Gradenigo's Syndrome - A Sequela of Chronic Otitis Media: A Case Report of Successful Medical and Surgical Management

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ABSTRACT

Background:

Gradenigo's syndrome is a rare, complex, and potentially life-threatening complication of suppurative otitis media, classically defined by the triad of otorrhea, retro-orbital pain, and ipsilateral abducens nerve palsy.

Case Presentation:

A 54-year-old male with uncontrolled diabetes presented with a one-month history of progressive left ear pain, deep-seated retro-orbital pain, double vision, and occasional scanty ear discharge. Clinical examination revealed mastoid tenderness, a retracted pars tensa, and left lateral rectus palsy. High-resolution computed tomography (HRCT) of the temporal bone confirmed left otitis media, mastoiditis, and petrous apicitis.

Management:

Initial medical management included broad-spectrum intravenous antibiotics (Piperacillin-Tazobactam and Metronidazole) and strict glycemic control via an insulin sliding scale. Once stabilized, the patient underwent a left modified radical mastoidectomy and petrous apex dissection utilizing a combined microscopic and endoscopic approach, alongside a concurrent type 3b ossiculoplasty. This approach allowed for the complete clearance of keratin debris, cholesteatoma matrix, and granulation tissue.

Outcomes:

The patient demonstrated tremendous postoperative improvement, experiencing rapid relief from ear pain, headache, and retro-orbital pain. A clinical reduction in lateral rectus palsy was also observed. Long-term follow-up up to one year showed sustained recovery, and postoperative pure tone audiometry at six months indicated a mild conductive hearing loss with good functional improvement.

Conclusion:

This case underscores the efficacy of early diagnosis and a combined medical-surgical approach in managing petrous apicitis with cranial nerve involvement. The integration of endoscopy with microscopic dissection alongside functional ossicular reconstruction safely achieves complete disease eradication while prioritizing hearing preservation.

Keywords: Gradenigo's syndrome; Petrous apicitis; Chronic otitis media; Abducens nerve palsy; Ossiculoplasty; Endoscopic ear surgery.

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INTRODUCTION:

Gradenigo's syndrome is a rare, complex, and potentially life-threatening complication of suppurative otitis media. It is classically defined by the clinical triad of otorrhea, deep-seated retro-orbital pain, and ipsilateral abducens nerve palsy[1]. While the advent of the modern antibiotic era has drastically reduced the incidence of petrous apicitis, the anatomical vulnerability of the temporal bone's petrous apex to the direct spread of mastoid infection remains[2].

The distinct clinical presentation arises from the physical proximity of this region to critical neurovascular structures, specifically the trigeminal ganglion and the abducens nerve as it traverses Dorello's canal[3]. Because the classical triad is frequently incomplete at initial presentation and routine clinical examination of the petrous apex is impossible, delayed diagnosis is a significant risk[4].

This report details a contemporary presentation of Gradenigo's syndrome secondary to a squamosal type of chronic otitis media. We emphasize the critical role of prompt radiological evaluation and the efficacy of a combined microscopic and endoscopic surgical approach in achieving complete disease clearance and remarkable functional recovery[3].

CASE REPORT:

A 54-year-old male, known diabetic with uncontrolled sugars, presented to the ENT OPD with complaints of left ear pain since 1 month which was insidious in onset and gradually progressive. Patient also complained of headache and deep-seated pain behind the left eye with double vision since 1 month. There was history of occasional scanty ear discharge. On ear examination, mastoid tenderness was present on the left side. Otoscopic examination revealed the following findings. In the left ear, the EAC was congested and edematous and tympanic membrane showed congestion and grade 2 retraction of pars tensa. In the right ear, the EAC was normal and tympanic membrane was congested and thinned out.

Tuning fork test suggested a moderate conductive hearing loss in the left ear. There were no signs of facial nerve weakness or vestibular dysfunction and fistula test was negative. There was impairment of movement of left eye on lateral gaze, suggestive of left lateral rectus palsy.

Pure tone audiometry done suggested moderate gradually falling mixed hearing loss in left ear(Figure 1). HRCT Temporal bone was suggestive of left petrous apicitis and opacification of the petrous apex air cells with possible bone erosion"(Figure 2 and 3) with random blood glucose levels being 256 mg/dl, white blood cell count is 11,900 cells per microliter and HbA1C is 12.0%.

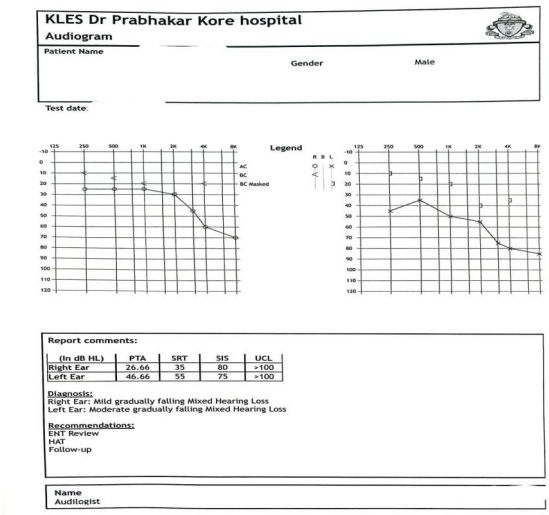

Figure 1

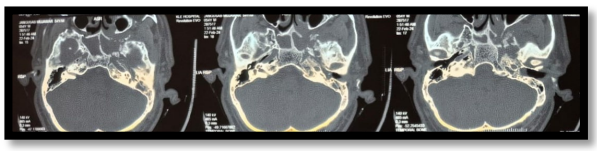

Figure 2

Figure 3

Routine blood investigations were done and patient was started on with intravenous Piperacillin–Tazobactam 4.5 g four times a day and Metronidazole 500mg 3 times a day. Ophthalmology and endocrine started treatment for lateral rectus palsy and Human Actrapid administered as a sliding scale insulin regimen for controlling high sugars.

Once patient was fit for surgery, left modified radical mastoidectomy with left petrous apex dissection using both the microscope and endoscope with also type 3b ossiculoplasty was done under general anaesthesia. Intraoperative findings were as follows: Grade 2 retraction of pars tensa of tympanic membrane; Keratin debris with Cholesteatoma matrix noted in epitympanum extending posteriorly into the mastoid antrum, sac was meticulously dissected and removed using a combined microscopic and endoscopic approach to ensure complete clearance from the perilabyrinthine areas. Granulation tissue was noted in the mastoid antrum and around the malleus which was removed; Granulation followed along the posterosuperior part of mastoid air cells until complete clearance of granulation obtained. Hypermobility of malleus was noted and malleus removed; Chorda tympani was identified and preserved; The short process of incus was eroded and incudostapedial joint destruction was noted (Figure 4); Incus was removed; Septal cartilage was refashioned and kept over the stapes head, over which the temporalis fascia graft was placed; Tympanomeatal flap was then repositioned.

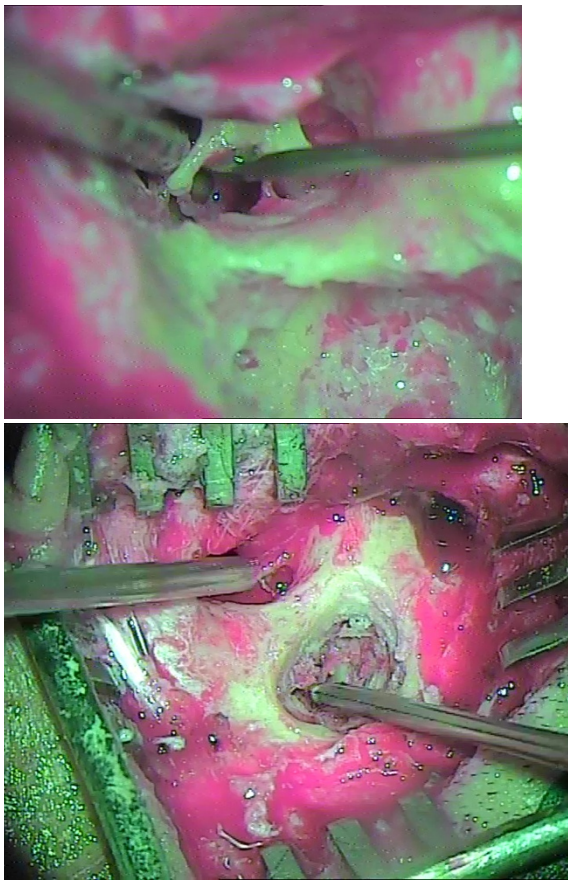

Figure 4

Postoperatively patient showed substantial symptomatic improvement in terms of left ear pain, headache and deep-seated eye pain. Reduction in the degree of lateral rectus palsy was also clinically appreciated with maximal neurological recovery noted at 6 months followup. 12 days postoperatively, patient was discharged on a 1-week course of antibiotics and other symptomatic medications. He was followed up weekly till one month post-surgery (Figure 5) and once every month till 6 months and once in 3 months for next 6 months (Figure 6) till 1 year post-surgery. Reduction in the degree of lateral rectus palsy was also clinically appreciated with maximal neurological recovery noted at 6 months followup. Pure tone audiometry done preoperative pure tone average (PTA) was 46.66 dB HL, indicating mixed hearing loss with an air–bone gap (ABG) of 15 dB. Postoperatively after 6 months, the PTA improved to 26.66 dB HL, consistent with conductive hearing loss and a reduced ABG of 5dB. Post operatively the patient showed good improvement in terms of functional gain of Abducens and relief from the retro orbital pain. Patient reported an improvement in

VAS pain score decreased from 8/10 pre-operatively to 3/10 post-operatively (0 being no pain and 10 being worst possible pain).

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Figure 5- Follow up at 1 month post operative

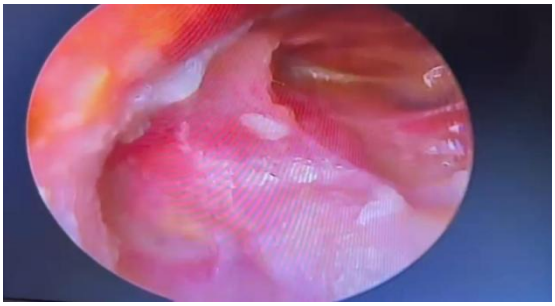

Figure 6- 1 year post operative pictures of cavity

DISCUSSION:

Among the assortment of sequelae of otitis media, Gradenigo's syndrome is a unique and uncommon condition. The primary cause of the condition is the spread of infection from the middle ear to the petrous apex of the temporal bone.It is classically characterized by the triad of persistent otorrhea, deep retro-orbital pain due to trigeminal nerve (CN V) involvement, and ipsilateral lateral rectus palsy caused by abducens nerve (CN VI) paralysis leading to diplopia[2,3].

Uncontrolled diabetes mellitus impairs local immunity by causing neutrophil dysfunction, reduced chemotaxis, and diminished phagocytosis, allowing persistent infection in chronic otitis media. Diabetic microangiopathy leads to basement membrane thickening, endothelial damage, and reduced tissue perfusion, resulting in hypoxia and poor antibiotic penetration. Hyperglycemia also promotes bacterial proliferation and biofilm formation, increasing the virulence of pathogens. These factors accelerate osteitis and osteomyelitis within the mastoid bone. Consequently, infection spreads through bony channels to the poorly pneumatized, poorly vascularized petrous apex, predisposing to petrous apicitis and Gradenigo's syndrome[3].

From Life-Saving to Functional Preservation: Historical surgical interventions for petrous apicitis primarily focused on wide drainage and life preservation, often at the expense of middle ear function and hearing. In contrast, our approach demonstrates the modern otologic priority of combining aggressive disease clearance with functional reconstruction. By performing a Type 3b ossiculoplasty same time as the modified radical mastoidectomy and apical dissection, we achieved both source control of the infection and hearing rehabilitation[4,5].

Furthermore, the utilization of an endoscope as an adjunct to the operating microscope provided a distinct advantage. The endoscope allowed for superior, angled visualization of the hidden epitympanic recesses and the deep tracts leading to the petrous apex, ensuring complete eradication of granulation tissue that might have been missed with microscopic line-of-sight alone, while minimizing the need for extensive, potentially morbid bone removal[5].

The patient was managed with intravenous Piperacillin–Tazobactam 4.5 g four times a day and Metronidazole 500mg 3 times a day to provide broad-spectrum antimicrobial coverage against aerobic and anaerobic pathogens as per culture report of ear discharge . Strict glycemic control was maintained using Human Actrapid administered as a sliding scale insulin regimen. This combined approach effectively targeted the infection while optimizing metabolic status to promote recovery and prevent complications. Postoperatively, the patient showed improved abducens function with relief of retro-orbital pain, as reflected by a reduction in VAS score from 8/10 to 3/10.

Conclusion

This case highlights the importance of maintaining a high index of suspicion for Gradenigo Syndrome in patients presenting with otitis media symptoms, especially in the setting of uncontrolled diabetes and cranial neuropathies such as lateral rectus palsy. Early diagnosis using imaging and prompt initiation of intravenous antibiotics, followed by timely surgical intervention, are critical in preventing life-

threatening complications. Our patient showed marked postoperative improvement, both symptomatically and functionally, underscoring the effectiveness of a combined medical-surgical approach in managing petrous apicitis with associated cranial nerve involvement.

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