Case report

Brain abscess and epidural empyema caused by *Salmonella enteritidis* in a child: successful treatment with ciprofloxacin: a case report

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Abstract

Focal intracranial infections caused by *Salmonella* are rare, especially those produced by *S. enteritidis*. We describe the case of a 26-month-old girl who underwent surgery for a frontoparietal ependymoma and presented with epidural empyema and a brain abscess due to *S. enteritidis* following an episode of gastroenteritis. The child was successfully treated by surgical drainage along with 9 weeks of antibiotic therapy including ciprofloxacin.

Introduction

Despite bacteremia, sepsis and meningitis being relatively common in infants, episodes of focal intracranial infection produced by *Salmonella* are rare. Torrey et al. [1] reported an incidence of up to 6% bacteremia in infants under 12 months old with salmonellosis and Rocha described a 1.3% rate of meningitis in newborns under 18 months with this disease [2].

The literature contains only 80 described cases of focal intracranial infection by *Salmonella*, including cerebral abscesses and subdural and epidural empyemas. In these infections, *Salmonella typhi* is the most frequently isolated causative agent [3]. Brain abscesses caused by *Salmonella enteritidis* are especially rare, and only 12 episodes have been described in the literature, 3 of these affecting children [4,5]. The present case report is the first description of a *Salmonella* infection producing both epidural empyema and brain abscess.

Case presentation

A 26-month-old girl underwent surgery for a grade II right frontoparietal ependymoma, in which the tumor was completely resected. Dexamethasone (1 mg/kg/day) was given 8 days after surgery as antiedema treatment. Seven days after the operation, the child suffered an episode of vomiting and diarrhea that lasted 24 hours. Two days later, she presented at the Emergency unit with a fever of 39°C. Her general state was good, with no neurological signs or other accompanying symptoms. Of the blood tests performed on hospital admission, the following results are of interest: 12000 leucocytes per mm³, with 72% neutrophils and 8 mg/dl and C-reactive protein (CRP) (normal < 0.5 mg/dl). On suspicion of a possible complication of surgery, a cranial CT-scan was requested, which showed a fluid collection indicative of a right epidural parietal empyema (Figure 1A). Through a right parietal craniectomy, the epidural fluid collection was drained and a sample obtained for culture. After
placement of a subdural drainage tube the patient was
started on empirical antibiotic treatment with ceftazidime
and vancomycin.

Cultures of the epidural empyema fluid, cerebrospinal
fluid and feces revealed the growth of Salmonella enterica,
subspecies enterica I, serotype Enteritidis 9, 12: g, m, phage
type 6a.

In all the cultures, MICs for ceftazidime (1 ≤ μg/mL),
cefotaxime (1 ≤ μg/mL), ciprofloxacin (1 ≤ μg/mL),
nalidixic acid (4 ≤ μg/mL), and chloramphenicol (8 ≤
μg/mL) indicated a good sensitivity of the bacterium to
these antibiotics.

On the sixth day of empirical antibiotic treatment, the
patient continued to have fever and clonic jerking started
in the left arm. A further CT scan revealed a right
frontoparietal lesion with rim enhancement consistent
with a cerebral abscess (Figure 1B).

A drainage tube was placed in the abscess (Figure 1C),
and anticonvulsant therapy with valproic acid initiated. At this
time point, vancomycin was discontinued and ceftazidime
was replaced with i.v. chloramphenicol and this new
antibiotic regimen continued for 4 weeks. In the fluid
evacuated from the abscess, an identical strain of
Salmonella enteritidis as in the previous cultures was
identified. Twenty four hours after the introduction of
chloramphenicol and placement of the new drainage tube,
the infant’s temperature returned to normal and she
suffered no more seizures. Given that Salmonella enteritidis
continued to appear in cultures of the abscess drainage
fluid, on day 38 of treatment, chloramphenicol was
replaced with i.v. ciprofloxacin and i.v. cefotaxime. This
regimen was maintained for 2 weeks. The patient was
discharged after 7 weeks of intravenous antibiotic treat-
ment and was given oral ciprofloxacin at home for a
further 15 days.

Lesion progression was monitored weekly by transcran-
iectomy cerebral ultrasonography and monthly by
cerebral NMR. These follow up exams revealed a gradual
reduction in abscess size until its resolution 9 weeks after
the onset of antibiotic therapy.

At 10 months, the previously extracted and sterilized bone
fragment was replaced by cranioplasty. After two years of
follow up, the child is well with no signs of infection or
tumor recurrence observed in the CT or NMR scans. She
has no neurological or development alterations and her
weight and height are within the 50th percentile for
her age.

Discussion

The genus Salmonella has two species, Salmonella enterica
and Salmonella bongori, although only the first of these
causes diseases in humans. Salmonella enterica includes
more than 2300 serovars, which are classified as six
genogroups (subspecies) I-VI. Most strains pathogenic for
man (causing gastroenteritis and typhus) are serotypes of
subspecies I.

Intracranial focal lesions due to Salmonella can present at
any age, though subdural and epidural empyemas are
more common in children than adults. In general, their
prognosis is poor with a mortality rate as high as 40%
described in some patient series [6].

There is often a series of predisposing factors for
developing an intracranial lesion due to Salmonella
including: associated meningitis due to Salmonella,
primary or metastatic brain tumors, subarachnoid hemor-
rhage, epidural or subdural hematoma, neurosurgery and
immunodeficiency [7]. The patient described here had
been recently operated on for a low grade supratentorial
ependymoma, and it was a residual epidural collection of
fluid following neurosurgery that triggered the infection.
The same microbe was isolated from the stools and in
cultures of the empyema and cerebral abscess. It is likely
that the bloodstream was the route of spread from the
enteric focal infection. Immunological determinants in
our patient were normal.

The treatment of choice for brain abscesses caused by
Salmonella is long-duration antibiotic therapy along with
surgical drainage [8]. Salmonella is an intracellular
pathogen, so antibiotics acting as this level are required.
Traditionally, chloramphenicol has been used to treat
brain abscesses caused by this bacterium, since the drug is
capable of crossing the blood-brain barrier and adequately
dissemnates through the CNS [6]. However, a fear of
possible side-effects and increasing microbial resistance
have largely limited its use in favor of an increased use of
third generation cephalosporins. In our patient, intrave-
nous treatment with ceftazidime followed by chloram-
phenicol along with surgical drainage managed to

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Figure 1. (A) Right parietal epidural empyema caused by
Salmonella enteritidis. (B) Right frontoparietal brain abscess
caused by Salmonella enteritidis. (C) Drainage tube placed
in the abscess.
considerably reduce the size of the abscess, but despite the good sensitivity of the agents in vitro, this treatment combination was unable to completely eradicate the bacterium, which continued to appear in the abscess drainage fluid after 4 weeks of treatment. In contrast, the inclusion of ciprofloxacin in the antibiotic regimen was able to completely resolve the child’s symptoms. Wessalowski [9] described the case of a neonate with multiple brain abscesses caused by Salmonella enteritidis, who required the use of intravenous ciprofloxacin after treatment with cefotaxime and chloramphenicol had failed despite sensitivity shown towards the two drugs in vitro. As in our case, the patient also progressed favorably in response to ciprofloxacin.

Recent studies have failed to find evidence of permanent cartilage lesions in children receiving fluoroquinolones, and the number of indications of fluoroquinolones has increased in pediatric practice to the extent that they are currently an accepted treatment option for severe Salmonella infection [10,11].

In the case described here, early surgical drainage together with intravenous long-duration antibiotic therapy including ciprofloxacin served to completely resolve the intracerebral lesions present.

List of abbreviations
CRP, C-reactive protein; CT, Computer tomography; MIC, Minimum Inhibitory Concentration; i.v, intravenous; NMR, Nuclear Magnetic Resonance; CNS, Central Nervous System.

Consent
Written informed consent was obtained from the patient 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.

Competing interests
The authors declare that they have no competing interest.

Authors’ contributions
DB, MM, EA and JR had wrote the manuscript. CG had reviewed the literature. FE had performed the microbiological examination of the cultures and had prepared the images. All authors read and approved the final manuscript.

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