Case Report

Combination of drainage and chemotherapy for treatment of a *Staphylococcus aureus* brain abscess in a pre-term infant

Marta Suárez,¹ Marta Costa,¹ Gonzalo Solís,¹ Belén Fernández,¹ Enrique García,¹ Rosa Arias,¹ Jorge Peña² and Daniel Coto¹

Correspondence
Marta Suárez
msr1070@hotmail.com

¹Service of Neonatology, Pediatrics Department, Hospital Universitario Central de Asturias, Oviedo, Spain

²Service of Radiology, Hospital Universitario Central de Asturias, Oviedo, Spain

Introduction: Neonatal brain abscess is an uncommon intracranial suppuration that usually occurs as a complication of bacterial meningitis or septicaemia. *Staphylococcus aureus* rarely causes brain abscesses during the first months of life.

Case presentation: A case of a premature infant who developed cerebellar, left temporal and left occipital lobe abscesses after *S. aureus* sepsis is presented. The pus provided the same *S. aureus* strain of the sepsis. The patient was treated with vancomycin for 37 days, accompanied by extraction of the purulent material. The abscesses resolved and no sequelae remained.

Conclusion: It appears that long antibiotic treatment regimes, when associated with early pus drainage, are effective in resolving infection and abscesses caused by *S. aureus* in neonates.

Keywords: Brain abscess; hydrocephalus; neonatal sepsis; *S. aureus*; vancomycin.

Received 3 December 2014

Accepted 28 August 2015

Introduction

Neonatal brain abscess is an uncommon intracranial suppuration that usually occurs as a complication of bacterial meningitis or septicaemia (Kao *et al.*, 2008; Krajewski & Stelmasiak, 1992). The most common aetiological agents are: *Citrobacter* spp., *Pseudomonas aeruginosa* and enterobacteria such as *Proteus mirabilis* and *Serratia marcescens* (Azrak *et al.*, 2009; Krajewski & Stelmasiak, 1992). In contrast, *Staphylococcus aureus* rarely causes brain abscesses during the first months of life (Arora *et al.*, 2012; de Oliveira *et al.*, 2007; Regev *et al.*, 1995; Vartzelis *et al.*, 2005). In this report, we present the clinical features, treatment and outcome of a premature infant with multiple brain abscesses caused by *S. aureus*.

Case report

A 2-month-old male infant was admitted to the Neonatal Intensive Care Unit of the University Hospital of Asturias, Spain, with macrocephaly as the main clinical sign, which was accompanied by irritability, vomiting and inability to look upwards. He had, however, normal tone and primitive reflexes, as well as good connection with the environment.

The child was delivered pre-term in the 30th gestation week by an emergency Caesarean section. The Apgar

scores were 5 and 8 at 1 and 5 min, respectively. Physical parameters were: birth weight, 1270 g [25th percentile (P25)]; length, 39.5 cm (P25–50) and head circumference, 28 cm (P50). Forty-eight hours after delivery, he became unstable with signs of sepsis. Empirical treatment with vancomycin (10 mg kg⁻¹ every 18 h) and amikacin (18 mg kg⁻¹ every 36 h) was started. The blood culture was positive for a coagulase-positive *S. aureus* strain, which was susceptible to penicillin G, oxacillin, vancomycin, co-trimoxazole, erythromycin and clindamycin. Given these data, the treatment with vancomycin was continued, the trough levels being 8 µg ml⁻¹. No cerebrospinal fluid culture was done at the time. The symptoms were relieved and C-reactive protein levels returned to normal 48 h after initiation of the monotherapy treatment, and for this reason the antibiotic was discontinued on day 8, in accordance with the recommendations of the Spanish Paediatric Association (Fernández *et al.*, 2009). A brain ultrasound test, performed on day 32 of life, was normal. Finally, the patient was discharged in excellent condition at 50 days of age. His physical parameters at that time were: weight, 2280 g (P3–10); length, 47 cm (P3) and head circumference, 35 cm (P75).

The macrocephaly observed at the time of admission to the paediatric emergency department (which occurred 11 days after the previous discharge) was accompanied by sutural

Fig. 1. Cerebral magnetic resonance images. (a, b) Sagittal T1 without (a) and with (b) contrast: a high ventriculomegalia with two ring-shaped lesions showing a peripheral hyperintense signal in the posterior fossa and a small abscess in the occipital lobe can be distinguished. (c) Axial T2 showing the liquid-filled lesions and their peripheral hypointense rings. (d) Axial diffusion: hyperintense signal due to diffusion restriction.

diastasis and anterior fontanelle bulging. The physical parameters were: weight, 2450 g (P3); length, 48 cm (P30) and head circumference, 36.5 cm (P93). The blood biochemical evaluation revealed the following data: haemoglobin, 9.3 g l^{-1} ; white blood cells, $26\,400 \text{ mm}^{-3}$; platelets, $681\,000 \text{ mm}^{-3}$; C-reactive protein, 2.7 mg dl^{-1} ; procalcitonin, 0.1 ng ml^{-1} . The data obtained from examination of the cerebrospinal fluid were: leukocytes, 10 mm^{-3} , glucose, 33 mg dl^{-1} and protein, 73.9 mg dl^{-1} .

The cerebral ultrasound test showed a triventricular hydrocephalus, while the cerebral magnetic resonance revealed cerebellar, left temporal and left occipital lobe abscesses (Fig. 1). A surgical approach was taken for diagnosis and treatment. During the surgery, the largest abscess (located in the occipital lobe) was drained and an Ommaya reservoir was placed in the ventricular brain space. Culturing of the abscess aspirate produced *S. aureus*, which turned out to be phenotypically identical to the strain isolated during the previous sepsis episode suffered by the patient.

Given the success of the previous treatment and in accordance with the Infectious Diseases Society of America recommendations for treatment of meningitis (Tunkel *et al.*, 2004) an intravenous vancomycin treatment was prescribed that lasted 37 days, after which it was substituted by oral administration of co-trimoxazole for another week. During the first 15 days of admission, repeated punctures of the Ommaya reservoir were needed to relieve the hydrocephalus signs. All cerebrospinal fluid cultures were negative. Serial imaging tests performed throughout the admission time showed a gradual decrease of the abscesses, ending with their resolution and stabilization of the ventricular size. Cardiac ultrasonography did not reveal congenital abnormalities and no signs of endocarditis were observed. The baby was discharged after 46 days.

Outcome and follow-up

At the 15-month follow-up visit, the child appeared to be healthy and was not showing any neurological or

developmental sequelae: he walked without help, asked for objects by finger pointing, said 'hello' and 'bye', kissed, played with other children and made two-cube towers.

Discussion

Brain abscesses in neonates or young infants are uncommon central nervous system infections and have different characteristics from those in older children and adults. Thus, in older children they are often recognized by the presence of a higher intracranial pressure, while in neonates the fontanelles and the cranial sutures are still open and an intracranial mass lesion can grow without raising the intracranial pressure (de Oliveira *et al.*, 2007). Of these infections, staphylococcal brain abscesses are rare entities in young infants and, to the best of our knowledge, only three have been reported previously as secondary to sepsis (Vartzelis *et al.*, 2005; Regev *et al.*, 1995; Arora *et al.*, 2012). In these cases, it appears that the brain became infected through the haematogenous route during the sepsis, because culture of the cerebrospinal fluid remained negative in all cases, while identical strains were obtained from the blood during sepsis and from the brain abscess drainages. The main difference between the case described by Vartzelis *et al.* (2005) and the others (Regev *et al.*, 1995; Arora *et al.*, 2012), including our own, is that in the first instance the treatment of the previous sepsis was performed empirically with ampicillin plus gentamicin, while in the others vancomycin was used. It turned out that the causative staphylococcal strain of the first report was resistant to this β -lactam antibiotic, whereas the strains isolated from the other cases were susceptible to the glycopeptide. This did not prevent abscess formation, in spite of the facilitated diffusion of vancomycin through the inflamed haematoencephalic barrier (Tunkel *et al.*, 2004; García-Sánchez *et al.*, 1993), thus indicating that the physiological immaturity of the immune system makes pre-term neonates especially susceptible to infection, even when treated adequately. However, our patient and the one described by Vartzelis *et al.* (2005) were subjected to early abscess drainage to lower intracranial pressure, while it seems that drainage in the case reported in Regev *et al.* (1995) was done later as a consequence of antibiotic treatment failure, while no indication on whether this was performed at all was provided by Arora *et al.* (2012). Interestingly, no neurological or developmental sequelae were observed in the two first children (Vartzelis

et al., 2005 and this study), which contrasts with the psychomotor retardation reported in the third case (Regev *et al.*, 1995) and the lack of reference to the outcome for the fourth child (Arora *et al.*, 2012).

Based on the literature available and this work, it can be concluded that the long antibiotic treatment regimes used, when associated with early pus drainage, are effective in resolving infection and abscesses caused by *S. aureus* in neonates, as well as in elimination of any sequelae derived from this encephalopathy.

Acknowledgements

The authors declare no conflicts of interest.

References

- Arora, P., Kalra, V. K. & Pappas, A. (2012). Multiple brain abscesses in a neonate after blood stream infection with methicillin-resistant *Staphylococcus aureus*. *J Pediatr* **161**, 563.
- Azrak, M. A., D'Agustini, M., Fernandez, Z., Peruffo, M. V. & Malvaso, R. (2009). [*Citrobacter koseri* brain abscess in an infant: case report and literature review]. *Arch Argent Pediatr* **107**, 553–556, (in Spanish).
- de Oliveira, R. S., Pinho, V. F., Madureira, J. F. & Machado, H. R. (2007). Brain abscess in a neonate: an unusual presentation. *Childs Nerv Syst* **23**, 139–142.
- Fernández, B., Lopez, J., Coto, G., Ramos, A. & Ibañez, A. (2009). Meningitis neonatal. In *Protocolos Diagnósticos y Terapéuticos en Pediatría*, pp. 207–218. Edited by A. Delgado. Spain: Spanish Pediatric Association, Ergon.
- García-Sánchez, E., García-Sánchez, J. E., García-García, M. I. & García-Rodríguez, J. A. (1993). Glucopéptidos: vancomicina y teicoplanina. *Rev Esp Quimioterap* **6**, 275–282.
- Kao, K. L., Wu, K. G., Chen, C. J., Wu, J. J., Tang, R. B., Chang, K. P. & Wong, T. T. (2008). Brain abscesses in children: analysis of 20 cases presenting at a medical center. *J Microbiol Immunol Infect* **41**, 403–407.
- Krajewski, R. & Stelmasiak, Z. (1992). Brain abscess in infants. *Childs Nerv Syst* **8**, 279–280.
- Regev, R. H., Dolfín, T. Z. & Zamir, C. (1995). Multiple brain abscesses in a premature infant: complication of *Staphylococcus aureus* sepsis. *Acta Paediatr* **84**, 585–587.
- Tunkel, A. R., Hartman, B. J., Kaplan, S. L., Kaufman, B. A., Roos, K. L., Scheld, W. M. & Whitley, R. J. (2004). Practice guidelines for the management of bacterial meningitis. *Clin Infect Dis* **39**, 1267–1284.
- Vartzelis, G., Theodoridou, M., Daikos, G. L., Dellagrammaticas, H. & Syriopoulou, V. P. (2005). Brain abscesses complicating *Staphylococcus aureus* sepsis in a premature infant. *Infection* **33**, 36–38.