Otological Manifestations of Nonseptic Lateral Sinus Thrombosis: A Review

M. S. Vijayashree · B. Viswanatha

Received: 28 November 2014 / Accepted: 30 January 2015 / Published online: 4 February 2015
© Association of Otolaryngologists of India 2015

Abstract Nonseptic lateral sinus thrombosis differs from septic lateral sinus thrombosis in that it is not associated with ear or sinus infection. Etiologies of these conditions are different and management of these conditions are different. Nonseptic lateral sinus thrombosis requires medical line of management and anticoagulant therapy where as septic lateral sinus thrombosis treatment involves surgical exploration of the mastoid cavity, sinus decompression, and long-term antibiotic therapy. Mastoid changes are frequently detected on computed tomography or magnetic resonance imaging in cases of nonseptic lateral sinus thrombosis. An otolaryngologic evaluation is usually required to exclude coexisting mastoiditis. An otologist should be familiar with the septic lateral sinus thrombosis and existence of nonseptic variant lateral sinus thrombosis for early recognition and initiation of appropriate treatment.

Keywords Otological manifestations · Lateral sinus · Nonseptic lateral sinus thrombosis

Introduction

Thrombosis of the lateral sinus can occur alone or in association with cortical venous thrombosis. Thrombosis of the lateral sinus can give rise to thromboembolism. Thrombosis of the lateral sinus can be classified into nonseptic lateral sinus thrombosis and septic lateral sinus thrombosis. Etiologies of these conditions are different and management of these conditions are different. The non septic variant of

lateral sinus thrombosis is being diagnosed with increasing frequency because of the availability of CT and MRI scan. It is seen more often in women than men and it usually occurs in adolescents or adults. Nonseptic lateral sinus thrombosis requires medical line of management and anticoagulant therapy, where as septic lateral sinus thrombosis needs surgical treatment along with antibiotics therapy. Three cases of nonseptic lateral sinus thrombosis are presented along with the review of literature.

Case Reports

Case 1

A 24-year-old man presented with a history of headache of 1 month duration and a history of diplopia of 7 days duration. He had intermittent headache localized to the right temporal and mastoid regions. He had three episodes of vomiting for the past 2 days. The patient had no history of fever, ear pain, ear discharge, or hearing loss. He had been a smoker for 9 years.

On examination patient had right lateral rectus paresis and fundus examination showed bilateral papilloedema; the examination showed no other abnormalities. Magnetic resonance imaging (MRI) showed hyperintensity in the right lateral sinus (Fig. 1). T2-weighted MRI showed hyperintensity in the right mastoid region (Fig. 2). Cerebrospinal fluid pressure was 190 mm H₂O (normal range 50–180 mm H₂O).

Magnetic resonance venography (MRV) showed the absence of flow in the right lateral sinus, and internal jugular vein (Fig. 3). Because of his symptoms and the MRI findings, the patient was referred to the otolaryngology clinic for mastoiditis management.

M. S. Vijayashree · B. Viswanatha (✉)
ENT Department, Bangalore Medical College & Research
Institute, Bangalore, India
e-mail: drbviswanatha@yahoo.co.in

Fig. 1 MRI showing hyperintensity in the right lateral sinus (*arrow*)

Fig. 2 T2-weighted MRI shows hyperintensity in the right mastoid region (*arrow*)

On examination both ears were found to be normal, and there was no mastoid tenderness. Examinations of the nose, sinuses, and throat also were normal. Audiological examination reports were normal. A diagnosis of nonseptic lateral sinus thrombosis without mastoiditis was made. The patient was treated for increased intracranial tension and was given anticoagulant therapy. He made a complete recovery from his symptoms within 2 months.

Case 2

A 28-year old female patient came with the history of severe pain in the left mastoid region for the past 20 days.

Fig. 3 MRV showing an absence of flow in the right lateral sinus and internal jugular vein (*arrow*)

Fig. 4 CT scan with contrast showing delta sign in the region of left lateral sinus (*arrow*)

It was not associated with any other symptoms. She was using oral contraceptives for the past 3 years. On examination both ears were found to be normal, and there was no mastoid tenderness. Examinations of the nose, sinuses, and throat also were normal. Audiological examination reports were normal. CT scan with contrast showed a ‘delta-sign’ in the left lateral sinus area (Fig. 4).

Magnetic resonance imaging showed hyperintensity in the left lateral sinus (Fig. 5). MRV showed the absence of flow in the left lateral sinus (Fig. 6). T2-weighted MRI showed hyperintensity in the left mastoid region.

Fig. 5 MRI showing hyperintensity in the left lateral sinus (*arrow*)

Fig. 6 MRV showing an absence of flow in the left lateral sinus (*arrow*)

Patient was asked to stop oral contraceptives and she had complete relief from headache with medical line of management at the end of 1 month.

Case 3

A 30-year old male patient who had head injury was on treatment with neurologist. He complained of severe pain in the mastoid region. MRI scan which was taken showed

Fig. 7 T2-weighted MRI shows hyperintensity in the right mastoid region (*arrow*) and right temporal lobe injury (*triangle pointer*)

Fig. 8 MRV showing an absence of flow in the right lateral sinus and internal jugular vein (*arrow*)

injury to the lower part of the temporal lobe. T2-weighted MRI showed hyperintensity in the right mastoid region (Fig. 7). MRV showed the absence of flow in the right lateral sinus, sigmoid sinus (Fig. 8).

Because of his symptoms and the MRI findings, the patient was referred to the otolaryngology clinic for mastoiditis management. On examination both ears were found to be normal, and there was no mastoid tenderness. Examinations of the nose, sinuses, and throat also were normal. Audiological examination reports were normal. A diagnosis of nonseptic lateral sinus thrombosis without

mastoiditis was made and patient was referred back to the neurologist for the medical management.

Discussion

Nonseptic lateral sinus thrombosis involves primary thrombus formation within the dural sinus. As there is no ear or sinus infection, otolaryngological examination will be normal. From 1999 to 2014, 36 cases of septic lateral sinus thrombosis and three cases of non septic variant of lateral sinus thrombosis have been reported in our institution. The non septic variant of lateral sinus thrombosis is being diagnosed with increasing frequency because of the availability of CT and MRI scan. It is seen more often in women than men and it usually occurs in adolescents or adults [1–3].

Predisposing conditions in women are:

1. Pregnancy
2. Puerperium, oral contraceptive
3. Smoking is also a contributing factor in both sexes [1–3].

Nonseptic lateral sinus thrombosis has been reported to occur in association with following conditions [1, 4–6]:

1. Thrombocytosis;
2. Sickle cell disease;
3. Chronic debilitating diseases (malignancies such as leukemia);
4. Altered cerebral hemodynamic states (congestive heart failure, dehydration, malnutrition, diabetic ketoacidosis).

In oral contraceptive users and in pregnant women, several factors in the coagulation cascade have been found to be altered. These changes results in hypercoagulable state. This altered coagulation cascade finally results in excessive fibrin deposition on endothelial lining of the venous system [7]. Researchers have shown endothelial proliferation in dural sinus wall in the areas adjacent to thrombus. It is proposed that vascular subendothelial stimulation favors excessive deposition of fibrin and results in thrombus formation [8]. The mechanism of thrombosis in dural sinus in women using oral contraceptives is not known. They are thought to be due to abnormal thrombogenesis, hypercoagulable state and vascular lesions induced by oral contraceptives [1, 5]. In the present study, in all the three patients bleeding time and clotting time were normal.

Generally, the initial symptom of nonseptic lateral sinus thrombosis is headache, which may be either generalized or localized to the temporoparietal region. There is no identifiable, uniform, recognizable pattern of headache in dural sinus thrombosis. It may be intermittent initially to become

a constant headache later. It is usually unilateral or localized to any region of the head and usually throbbing in nature [9, 10]. Subsequently, symptoms of increased intracranial pressure may develop, including seizures, blurred vision, and cranial nerve palsy. The characteristic fever of septic lateral sinus thrombosis is absent in non-septic lateral sinus thrombosis. As there is no ear or sinus infection, otolaryngological examination will be normal [1, 11].

The exact mechanism for headache in sinus thrombosis is not known. Variable patterns of headache among these patients may be due to following multiple mechanisms:

1. Raised intracranial pressure,
2. Subarachnoid hemorrhage,
3. Stretching of nerves in sinus walls
4. Inflammation of sinus walls

In some patients sigmoid sinus thrombosis is associated with occipital pain. This is probably related to inflammation and stretching of sigmoid sinus walls due to thrombus [9].

The increased intracranial tension seen in nonseptic lateral sinus thrombosis is associated with blockage of the dominant sinus. Because the right sinus is usually dominant, symptoms are more likely to occur when this sinus is involved. The presence of anastomotic channels is important for recovery, because recovery depends on development of collateral circulation or the possibility of recanalization of the sinus [11].

Computed tomography (CT) may demonstrate abnormally high density of the lumen of the sinus, which does not enhance after intravenous contrast administration. Enhancement of the dura surrounding the sinus may be prominent, causing the “empty triangle”, or “delta sign”, which may suggest the diagnosis. This sign is not seen in all cases of lateral sinus thrombosis [2, 12, 13].

MRI is superior to CT scanning in detecting lateral sinus thrombosis [1, 12, 13]. MRI shows blood flow, sinus obstruction, and subsequent reversal of the flow. It also allows for earlier and more precise diagnosis of lateral sinus thrombosis and better delineates both its extent and the involvement of the surrounding structures. An early thrombus has an intermediate intensity on T1-weighted images and low intensity on T2-weighted images because it is rich in deoxyhemoglobin. As the clot matures, methemoglobin forms and the MRI appearance changes so that the clot becomes hyperintense on both T1- and T2-weighted images [13]. T2-weighted MRI is sensitive to mucosal changes and accumulation of fluid in the mastoid air cells [14].

Mastoid changes are frequently detected on MRI in case of nonseptic lateral sinus thrombosis. This mastoid abnormality consists of an increased T2-weighted MRI signal in

Table 1 Differences between septic and nonseptic lateral sinus thrombosis

No	Septic lateral sinus thrombosis	Nonseptic lateral sinus thrombosis
1	Associated with ear or sinus infection	Not associated with ear or sinus infection
2	Seen in both women than men	Seen more often in women than men
3	Occurs in all ages	Usually occurs in adolescents or adults
4	Requires surgical management	Requires medical management
5	MRI mastoid picture changes are due to mastoiditis	MRI mastoid picture changes are not due to mastoiditis
5	Anticoagulants therapy is usually not required	Anticoagulants therapy is required

the mastoid air space due to mucosal thickening within the air cells. These changes are not due to mastoiditis but it is due to venous congestion as a consequence of thrombosis [3]. Occlusion of the lateral sinus as a result of a nonseptic thrombus impairs venous drainage from the mastoid cells, resulting in venous congestion, interstitial edema, and transudation of fluid into the air spaces [1, 14].

Fink and McAuley found mastoid abnormality on MRI in 9 of 23 (39 %) cases of nonseptic lateral sinus thrombosis [13]. Minimal mucosal irregularity within mastoid air cells may be associated with nonseptic lateral sinus thrombosis. The mastoid air cells may have the appearance of florid mastoiditis on CT or MRI. These findings are often enough to alert the primary care physician and the radiologists to the possibility of coexisting mastoiditis. Mastoid radiologic findings should be considered only in conjunction with other pertinent clinical information necessary for the diagnosis of mastoiditis, such as fever, a history of otitis media, hearing loss, or coalescence [1].

The aim of treatment of nonseptic lateral sinus thrombosis is

1. To prevent propagation of the thrombus;
2. To avoid the thromboembolism phenomenon; and
3. To control elevated intracranial pressure, when present [1].

Most authors recommend anticoagulant therapy for the management of nonseptic lateral sinus thrombosis [1–3, 13–15]. This condition should be identified early and patient should be started on anticoagulant therapy to prevent thromboembolism and its complication. Duration of treatment depends on extent of thrombosis and patients condition. This condition responds well to anticoagulant therapy and surgical intervention is not required. The differences between septic and nonseptic lateral sinus thrombosis is summarized in Table 1.

Our first patient was a smoker for the past 9 years. Second patient was using oral contraceptives for the past 3 years. Third patient developed nonseptic lateral sinus thrombosis following head injury. Review of the literature did not show any case report of isolated nonseptic type lateral sinus thrombosis following head injury. To best of

our knowledge this is the first case report of isolated nonseptic type lateral sinus thrombosis following head injury.

Conclusion

Mastoid abnormalities are seen on MRI in majority of the patients with nonseptic lateral sinus thrombosis. Minimal mucosal irregularity within mastoid air cells may be associated with nonseptic lateral sinus thrombosis. These changes are not due to mastoiditis but it is due to venous congestion as a consequence of thrombosis and do not require any surgical treatment. An otologist should be familiar with the existence of the nonseptic variant of lateral sinus thrombosis for early recognition and initiation of appropriate therapy. Prognosis is good and any predisposing factors should be identified and managed accordingly.

References

1. Rosen A, Scher N (1997) Nonseptic lateral sinus thrombosis: the otolaryngologic perspective. *Laryngoscope* 107(5):680–683
2. Ooi EH, Hilton M, Hunter G (2003) Management of lateral sinus thrombosis: update and literature review. *J Laryngol Otol* 117(12):932–939
3. Viswanatha B (2009) Nonseptic lateral sinus thrombosis. *Ear Nose Throat J* 88(1):731–733
4. Bouser MG, Chiras J, Bories J et al (1985) Cavernous venous thrombosis: a review of 38 cases. *Stroke* 16(2):199–213
5. Imai WK, Everhart FR, Sanders JM (1982) Cavernous venous thrombosis: a report of a case and review of literature. *Pediatrics* 70:965–970
6. Pannke TS (1991) Cerebral dural venous thrombosis. *Ann Emerg Med* 20:813–816
7. Inauen W, Baumgartner HR, Haeberli A, Straub PW (1987) Excessive deposition of fibrin platelets and platelet thrombi on vascular subendothelium during contraceptive drug treatment. *Thromb Haemost* 57(3):306–309
8. Poltera AA (1972) The pathology of intracranial venous thrombosis in oral contraception. *J Pathol* 106:209–219
9. Mohammad W, Suleman K, Alper ID, George B, Zubair S (2010) Headache in cerebral venous thrombosis: incidence, pattern and location in 200 consecutive patients. *J Headache Pain* 11:137–139

10. Ravishankar K (2006) Incidence and pattern of headache in cerebral venous thrombosis. *J Pak Med Assoc* 56(11):561–564
11. Goldenberg RA (1985) Lateral sinus thrombosis. Medical or surgical treatment ? *Arch Otolaryngol* 111(1):56–58
12. Irving RM, Jones NS, Hall-Craggs MA, Kendall B (1991) CT and MR imaging in lateral sinus thrombosis. *J Laryngol Otol* 105(8):693–695
13. Levine SC, DeSouza SC (2002) Intracranial complications of otitis media. In: Glasscock M II, Gulya A (eds) *Glasscock-Shambaugh surgery of the ear*, 5th edn. BC Decker, Hamilton, pp 443–461
14. Fink JN, McAuley DL (2002) Mastoid air sinus abnormalities associated with lateral sinus thrombosis: cause or consequence? *Stroke* 33(1):290–292
15. Hawkins DB (1985) Lateral sinus thrombosis: a sometimes unexpected diagnosis. *Laryngoscope* 95(6):674–677