotic treatment was promptly started, imagistic studies were performed only in the 3rd week after onset. TF ultrasound was first to raise the suspicion of venticulitis complicated with cerebral abscess, confirmed by the cerebral MRI. The meningeal infection with secondary cerebral abscess formation imposed multiple surgical interventions with a low benefit for both patients who are now severely mentally disabled following a complex rehabilitation programme.

Ultrasound differentiation between an early phase abscess and an ischemic process is sometimes difficult, but clinical data along with serial TF examinations may substantially help the correct diagnosis [4]. On account of its high resolution, MRI scans are extremely useful, but compared to the ease of use and the excellent accuracy of TF ultrasound, MRI might be a second imagistic option. It is strongly recommended that all infants under 6 months of age diagnosed with bacterial meningitis have an initial ultrasound examination followed by CT and /or RMN to exclude cerebral abscess and hydrocephalus. As in the first case, CT examination in the early phase of abscess formation might have been equivocal and inferior to ultrasound. Ultrasound examination proved to be an excellent tool not only for the initial diagnosis but also for the follow-up [1,2,5].

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