



# Intracranial venous sinus thrombosis as a complication of otitis media in children: Critical review of diagnosis and management



Elisabetta Zanoletti<sup>\*</sup>, Diego Cazzador, Chiara Faccioli, Marianna Sari, Roberto Bovo, Alessandro Martini

Department of Neuroscience, Operative Unit of Otolaryngology, Padova University, via Giustiniani 2, Padova, Italy

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## ABSTRACT

**Objectives:** Otogenic lateral sinus thrombosis (LST) is a rare intracranial complication of acute otitis media (AOM), which can lead to severe neurological sequelae and death. The aim of this study was to analyze the clinical presentation, management and outcome of LST in children, investigating a possible correlation between clinical aspects, radiological findings and anatomical variations.

**Methods:** At a tertiary Italian hospital, a retrospective review was conducted on the medical records of eight patients diagnosed with otogenic LST over a 3-year period. Four children were males and mean age was 4.7 years.

**Results:** All patients had a history of otitis media at diagnosis and 4/8 presented also with more than one neurological sign or symptom. Mastoiditis signs were detected in 5/8 patients. Thrombosis was diagnosed by computed tomography, enhanced magnetic resonance and magnetic resonance venography. Treatment was medical, alone or combined with surgery. Medical treatment consisted in anticoagulants eventually combined with anti-edema medication on clinical basis. Mastoidectomy and/or myringotomy ± trans-tympanic drainage placement were performed in 7/8 patients. Complete vessel recanalization was obtained in 6/8 children after a median follow-up time of 4.8 months. No complications, neither clinical sequelae occurred. In our series, neurological signs and symptoms were significantly associated with the presence of hypoplasia of the contralateral venous sinus ( $p = 0.029$ ).

**Conclusion:** LST is a severe condition occurring even in absence of otological signs, and despite adequate antibiotic therapy for AOM, which should be ruled out and promptly treated. A dominant neurological presentation is associated in our series with anatomical variations of cerebral sinus venous drainage patterns. This should be carefully evaluated and considered in diagnosis, treatment planning and prognosis.

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## 1. Introduction

Acute mastoiditis (AM) is still a relatively common intra-temporal complication of acute otitis media (AOM) in children. A recent meta-analysis reported that suppurative complications develop in 0.24% of cases of AOM, despite adequate treatment [1,2]. The incidence of AM varies, depending on regional trends in prescribing antibiotic therapy. In Europe the incidence varies between 3.5 and 4.2 per 100,000 people/year [3]. Despite improvements in imaging, surgical techniques and a proper use of antibiotics, complications of AM still occur between 13% and 38% of cases [4,5]. Among them, otogenic lateral sinus thrombosis (LST) develops in about 2–3% of patients with AM [5,6]. Even nowadays,

LST carries a high mortality rate ranging from 5% to 10% [6,7]. It can lead to serious long-term neurological morbidities, with potentially lethal outcomes if not promptly recognized [8].

We report on a series of 8 consecutive patients with LST managed at our institution in the last 3 years, providing an up to date review of the literature on this topic. We retrospectively investigated the prior conditions defining the various clinical features of LST, and analyzed the correlation with radiological findings.

## 2. Materials and methods

After IRB approval, the medical charts of eight children with a documented diagnosis of otogenic LST were retrospectively reviewed. The patients were treated at a tertiary medical center between January 1, 2011 and February 28, 2014. The diagnosis was

<sup>\*</sup> Corresponding author. Tel.: +39 0498211993; fax: +39 0498211994.  
E-mail address: [elisabetta.zanoletti@tiscali.it](mailto:elisabetta.zanoletti@tiscali.it) (E. Zanoletti).

based on otological, neurological, fundoscopic evaluations and neuroimaging tests. All patients underwent high-resolution temporal bone computed tomography (CT) performed within 24 h of admission to assess temporal bone erosion and to rule out intra-temporal sequelae of AM. Magnetic resonance imaging (MRI) with Gadolinium was performed in cases with neurological symptoms or suspected intracranial complications. When LST was evident, magnetic resonance venography (MRV) assessed the dural venous system drainage, focusing on the collateral venous flow and the patency of the contralateral venous sinuses. The data were grouped into presenting signs and symptoms, medical history, laboratory findings, and diagnostic imaging results. Medical and surgical management was recorded. Clinical outcome was evaluated on the strength of otological, radiological, ophthalmological and neurological examinations. Follow-up was clinical and radiological.

To assess the correlation between the neurological presentation of LST and the anatomical intracranial venous drainage, two subgroups of patients were identified: children with 0–1 and children with  $\geq 2$  neurological signs or symptoms at admission. According to MRV-findings, the contralateral venous drainage was investigated revealing a normal or a hypoplastic condition. The statistical method applied was the Fisher's exact test. A  $p$  value  $< 0.05$  was considered significant. The Statistical Package for the Social Sciences (SPSS, rel. 20.0, Chicago, IL) was used for the analysis.

### 3. Results

During the 3-year period from January 2011 to February 2014, 8 cases (4 boys and 4 girls) of LST complicating AM were managed

at our Institution. The patients were between 2 and 7 years old, mean 4.7 (1.6) years, median 4.5. Their presenting signs and symptoms, and their clinical-radiological data are summarized in Tables 1 and 2.

#### 3.1. Clinical findings

All patients had a recent history of AOM, developing a mean 7.7 (4.5) days before the onset of symptoms of LST (range 3–15 days; median 7). Three of the eight patients (37.5%) had received adequate antibiotic therapy for at least 10 days, while LST occurred in five cases (62.5%) shortly ( $\leq 7$  days) after the onset of AOM. Three of the eight patients had previously suffered from recurrent AOM, while it was the first episode for the other five patients. On admission, all patients complained of ear pain, but only 5/8 (62.5%) had clinical signs of AOM. Otitis media with effusion was identified in 3/8 children (37.5%), with symptoms lasting  $\geq 10$  days in two of them (66.6%). None of these three children presented with clinical signs of AM, which were apparent in 3/5 patients with AOM on admission. All but one of the patients in the series reported fever and headache, which was described as a dull frontal or parietal pain.

The most common neurological symptoms at admission were diplopia (37.5%) caused by abducens nerve palsy, and photophobia (25%). Papilledema was seen in 75% of the children, and lethargy in 37.5%. In particular, 50% of the children presented with more than one neurological sign or symptom at diagnosis.

Blood examination at diagnosis revealed elevated parameters of infection in most of the cases, with a WBC count ranging between 11.700 and 20.040 cells/mm<sup>3</sup> and CRP between 2.90 and 167 mg/L.

**Table 1**  
Patients' characteristics, radiological findings, management and outcome.

| Case | Age (years) | CT                        | Thrombosis site                 | Contralateral venous drainage | Surgery             | ATB (days) | Recanalization (months) |
|------|-------------|---------------------------|---------------------------------|-------------------------------|---------------------|------------|-------------------------|
| 1    | 5           | IM sigmoid sulcus erosion | SS/TS/gIJV                      | H-SS/TS                       | M                   | 10         | Complete (9)            |
| 2    | 5           | CM tegmen tympani erosion | SS/gIJV                         | –                             | M + sinus opening   | 10         | Partial (27)            |
| 3    | 4           | IM                        | SS/TS                           | –                             | TTD                 | 12         | Complete (3)            |
| 4    | 4           | CM sigmoid sulcus erosion | SS/TS/gIJV epidural abscess     | –                             | M                   | 21         | Sinus disruption        |
| 5    | 4           | IM                        | SS/TS                           | H-TS                          | M + myringocentesis | 14         | Complete (6)            |
| 6    | 7           | IM                        | SS/TS/gIJV                      | H-TS                          | TTD                 | 24         | Complete (1)            |
| 7    | 2           | CM                        | SS/TS<br>retroauricular abscess | H-TS                          | M + myringocentesis | 14         | Complete (6)            |
| 8    | 7           | IM bilateral              | SS                              | –                             | none                | 12         | Complete (4)            |

L: left, R: right, IM: incipient mastoiditis, CM: coalescent mastoiditis, SS: sigmoid sinus, TS: transverse sinus, gIJV: gulf of internal jugular vein, H: hypoplasia, M: mastoidectomy, TTD: trans tympanic drainage, ATB: antibiotics.

**Table 2**  
Presenting signs and symptoms at admission.

| Symptoms                   | 1      | 2      | 3      | 4      | 5      | 6           | 7   | 8      | Total |
|----------------------------|--------|--------|--------|--------|--------|-------------|---|--------|-------|
| Neurologic                 |        |        |        |        |        |             |   |        |       |
| Diplopia                   |        |        |        |        | X      | X           | X   |        | 3     |
| Lethargy                   | X      |        |        |        |        | X           | X   |        | 3     |
| Papilledema                | X      | X      |        |        | X      | X           | X   | X      | 6     |
| Other                      |        |        |        |        |        | Photophobia | Photophobia <sup>*</sup><br>facial paralysis <sup>*</sup> (R) |        | 2     |
| Otomastoid                 |        |        |        |        |        |             |   |        |       |
| Otalgia                    | X      | X      | X      | X      | X      | X           | X   | X      | 8     |
| Otorrhea                   |        | X      |        |        |        |             |   |        | 1     |
| Mastoiditis signs          |        | X      | X      |        |        |             | X   | X      | 4     |
| AOM/EOM (days)             | AOM 15 | AOM 3  | AOM 7  | EOM 11 | EOM 12 | EOM 3       | AOM 4   | AOM 7  |       |
| General                    |        |        |        |        |        |             |   |        |       |
| Fever                      | X      | X      | X      | pikes  | X      |             | X   | X      | 7     |
| Nausea/vomiting            | X      | X      | X      |        |        | X           | X   |        | 5     |
| Headache                   | X      |        | X      | X      | X      | X           | X   | X      | 7     |
| Torticollis                |        |        |        | X      |        |             |   |        | 1     |
| Gait instability           | X      |        |        |        |        |             |   |        | 1     |
| Lab                        |        |        |        |        |        |             |   |        |       |
| Leucocytes/mm <sup>3</sup> | 12.900 | 13.600 | 18.540 | 11.700 | 11.550 | 13.200      | 20.040  | 11.920 |       |
| CRP (mg/L)                 | 21     | 121    | 144    | 161    | 167    | 2.90        | 160   | 44     |       |

<sup>\*</sup> Onset during hospital stay. (R) right. AOM: acute otitis media, EOM: effusive otitis media, CRP: C-reactive Proteine.

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