Steroid-Responsive Gradenigo’s Syndrome Mimicking Subdural Hematoma

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Abstract

Gradenigo’s syndrome (GS) is featured by a clinical triad of otorrhea, retro-orbital pain, and a sixth nerve palsy. Clinical examination is crucial prior to considering neuroimaging. The majority of cases are secondary to infection thus requiring long-term broad-spectrum antibiotics; severe cases also require surgical intervention for risk of intracranial abscess or even death.

The patient was a 35-year-old female who presented with right temporal headache and right retro-orbital pain. The initial diagnosis from the local clinic was of subdural hemorrhage. Cranial nerve (CN) VI paresis was noted upon examination and inflammatory process was documented based on brain MR. The patient was diagnosed with Gradenigo’s syndrome and administered antibiotics and steroids. Symptoms recurred after cessation of steroids and once antibiotics-related fever developed. The symptoms resolved after stopping the antibiotics and reintroducing steroids. The MRI performed after three months recorded no brain inflammation.

We report a Gradenigo’s syndrome caused by chronic inflammation with good response to steroids. To our best knowledge, there were merely approximately 80 patients who were reported with Gradnigo or Gradenigo’s syndrome before. Infection comprised 76% of cases, thus broad-spectrum and long-term antibiotics use have been emphasized instead of steroid use. However, steroids also play an important role in reducing nerve injury by edematous change.

Introduction

Gradenigo’s syndrome (GS) was first described in a case series by Giuseppe Gradenigo in 1904 [1]. GS is characterized by the clinical triad of otorrhea, retro-orbital pain, and sixth nerve palsy. Moreover, it is commonly caused by the progression of untreated or incompletely treated otitis media. However, the classical triad may not always be observed in GS. Even in the original series by Gradenigo, only 42% (24 of the 57 cases) of patients presented with the classic triad. Other patients exhibited the complete triad of symptoms without evidence of petrous bone inflammation.

The patient was a 35-year-old female who presented with right temporal headache and right retro-orbital pain. The initial diagnosis from the local clinic was of subdural hemorrhage. Cranial nerve (CN) VI paresis was noted upon examination and inflammatory process was documented based on brain MR. The patient was diagnosed with Gradenigo’s syndrome and administered antibiotics and steroids. Symptoms recurred after cessation of steroids and once antibiotics-related fever developed. The symptoms resolved after stopping the antibiotics and reintroducing steroids. The MRI performed after three months recorded no brain inflammation.

We report a Gradenigo’s syndrome caused by chronic inflammation with good response to steroids. To our best knowledge, there were merely approximately 80 patients who were reported with Gradnigo or Gradenigo’s syndrome before. Infection comprised 76% of cases, thus broad-spectrum and long-term antibiotics use have been emphasized instead of steroid use. However, steroids also play an important role in reducing nerve injury by edematous change.

Categories: Emergency Medicine, Neurology, Otolaryngology

Keywords: gradenigo syndrome, gradenigo’s syndrome, sixth nerve palsy, retro-orbital pain, otorrhea, subdural hematoma, petrous apicitis

Case Presentation

A 35-year-old woman without a significant medical history presented to a regional hospital due to severe pain over the right temporal and right retro-orbital area for two weeks, followed by double vision and right
facial numbness for three days. The patient claimed the absence of fever, ear pain, hearing loss, and head trauma. However, she had a habit of picking the right ear for several years. Non-contrast-enhanced brain CT scan showed a high-density region along the right falx cerebri to the tentorium cerebelli. Thus, she was referred to our hospital for suspected subdural hemorrhage.

Neurological examination revealed right abducens palsy and paresthesia in the area involving the maxillary and mandibular branches of the right trigeminal nerve. The tympanic membrane was normal. Blood examinations showed a normal white blood cell count (6.16 × 10³/uL), but elevated inflammatory marker levels (erythrocyte sedimentation rate [ESR]: 86 mm/h, C-reactive protein level: 1.81 mg/dL). The cerebrospinal fluid assessment results were normal, except for elevated total protein levels (88 mg/dL), and cultures were sterile. Moreover, autoimmune and coagulation disorders including HIV were ruled out. The homocysteine, antinuclear antibodies (ANA), rheumatic factor, antistreptolysin O titer (ASOT), C3, C4, IgG, IgM, IgA, d-dimer, anti-thrombin III, lupus anticoagulant, protein C and S, rapid plasma reagin (RPR), anti-cardiolipin IgG, alpha-fetoprotein (AFP), carcinoembryonic antigen (CEA), cancer antigen (CA)-125, CA-153, CA19-9, squamous cell carcinoma (SCC), and hemoglobin A1C (HbA1c) levels and thyroid function were normal. After adjusting the window of initial brain CT at clinic, there was less pneumatized mastoid air cell system suggesting chronic otitis media at right ear (Figure 1A). Contrast-enhanced brain MRI showed pachymeningitis involving the right tentorium cerebelli and the right temporal region, leptomeningitis in the right temporo-occipital region (Figure 1B), cerebritis in the right temporal lobe (Figure 1C), inflammation in the right side of the Meckel cave (Figure 1D) and the Dorello canal (Figure 1E), and right otomastoiditis with petrous apicitis. Thus, the patient was diagnosed with GS, and broad-spectrum antibiotics were administered. Symptoms resolved five days after steroid treatment (Figure 2). However, the patient developed high fever after two weeks, which was refractory to antipyretic medications. Next, she presented with generalized skin rash, but not until developing a drug reaction with eosinophilia and systemic symptoms (DRESS) for lacking of eosinophilia nor internal organs dysfunction [4]. Her symptoms initially improved after methylprednisolone therapy but recurred after discontinuation. To rule out infection, right modified radical mastoidectomy and myringotomy with Grommet insertion were performed for pathologic assessment. Results showed chronic inflammation with fibrosis. Since the bacterial culture results were negative, antibiotic therapy was discontinued, and methylprednisolone therapy was maintained. Fever then subsided after two days, and symptoms improved simultaneously. The patient was discharged after one month, with complete resolution of symptoms and without neurological sequelae. Although the patient was asymptomatic, she was treated with methylprednisolone 4 mg 0.5-2 tabs per day due to elevated ESR levels in the outpatient department. Follow-up brain MRI was performed after three months, and results showed complete resolution of signal abnormalities (Figures 1C, 1F).
FIGURE 1: Brain computed tomography (CT) scan and magnetic resonance imaging (MRI) results indicated Gradenigo’s syndrome, which was characterized by pachymeningitis, leptomeningitis, and cerebritis.

Non-contrast-enhanced brain CT scan showed right petrous apicitis with ill-defined irregular edges, and there was soft tissue in the mastoid cavity and less pneumatized mastoid air cell system (arrowhead) as compared to the opposite side suggesting chronic otitis media. (A). Brain MRI revealed pachymeningitis, leptomeningitis, and cerebritis involving the right tentorium cerebelli (B) and the right temporal region (C). Moreover, there was inflammation in the Meckel cave and CN V (arrowhead) (D). The right Dorello canal was swollen compared with the left one (arrowheads) (E). Follow-up MRI revealed the complete resolution of previous signal abnormalities. Cerebritis in the right temporal area [(F) vs (C)].
FIGURE 2: Right abducens nerve paresis improved after steroid treatment.

(A) At the initial presentation, right abducens nerve paresis was observed, and the patient presented with diplopia, particularly looking toward the right side. (B) Diplopia disappeared gradually after 5 days of steroid treatment, and there were no limitations in eyes movement.

Discussion

Herein, we describe a young woman with idiopathic GS that responded well to steroids. Data that can be used as a guide by clinicians in the workup, treatment, and assessment of similar cases is limited. Hence, more scientific evidence must be collected.

We searched Medline, PubMed, and Google scholar and Google search engines using the following keywords: (Gradnigo OR Gradenigo’s syndrome OR Gradenigo’s OR apicitis OR idiopathic Gradnigo). Then, the references and citations of each study, published from 1980 to 2021, were assessed. Reports describing apicitis but not GS were excluded. Finally, we retrieved 60 relevant articles, which included 80 patients diagnosed with GS (Table 1) [1,5-63].

| Reference          | Age (yrs)/gender | Medical history/Preceding events | Etiology                              | Treatment             | Prognosis                  |
|--------------------|------------------|---------------------------------|---------------------------------------|-----------------------|---------------------------|
| 1980, Paolucci, et al. [5] | NA               | NA                              | Metastasis of prostatic carcinoma     | NA                    | NA                        |
| 1983, Chole, et al. [6]        | 78M; 57M; 18F; 46M; 65M; 73M; 28M | Histiocytic lymphoma; cholesteatoma; severe deep ear pain; ototmea and hearing loss*; ototmea(12yrs); healthy; deafness; congenital petrous apex cholesteatoma | Bacterial infection | All surgery | Vernet's syndrome and died (73M) |
| 1984, Capanna, et al. [7]      | 19M              | NA                              | Gunshot                               | craniotomy            | NA                        |
| 1988, Ggraaf, et al. [8]       | 58F              | Otosclerosis, right stapes       | Bacterial infection                   | NA                    | NA                        |
| 1989, Norwood, et al. [9]      | 13M              | Healthy                          | T Cell lymphoma                       | chemotherapy and radiotherapy | NA                        |
| Year  | Authors             | Gender | Age/Additional Details | Diagnosis                              | Treatment                                      | Outcome                                                                 |
|-------|---------------------|--------|------------------------|-----------------------------------------|------------------------------------------------|------------------------------------------------------------------------|
| 1991  | Grewal, et al.      | 3 Patients | NA | TB                      | NA                                            | NA                                                                 |
| 1992  | Hehl, et al.        | 36F_bilateral | NA | NA                      | hyperbaric oxygenation                       | NA                                                                 |
| 1993  | Linstrom, et al.    | 42M     | HIV                    | B-cell non-Hodgkin's lymphoma            | chemotherapy                                   | NA                                                                 |
| 1995  | Hardjasudarma, et al.| 32M | Healthily              | Bacterial infection                      | Abx                                            | NA                                                                 |
| 1997  | Morales, et al.     | 44M     | HIV, right ear surgery recent | Bacterial infection                      | Abx                                            | NA                                                                 |
| 1998  | Bourne, et al.      | 45M     | myeloma                | Intracranial plasmacytoma                | NA                                            | NA                                                                 |
| 1999  | Minotti, et al.     | 47F; 36F(bilateral) | Healthy; bilateral chronic otitis media | Bacterial infection | Surgery and Abx; Surgery, Abx, dexamethasone, mannitol, and Dilantin. | NA                                                                 |
| 2000  | Motamed, et al.     | 78M     | T2DM                   | Bacterial infection                      | Abx                                            | Vernet's syndrome, aspiration pneumonia.                              |
| 2001  | Penas-Prado M, et al.| 53M | Healthy                | NPC                                     | Radiotherapy                                   | NA                                                                 |
| 2002  | Mathew, et al.      | 25M; 12M | Healthy; Healthy       | Bacterial infection                      | Abx, mastoidectomy; Abx, mastoidectomy        | NA                                                                 |
| 2004  | Sherman, et al.     | 55M     | T2DM                   | Bacterial infection                      | 6wks Abx(ceftrin), myringotomy                 | NA                                                                 |
| 2005  | Burston, et al.     | 6M(bila.), 71M | Nil, bilateral chronic suppurative otitis media, and a left pars tensa perforation | Bacterial infection | Abx(cef), myringotomies; Abx(metro 4w, ceftr 6w, Cipro 6w, clinda)Streptococcus milleri | remained well over the ensuing 12 months |
| 2006  | Jana, et al.        | 15M     | NM                     | NPC                                     | Chemotherapy+ RT                               | NA                                                                 |
| 2007  | Bravo, et al.       | 53M     | Healthy                | Bacterial infection                      | chloramphenicol and ceftriaxone, for 21 days | NA                                                                 |
| 2010  | Ilias Kantas, et al.| 24F | infection of the upper respiratory tract one month ago | Bacterial infection | Abx Streptococcus pneumoniae | hearing loss was recovered                                                   |
| 2010  | Tornabene, et al.   | 60F     | breast cancer          | Bacterial infection                      | Abx                                            | complete resolution of her facial pain and right abducens nerve palsy after 2 months |
| 2011  | José Luiz Pedroso, et al. | 33F | smoked for 9 years.    | Diffuse giant B-cell non-Hodgkin’s lymphoma and a nasopharyngeal mass | chemotherapy                                   | NA                                                                 |
| 2012  | Burak Ulkumen, et al.| 56M | Healthy                | Bacterial infection                      | Abx                                            | NA                                                                 |
| Year       | Authors                        | Age | Gender | Diagnosis | Treatment                          | Outcome                                                                 |
|------------|--------------------------------|-----|--------|-----------|-------------------------------------|------------------------------------------------------------------------|
| 2012       | Delgado, et al. [28]            | 28F | Healthy| Bacterial infection | Staphylococcus aureus | NA                                                                     |
| 2012       | Esteban Espinola Duarte, et al. | 29M | deaf-mute | NPC       | Chemotherapy + RT                  | NA                                                                     |
| 2013       | Bhatt, et al. [30]              | 72M | CSOM   | Aspergillus | Prednisolone 60 mg QD + Augmentin, ceftr; metro, liposomal amphotericin B, voriconazole | Facial palsy was still present at three months' follow up and was managed with tarsorrhaphy. |
| 2013       | Macasaet, et al. [31]           | 54F | Ear discharge 6 months prior | post-mastoidectomy recurrent chronic supplicative otitis media with cholesteatoma formation | Ceftriaxone, Amikacin, Gentamicin, Ceftriaxone, Amikacin, Gentamicin | Hoarseness and lateral gaze palsy remained. |
| 2014       | Chen, et al. [32]               | 64F, 33F, 58M, 46M | Pulmonary TB; COM; HTN; Healthy; previous tympanoplasty | TB | Mastoidectomy; Abx for 13 months; mastoidectomy, Abx for 12 months; mastoidectomy, Abx; mastoidectomy, Abx | Recovery of CN deficits after operation 20 d to 4 months |
| 2014       | Khalatbari, et al. [33]         | 46M | NA     | Solitary Osseous plasmacytosis | Radiotherapy | No recurrence or progression to multiple myeloma 4 yrs later |
| 2014       | Valles, et al. [34]             | 36F | NA, 23 weeks pregnant | Sinus thrombosis | Enoxaparin | NA |
| 2014       | Yuvatiya Poddai, et al. [35]    | 63M | NA     | Bacterial infection | Ceftriaxime + Levofoxacin | Complete recovery 2 months later |
| 2015       | Lattanzi, et al. [36]           | 60F | NA     | Cholesterol granuloma. | NA | NA |
| 2016       | Elham Ouspid, et al. [37]       | 65F | NA     | NPC       | Radiotherapy | 4 months later patient expired due to fulminant sepsis |
| 2017       | Jbali Souheil, et al. [38]      | 55F | NA     | Budd Chiari syndrome, | Radiotherapy | NA |
| 2016       | Jensen, et al. [39]             | 5M, 46F, 70F, 13M | AOM 1 mo, AOM 1 mo | Bacterial infection complicate with sinus thrombosis; Hemolytic streptococcus group A; Streptococci species; GNB; Candida | Mastoidectomy, Abx, LMWH; Abx; Abx; mastoidectomy; Abx, mastoidectomy, Abx, surgery | No relapse in 18 months, nil, nil, ni; |
| 2016       | Nayya, et al. [40]              | 55F | NA     | Bacterial infection | Abx, mastoidectomy | Well |
| 2017       | Grade, et al. [41]              | 40 years follow up of 44 patients | Mainly infection | Abx and surgery | 1 of them died |
| 2017       | Nicholas Taklalsingh, et        | 30F | Left ear discharge since 10-15 years | Congenital neuroenteric cyst and bacterial infection | Abx | NM |
| 2017       | Jensen, et al. [43]             | 9F  | Year-long history of CSOM | Bacterial infection | Abx and mastoidectomy | Mortality |
| 2017       | Nicholas Taklalsingh, et        |      |        |            |                      | Residual neurological |
| Year       | Author(s)                        | Age | Gender | Diagnosis | Treatment            | Outcome                                                                 |
|------------|----------------------------------|-----|--------|-----------|----------------------|-------------------------------------------------------------------------|
| 2017       | Suresh Mani, et al. [45]          | 25M | NA     | CSOM      | Bacterial infection  | Abx at least, NA                                                       |
| 2017       | Tayebeh Kazemi, et al. [46]       | 33M | NA     | CSOM      | Bacterial infection  | Abx, temporal bone CT 6 weeks later improved                            |
| 2018       | Ahmad, et al. [47]                | 61M | NA     | CSOM      | Abx and exploration  | Successful result after postoperative follow-up                         |
| 2018       | Aina Brunet-Garcia, et al. [48]   | 40M | NM     | CSOM      | Abx and surgery      | NM                                                                      |
| 2018       | Asude Aksyoy, et al. [49]         | 52M | Healthy| CSOM      | Abx and steroids, CCRT| Without any medical treatment and complaint in follow-up               |
| 2018       | Rajneesh Thaku, et al. [50]       | 51M | on and off discharge from his left ear since the age of 25 years | Bacterial infection | Abx, mastoidectomy and petrous exploration | Loss follow up |
| 2019       | Petrenko, et al. [51]             | 22F | T1DM   | Mucormycosis | Amphotericin B | NA                                                                      |
| 2019       | Conor Bowman, et al. [52]         | 67M | NA     | CSOM      | Abx                  | Has not been readmitted                                                |
| 2019       | Esmanhotto, et al. [53]           | 37F | SLE    | CSOM      | Abx                  | NA                                                                      |
| 2019       | Savasta, et al. [54]              | 11M | recurrent upper airways infections, frequently resulting in episodes of AOM since age 4 | Bacterial infection | Abx and steroids | Symptoms free for the 30 months follow-up |
| 2019       | Rossi, et al. [55]                | 4F  | Recent sinusitis | Bacterial infection | Abx and surgery | Notable improvement after 2 week |
| 2020       | Chandran, et al. [56]             | 54F; 23F | 3-year otalgic disease; contact with TB | TB | Anti-TB therapy | NA                                                                      |
| 2020       | Guilherme Correa Guimaraes, et al. [57] | 63F | HTN, T2DM | Bacterial infection* | Abx, enoxaparin | Complicated with cavernous sinus Thrombosis; total recovery 4 months after the first symptom presentation |
| 2020       | Hodges, et al. [58]              | 24M | Asthma | CSOM      | Surgery, steroids, Abx | NA                                                                      |
| 2020       | McLaren, et al. [59]              | 5F  | Healthy| CSOM      | Abx                  | Symptoms free                                                          |
| 2020       | Meena V. Kale, et al. [60]        | 3male 30-40yrs | NA | Bacterial infection* | Abx up to 8wks | NA                                                                      |
| 2020       | Nilam, et al. [61]                | 57M | Previous ear infection | Bacterial infection and chronic inflammation | Mastoidectomy, Abx | Lateral rectus palsy completely recovered |
| 2020       | Ghammam, et al. [62]              | 6F  | Healthy| CSOM      | Abx                  | Full recovery                                                           |
| 2021       | Parekh, et al. [63]               | 71M | T2DM   | NA        | Surgical and medical | Vernet's syndrome,                                                       |
TABLE 1: Previous published cases of Gradengo’s syndrome from 1980 to 2021/06

| *Pseudomonas aeruginosa, gram-positive cocci in pair, Proteus mirabilis, Alcaligenes faecalis, Enterococcus faecalis, Citrobacter koseri, and Bordetella trematum, pseudomonas aeruginosa, staphylococcus aureus, Streptococcus pneumonia, Klebsiella pneumonia |
|---|
| Abx: antibiotics |
| AOM: acute otitis media |
| CSOM: chronic suppurative otitis media |
| NA: not available |
| NPC: nasopharyngeal carcinoma |
| Surgery: radical mastoidectomy with petrous apicectomy, myringotomy |
| TB: tuberculosis |

Male predominance was observed, with a male-to-female ratio of 1.74. The average age of patients is 41.9, with the youngest aged four and the oldest 78. Approximately 76% of patients had infection. Six patients presented with nasopharyngeal carcinoma, five with cholesterol granuloma, and three with lymphoma. Moreover, other conditions including primary tumor, plasmacytoma, sinus thrombosis, and gunshot were reported. It’s crucial to identify head trauma for relatively high frequency of traumatic pathology in otolaryngologic practice, especially in young adults and males [64]. Immunosuppressed patients (HIV, type 2 diabetes mellitus, etc) were considered risk factors. Further, preceding otologic surgery and infection were commonly observed in all cases (Table 2).

| Classification (available cases/All cases) | Detailed |
|---|---|
| Gender (74/80) | M:F=1.74:1 (47M, 27F) |
| Age (74/80) | Average 41.9 years old |
| Etiology (79/80) | Infection (n=60); including bacterial infection (n=49), tuberculosis (n=9), aspergillus (n=1), and mucormycosis (n=1) |
| | Malignance (n=12); including nasopharyngeal carcinoma (n=6), metastasis of prostatic carcinoma (n=1), mass (n=1), lymphoma (n=3) and plasmacytoma (n=1) |
| | Cholesterol granuloma (n=5) |
| | Others (n=2); including gunshot (n=1) and sinus thrombosis (n=1) |

TABLE 2: Epidemiology and causes of Gradeno’s syndrome

Male is predominant with male to female ratio 1.74, average age is 41.9 with the youngest one aged 4 and the oldest aged 78. Infection composed of 76%; there were 12 cases of malignance, 5 cases of cholesterol granuloma, and also sinus thrombosis and gunshot. Immunoscompromises like HIV (case number=2) and type 2 diabetes mellitus (case number=4) were considered as the risk factors, also, preceding otologic surgery and infection were found common in all reported cases.

To the best of our knowledge, this is the first case of chronic inflammatory GS. Although the habit of ear picking does not cause otitis media but may cause otitis externa, clinicians should raise the concern of malignant otitis externa and skull base osteomyelitis caused by ear picking, particularly in immunocompromised patients. In cases of infection, high-dose broad-spectrum antibiotics are recommended. Moreover, surgery is indicated in more severe cases. The possible complications of GS include labyrinthitis, meningitis, intracranial abscess, venous sinus thrombosis, and carotid artery stenosis.

The current case is clinically defined as classic GS, which is attributed to chronic inflammation. In our patient, it was difficult to differentiate hemorrhage from inflammation due to focal high-density dural thickening on non-contrast-enhanced brain CT scan. Hence, the condition was initially misdiagnosed in the regional hospital. Subdural hemorrhage in young women is rare, and emergent vascular events including...
venous thrombosis must be ruled out as first priority for the opposite management manner and major complication if left untreated. Based on both clinical characteristics and brain MRI findings, hemorrhage and thrombosis were ruled out, and the patient was diagnosed with GS. Furthermore, we considered chronic inflammation correlated with GS after ruling out bacterial (tuberculous), fungal, and viral infections. In addition, there is no evidence of venous thrombosis or malignancy based on the assessments performed using the current diagnostic tools. We believe that the pathophysiology was associated with chronic inflammation; hence, the patient substantially benefited from steroid treatment.

Brain radiography revealed petrous apicitis that developed into leptomeningitis, pachymeningitis, and cerebritis. Even without evidence of bacterial infection, meropenem, vancomycin, and metronidazole were still administered initially via intravenous infusion to prevent progression into brain abscess and, subsequently, other morbidities and even mortality.

Steroid is used for the treatment of active inflammation, and it may be beneficial for cases with nerve compression. In our case, symptoms significantly improved after one dose of methylprednisolone 500 mg STAT. Then, methylprednisolone 8 mg every eight hours for three days was administered based on the study of Kazemi et al. [46]. However, in the current case, the condition was associated with idiopathic inflammatory process rather than pathogenic infection. Thus, prolonged treatment with steroids, rather than antibiotics, might be more suitable. We extended the treatment with methylprednisolone 8 mg every eight hours for six days, followed by a dose of 8 mg every 12 hours. Then, the treatment was changed to oral methylprednisolone 4 mg every 12 hours for three days and then once daily.

In a previous case, a teenager was finally diagnosed with Tolosa-Hunt syndrome with an apparent presentation of GS [2]. In another case, mastoiditis complicated by GS was attributed to immune-induced hypertrophic pachymeningitis [3]. There is no evidence confirming the efficacy of steroid, even though it has beneficial effects against inflammation and nerve damage. In several cases of GS, combination treatment with antibiotics and steroids has been effective [34,46,54].

Therefore, cautious clinical history taking, physical examination, and neuroimaging are required to diagnose GS. In most cases, the condition is caused by bacterial infections requiring broad-spectrum antibiotics. However, patients with chronic inflammation can have similar presentations and imaging findings and may require steroid treatment. Also, in the present case which developed also drug-related reactions, a complete allergy panel should be performed to exclude cross reactivity and exposure to environmental factors increasing chronic inflammation [65].

Conclusions

This is the first case of GS due to chronic mastoiditis (asymptomatic) based on radiological features; patients might miss subtle aura symptoms like past otalgia, aural fullness, dull pain etc.; which successfully resolved after steroid treatment. Unlike in previous cases in which patients were primarily treated with antibiotics, the current study highlighted the importance of steroids in treating inflammation and reducing nerve edema in GS after the management of infection.

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that they have no financial services. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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