Lateral sinus thrombosis: A review of seven cases and proposal of a management algorithm

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Summary

Objective: To evaluate the demographics, diagnosis, management, and outcomes of lateral sinus thrombosis in a pediatric population, and to propose a new treatment algorithm.

Methods: Retrospective review of seven patients.

Results: Patients averaged 7.4 years of age. They commonly presented with headache and otalgia (seven of seven patients), and nausea and vomiting (six of seven patients). All patients had abnormal otoscopy, and four of seven patients had a lateral rectus palsy, but fever was not always present (only three of seven patients). All patients underwent MRI with venography (MRV) for diagnosis. All patients were admitted to the hospital (average length of stay 8 days) and treated with antibiotics (six of seven patients with IV ceftriaxone). Five of seven were treated with simple mastoidectomy and concurrent middle ear ventilation tubes; two patients received only medical treatment. The average follow up was 114 months (range 33–387 months). Two patients had long-term sequela: one had persistent mild lateral gaze diplopia and another had unilateral moderate to severe high frequency sensorineural hearing loss. Six of seven patients had follow up imaging (average 15 months, range 1–40 months). Four of six patients showed recanalization of the lateral sinus on repeat imaging. Based on the current experience in the modern era of MRV and broad-spectrum antibiotics, a new treatment algorithm is proposed.

Conclusions: Lateral sinus thrombosis is an uncommon cranial complication of otitis media. The advent of non-invasive diagnosis and effective broad-spectrum antibiotics has drastically decreased the mortality and altered the diagnostic and treatment paradigm.

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1. Introduction

Intracranial complications of otitis media, which occur most commonly during childhood, are rare in this current antibiotic era [1, 2]. Lateral sinus thrombosis accounts for 2—20% of intracranial complications [1—3]. Numerous case series in the literature have discussed its ongoing evolution in diagnosis and management. The introduction of simple mastoidectomy, intravenous antibiotics, computed tomography (CT) scans, and magnetic resonance imaging (MRI) and have all contributed greatly to the current management paradigm. Historically, the disease was marked by spiking fevers (the so-called picket fence), headache, and otologic disease. With the advent of antibiotics, the classic picket fence pattern is less frequently seen, and the nature of the otogenic disease has shifted from acute to chronic otitis. As the clinical presentation has changed, the nature of diagnosis has also changed. Detailed non-invasive imaging is now commonplace. MRI, specifically magnetic resonance venography (MRV), and less reliably, CT, are now the preferred diagnostic imaging studies [3]. As the management has evolved to include surgical intervention, antibiotics, and more sophisticated imaging, the mortality has dropped from nearly 40% to essentially 0% [4].

We report here a case series of seven patients, the largest in the modern era of magnetic resonance imaging diagnosis and intravenous broad-spectrum antibiotics, with lateral sinus thrombosis. The demographics, diagnosis, management, and outcome will be discussed. Based upon the data presented and review of the literature, a modern management algorithm will be proposed.

2. Results

2.1. Study method

A search of all patients with lateral sinus thrombosis as a primary diagnosis was undertaken from 1997 to the present at the University of Rochester Medical Center. Additional searches were made under the following ICD-9 codes: 325—phlebitis and thrombophlebitis of intracranial venous sinuses, 377.01—papilledema associated with elevated intracranial pressure, 383.02—acute mastoiditis with other complications/Gradenigo’s syndrome, 378.54—sixth or abducens nerve palsy, and 382.9—unspecified otitis media. In addition, otolaryngology clinic records dating back to 1994 were researched. A total of eight patients were identified. One patient was found to have a hypercoagulable state (antiphospholipid antibody syndrome) and developed a unilateral lateral sinus thrombosis which required surgical treatment but did not have otitis media or concomitant infection and thus was excluded from the study.

2.2. Patient demographics, signs and symptoms

The mean age of the patients was 7.4 years (range 4—12), with two females and five males. The patients had acute symptoms for an average of 8 days prior to admission (range 2—14 days). Table 1 shows the presenting symptoms and signs of the seven patients. All patients had headache and otalgia on admission, six of seven patients reported nausea and vomiting, and three of seven reported dizziness, photophobia, or anorexia. Two patients reported blurry vision. Six of seven patients had abnormal otoscopy, and four of seven had an apparent abducens nerve palsy. Three of seven reported a fever within the previous 24 h, two patients had papilledema upon admission. All patients had a history of otitis, either recurrent acute (four of seven) or chronic (three of seven). One patient was found to have an IgA deficiency.

2.3. Diagnostic data

All patients were admitted. The average length of stay was 8 days (range 2—14). All patients underwent diagnostic imaging including CT and MRI/MRV. A LST was seen in all patients on MRI/MRV. Five patients underwent CT scans prior to MRI/MRV. LST was identified or suspected in four of five (80%) on the CT report. Six of seven (86%) patients underwent a lumbar puncture. The opening pressure was elevated (average 56 cm H2O, normal range 5—
28 cm H₂O) in four of the six patients (66%). Six of seven (86%) patients underwent microbiologic testing or surgical specimens. One patient had blood cultures alone, which reported no growth. Of the remaining five patients, three reported no growth from intraoperative cultures. Of the two patients with positive mastoid cultures, one patient grew out pan-sensitive staphylococcus aureus, and the other peptostreptococcus. Two of seven (29%) patients had leukocytosis during their hospital stay, which resolved with treatment. Five of seven (71%) patients were febrile during their admission, but only two displayed multiple fever spikes.

2.4. Treatment

All patients were treated with antibiotics. One patient was treated with oral antibiotics (amoxicillin) alone. The remaining six (86%) were treated with intravenous ceftriaxone, either alone (five of six), or in combination with ampicillin/sulbactam. All patients went home on antibiotic therapy for an average of 13 days; three of seven patients went home on intravenous ceftriaxone. One patient was anticoagulated with enoxaparin followed by warfarin following discharge. Five of seven (71%) patients underwent surgery. All five patients underwent simple mastoidectomies. One patient underwent bilateral simple mastoidectomies, and one patient had had a prior simple mastoidectomy. Four of five (80%) patients also underwent concurrent ventilation tube placement.

2.5. Outcomes

All patients were discharged to home. All patients were afebrile, clinically stable and improved upon discharge. Two patients had lingering headaches, two patients had evidence of resolving lateral rectus palsy, and one patient had resolving otalgia. However, two patients were subsequently readmitted for recurrent headache, nausea, and vomiting. Repeat exams showed persistent papilledema, elevated lumbar puncture opening pressures, and were diagnosed with otitic hydrocephalus that was treated medically with acetazolamide with good effect. The mortality rate was 0%. The average length of follow up was 114 months (range 17–387 months). Two patients had long-term sequela: one patient had persistent mild lateral gaze diplopia, and one patient had unilateral moderate to severe high frequency sensorineural hearing loss. One patient had long-term papilledema (3 years) that eventually resolved. One patient had persistent headaches and field cuts that resolved over several months. Six of seven patients had long-term follow up imaging (average 15 months, range 1–40 months). Four of six (66%) patients showed recanalization on repeat imaging.

3. Discussion

With the introduction of antibiotics, the incidence of intracranial complications of otitis media — and their mortality — dropped by a factor of 10 [5]. Now quite rare, LST continues to be an intracranial complication of otitis media with potentially devastating acute and chronic consequences. Therefore, in spite of the advent of MRV, and the ease of rapid, reliable, and non-invasive diagnosis, clinical suspicion must still be very high.

All of the patients in the current series presented with headache and otalgia, and many frequently reported nausea and vomiting. Only three of seven patients reported a fever within the 24 h prior to admission. Our experience was that under current treatment patterns, the classical presentation of spiking fevers, headache, and otitis is only partially correct.

In a recent large series of patients with intra- and extracranial otitis media complications, Dubey and Larawin [7] found that 24 of 70 (34%) patients had two or more complications. Petrous apicitis, or infection of the petrous apex of the temporal bone, is considered an extracranial intratemporal complication of otitis media. The classic clinical presentation, known as Gradenigo’s syndrome, is lateral rectus palsy, retro-orbital pain, and active otitis, represents spread of a mastoid infection into the petrous apex. The abducens nerve is in close proximity to the petrous apex as it runs through Dorello’s canal, which results in inflammation of the nerve and an ipsilateral lateral rectus palsy. Although somewhat less clearly defined than petrous apicitis, otitic hydrocephalus is another complication of otitis media. The overlap of these entities is not well described, given their relative rarity. In the current series, four of seven patients had evidence of abducens nerve palsy; however, no patients described having retro-orbital pain; all of these patients had evidence of active otitis. Therefore, no patients clearly had concurrent LST and classic Gradenigo’s syndrome, but three had partial evidence of both. In addition four of six patients who underwent lumbar puncture had elevated opening pressures consistent with otitic hydrocephalus.

In the present series, five of seven patients underwent ventilation tube placement and simple mastoidectomy (one patient underwent bilateral simple mastoidectomies) as a surgical treatment modality. During surgery, the sigmoid sinus was...
needle aspirated and unroofed of its bony covering, but never opened for thrombus removal. The neck was never explored for internal jugular vein ligation. All patients survived with good general health and were discharged to home.

The nature of the surgical procedure for treatment of lateral sinus thrombosis remains controversial, with advocates voicing support for procedures that range from simple ventilation tube placement to simple mastoidectomy to canal wall down or radical mastoidectomy [7—9]. The type of surgical procedure advocated recommended depends on the extent of the patient’s disease. If the patient has concurrent intracranial complications such as epidural or brain abscesses, then a more radical approach can be justified.

All of the patients in the present series underwent MRV for initial diagnosis. Those that underwent CT scans and subsequent MRV showed only a 66% success rate of identifying the thrombus. The early use of MRV has been advocated for nearly 20 years [10]. Angiography is no longer advocated as an imaging modality, given its relatively high rate of complications.

All patients were treated with antibiotics; seven of eight were treated with ceftriaxone because of its broad coverage and good penetration into the central nervous system. Early broad coverage is important given the wide range of species that have been reported to be the causative agent. Only two patients had positive culture data in our series: staphylococcus aureus and peptostreptococcus. Given that most patients have already been exposed to antibiotics, negative cultures are not uncommon in other reported series [11,12].

Fig. 1 Lateral sinus thrombosis management algorithm.
LST is a rare clinical entity and many questions remain about the management. The total duration of antibiotic therapy required is not clearly defined, although all the patients in our current series were treated for the entire duration of their hospital stay plus a course of home antibiotics for at least 1 week. The role of repeat imaging and the significance of sinus recanalization or thrombosis is also poorly defined. Four of six patients who underwent repeat imaging in our series did recanalize, although the consequences of this is unclear, as there was no apparent correlation to long-term complications. The role of anticoagulants is also contested. A recent report by Shah et al. highlights the potential complications of anticoagulation therapy in children with lateral sinus thrombosis. Finally, the role and extent of surgery is not fully characterized. More recent reports cite fewer internal jugular vein ligations [8,13,14]. Many advocate incision of the sinus with removal of the clot, while others simply unroof the sinus and confirm the presence of thrombus with needle aspiration.

Many questions about the management of LST remain unanswered. However, given the success of MRV and empiric broad-spectrum antibiotics, these can be advocated as primary diagnostic and treatment modalities. Fig. 1 is a proposed algorithm for the management of LST.

In conclusion, this review of a relatively large series of patients treated in the modern era advocates for a patient-tailored approach that includes early use of IV antibiotics, MRV, and assessment of patient’s overall clinical status. The proposed algorithm can serve as a template that must be modified based upon the judgment of the treating surgeon and the needs of the patient.

References