surgeries

MDPI

Case Report

Probable Isolated IgG4-Related Rhinosinusitis Presenting as a Unilateral Maxillary Sinus Mass: A Case Report and Literature Review

Ada Miruna Baciu [1], Anda Gâta [1,*], Veronica-Elena Trombitaș [1,2], Sabina Lungu [1], Elena Brehuescu [1], Andra Elena Babeii [1], Sebastian Mihail Nădășan [1], Carla Lupou [1], Horia Iulius Șirlincan [1], Mădălina Ioana Lazăr [1], Alexandra Roman [3] and Silviu Albu [1,2,*]

[1] 2nd Department of Otorhinolaryngology, CF Clinical Hospital, 400015 Cluj-Napoca, Romania
[2] Department of Otorhinolaryngology, CF Clinical Hospital, 400015 Cluj-Napoca, Romania
[3] Department of Periodontology, "Iuliu Hațieganu" University of Medicine and Pharmacy, 400012 Cluj-Napoca, Romania
* Correspondence: gataanda90@gmail.com (A.G.); silviualbu63@gmail.com (S.A.)

Abstract

IgG4-related disease (IgG4-RD) is a systemic fibroinflammatory disorder that can affect multiple organs, while sinonasal involvement remains uncommon and poorly characterized. Its clinical and radiological resemblance to malignancy may delay diagnosis. We report the case of a 41-year-old man presenting with unilateral left exophthalmos, facial pain, ptosis and paraesthesia. Imaging revealed a destructive maxillary sinus mass extending into the pterygopalatine fossa and orbit, raising strong suspicion of malignancy. Endoscopic biopsy demonstrated dense lymphoplasmacytic infiltration, storiform fibrosis, obliterative phlebitis and numerous IgG4-positive plasma cells, suggestive of IgG4-associated chronic rhinosinusitis. Although the lesion fulfilled key histopathological features of IgG4-RD, its isolated maxillary sinus location potentially represents an atypical site of the disease, not included in the current ACR/EULAR classification criteria. Following surgery and corticosteroid therapy, symptoms initially resolved; however, possible local recurrence was detected four months later on PET imaging. Haematological evaluation subsequently recommended clinical surveillance without systemic immunosuppressive therapy. This case highlights the diagnostic challenges of unilateral rhinosinusitis presenting as an isolated tumour-like lesion and displaying dense IgG4 plasma cell infiltrate. IgG4-RD should be considered in the differential diagnosis of destructive sinonasal masses, even without involvement of typical organs. Histopathological evaluation is essential to guide diagnosis and management and avoid unnecessary aggressive surgery.

Keywords: IgG4-related disease; IgG4-related rhinosinusitis; sinonasal disease; maxillary sinus; tumour-like lesion; differential diagnosis

Academic Editor: Takayuki Nakagawa

Received: 5 August 2026
Revised: 15 September 2026
Accepted: 17 September 2026
Published: 21 September 2026

1. Introduction

Chronic rhinosinusitis is a frequent inflammatory disease of the nose and paranasal sinuses that persists more than 12 weeks, with a wide prevalence of approximately 10.9% [1]. Although frequently perceived by the general population as a self-limiting condition, it can affect the quality of life drastically. To be diagnosed, at least 2 of the following symptoms are needed: nasal obstruction or congestion, anterior or posterior nasal drainage, decreased sense of smell and facial pressure or pain, associated with at least 1 of the following signs:

polyps, oedema or mucopurulent discharge on endoscopy or thickening of the sinus mucosa on CT [2]. On the other hand, IgG4-related disease (IgG4-RD) is another inflammatory condition, far less diagnosed. IgG4-RD is immune-mediated and systemic, affecting various organs. It continues to receive increasing attention as the incidence and prevalence remain largely underestimated due to its similarity in symptoms and clinical characteristics to neoplastic and other inflammatory conditions [3]. In 2019 the American College of Rheumatology/European League Against Rheumatism (ACR/EULAR) organised a classification for IgG4-RD, establishing a set of entry, exclusion and inclusion criteria for diagnosis. The entry criteria are either clinical or radiologic manifestations in one of the following organs: pancreas, bile ducts, orbits, lacrimal glands, major salivary glands, retroperitoneum, kidney, aorta, pachymeninges and thyroid glands, or the evidence of a lymphoplasmacytic infiltrate of uncertain aetiology in one of the mentioned organs. Apart from the entry criteria, the physician needs to assess a list of other clinical, serological, radiologic and pathologic items as exclusion or inclusion criteria [4]. The relationship between these two pathologies is not yet well defined, even though Moteki et al. suggest that IgG4 rhinosinusitis is becoming a new clinical entity in the ENT field after observing that patients with systemic IgG4-RD also developed chronic rhinosinusitis [5]. In this case report, we aim to underline the possibility that the sinonasal symptoms could be a manifestation of IgG4-RD and to illustrate the diagnostic uncertainty surrounding isolated sinonasal involvement. In addition, we aim to review the available literature on this subject.

2. Case Presentation

A 41-year-old male patient presented to the Neurology Department complaining of left exophthalmos, left palpebral ptosis, paraesthesia and pain on the left side of the face that had begun four months earlier. The patient had a medical history of allergic asthma and allergic rhinitis and also one episode of left maxillary sinusitis 10 years prior. CT and MRI were performed, showing a parenchymatous mass centred in the left maxillary sinus and extending into the pterygopalatine fossa and orbit through the inferior orbital fissure (Figure 1). The CT scan also revealed osteolysis of the left orbital floor and of the posterior wall of the maxillary sinus. He was diagnosed with left cavernous sinus syndrome and left trigeminal neuralgia and later on, he was referred to the ENT department. The ENT local examination showed nasal septum deviation, hypertrophic inferior nasal conchae, and normal mucosa and vocal cords, with no other specific findings. There were no abnormalities on the laboratory work-up except for an increased erythrocyte sedimentation rate (25 mm/h versus a normal interval of 1–15 mm/h) and a high total cholesterol level (240 mg/dL versus a normal interval of 0–200 mg/dL). Initially, the major concern was a malignant tumour of the left maxillary sinus; therefore, a surgical approach for biopsy was planned. The patient underwent endoscopic surgery and left maxillary antrostomy was performed. The parenchymatous mass was resected completely. The resected tissue was sent for histopathological examination. Postoperative treatment included anti-inflammatory, antibiotic and haemostatic medication, and the patient was discharged after 4 days. Later on, the biopsy results showed diffuse storiform fibrosis and obliterative phlebitis of the mucosa on almost all the resected fragments, along with numerous plasma cells, lymphocytes and eosinophils (Figure 2A). Immunohistochemical analysis demonstrated approximately 40–50 IgG4-positive plasma cells per high-power field (Figure 2B), with an IgG4/CD138 ratio <40%. CD38 highlighted abundant plasma cells (Figure 2C), while no kappa or lambda light-chain restriction was identified. Only rare CD20-positive B lymphocytes were present. Periodic acid-Schiff staining was negative for fungal organisms. The histopathological findings were highly suggestive of IgG4-associated chronic rhinosinusitis.

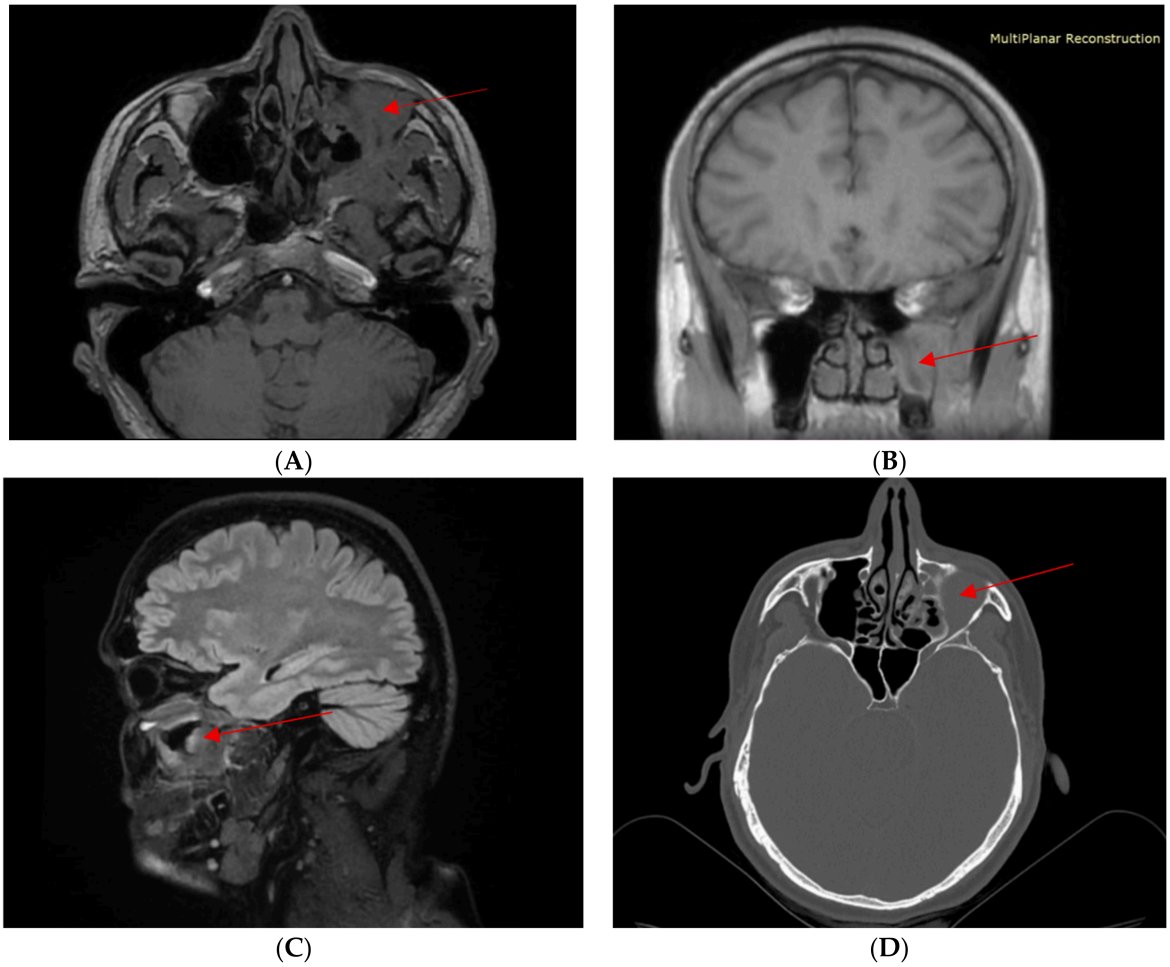

Figure 1. MR imaging (**A**–**C**), CT scan (**D**). Red arrows showing the fibroinflammatory mass invading the left maxillary sinus.

After surgery, the patient continued to complain of left facial pressure and pain; therefore, dexamethasone 8 milligrams once daily was prescribed for one week. At the one-month follow-up, his symptoms had resolved, and the local examination was unremarkable. However, the 4-month postoperative endoscopic examination revealed possible recurrent inflammatory tissue (Figure 3). The PET scan showed increased FDG uptake in the left maxillary sinus mucosa, while no evidence of involvement of other organs was identified on PET-CT. Following multidisciplinary evaluation, the patient was referred to the Haematology Department. Further evaluation included serum immunoglobulin levels (IgG, IgA and IgM) and viral serology (HIV, hepatitis viruses and HHV-8), all of which were unremarkable. In the absence of indications for systemic immunosuppressive therapy, annual clinical follow-up was recommended. Other biomarkers such as IgG4 serum level, ANCA antibodies and C-reactive protein were not available.

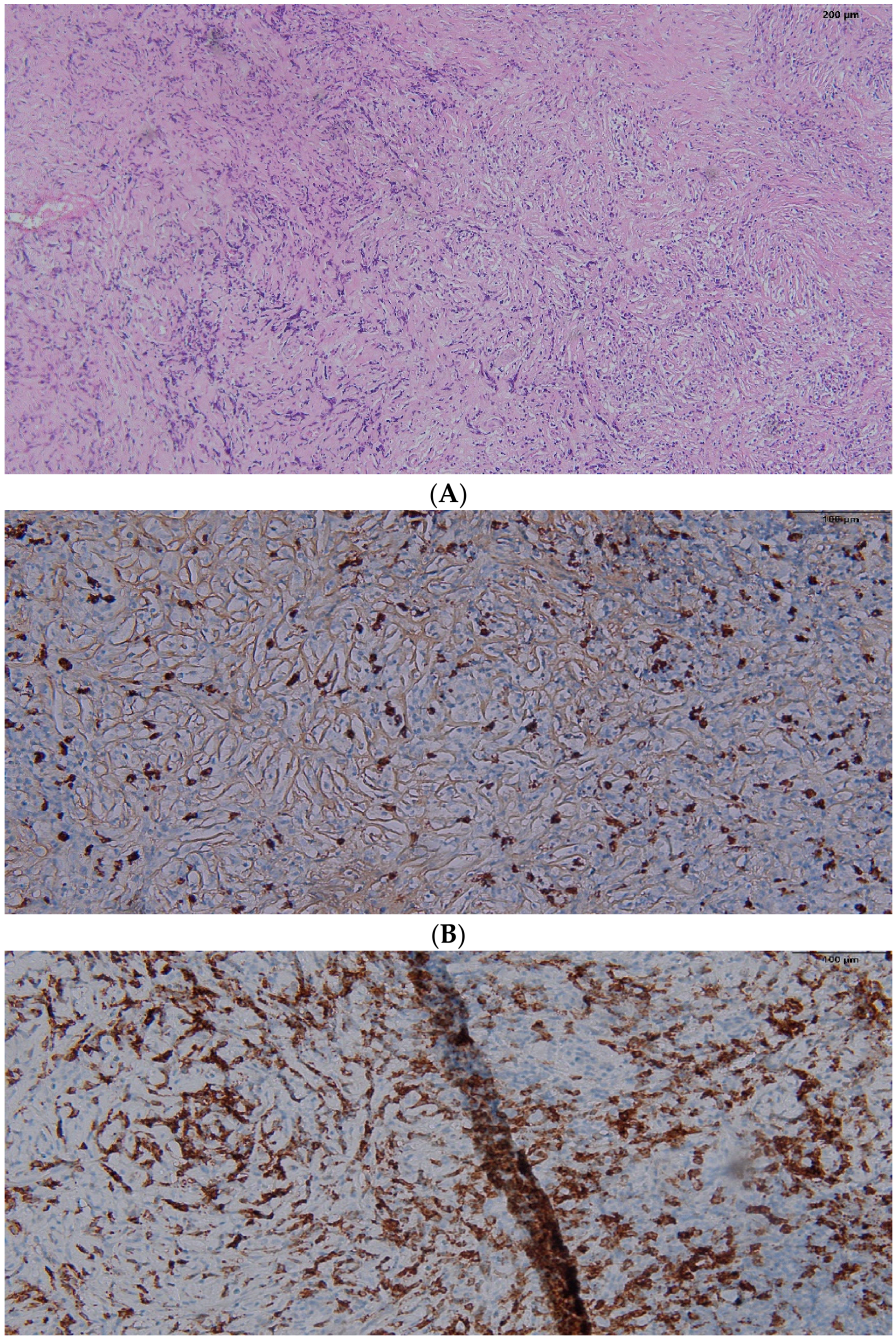

Figure 2. Haematoxylin and eosin staining of the lesion tissue showing storiform fibrosis and lymphoplasmacytic infiltrate (**A**); IgG4 staining showing numerous IgG4-positive plasma cells (**B**); CD38 staining showing numerous CD38-positive plasma cells (**C**).

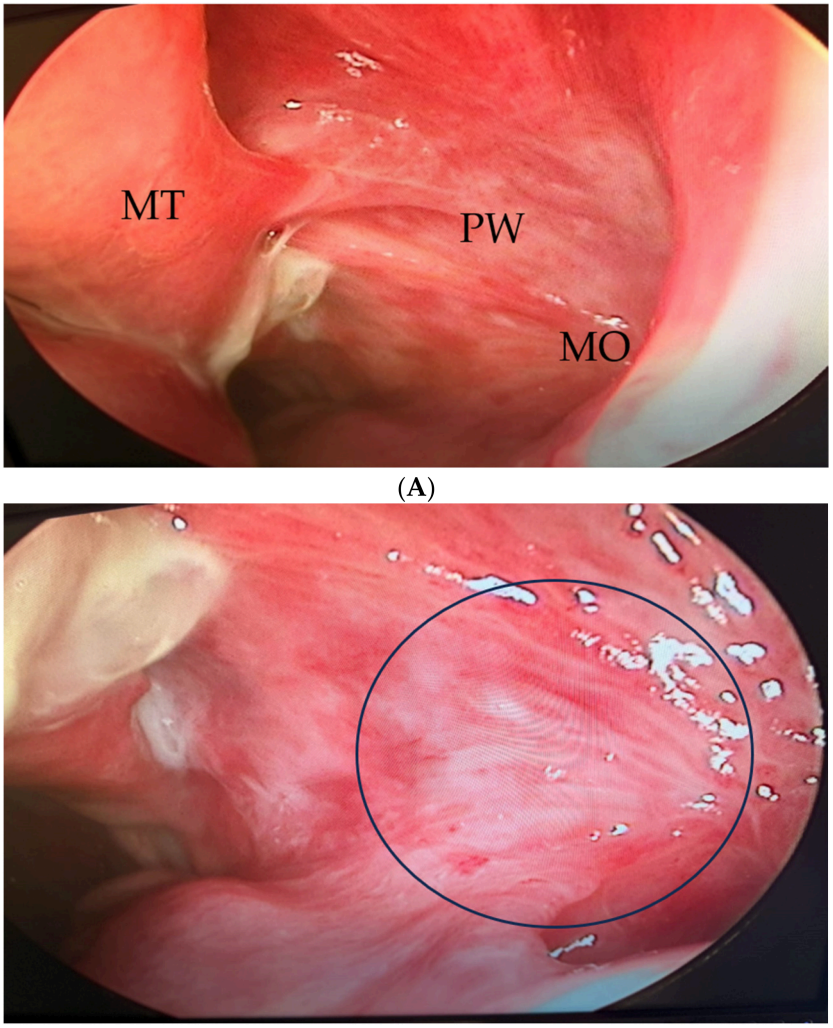

Figure 3. Nasal endoscopy. MT—middle turbinate, PW—posterior wall of maxillary sinus, MO—maxillary ostium (**A**). Maxillary ostium stenosis and posterior wall hypertrophy (area inside the circle) as a sign of possible recurrence (**B**).

3. Discussion

The two important particularities of this case are the location of the IgG4 plasma cell infiltrate, seen as an atypical site, and the unilateral tumour-like onset. On one hand, the biopsy showed lymphoplasmacytic infiltrate with numerous IgG4-positive plasma cells, along with storiform fibrosis and obliterative phlebitis, all of which are histopathological characteristics described in IgG4-RD [3]. Although our case demonstrates some of the histopathological features included among the ACR/EULAR inclusion criteria, it does not fulfil the entry criterion because of the isolated maxillary sinus location. This illustrates the challenge of applying current ACR/EULAR classification criteria to isolated sinonasal disease. On the other hand, even though our case demonstrates important histopathological criteria, the IgG4-positive to CD138-positive plasma cell ratio was under 40%, while the published literature commonly reports an IgG4/IgG ratio $\geq$40%. Although these markers are not directly interchangeable, this finding further contributes to the diagnostic uncertainty in our patient. Importantly, an IgG4/IgG ratio $\geq$40% should not be considered sufficient evidence for IgG4-RD when interpreted in isolation but should be correlated with histopathological findings and the clinical context. High serum IgG4 levels were thought to

be a hallmark for the condition until recently; however, they can be markedly heterogenous depending on the patient and the organ involved [6].

The salivary glands are already a well-known location for IgG4-RD. Nevertheless, the pathology can be identified in various head and neck locations, such as the orbit, the paranasal sinuses, the thyroid and the skull base. When the paranasal sinuses are involved, the disease can evolve either like rhinosinusitis, with obstruction, epistaxis, or anosmia, or like a mass (tumour-like involvement), developing bone erosion, perineural involvement and extension into adjacent tissue [6]. Our patient belongs to the latter group. Similar tumour-like cases have been reported in the literature [6–8], typically involving patients aged 30–50 years who presented with facial pain and headache, unilateral maxillary sinus mass extending into adjacent structures and ocular symptoms such as exophthalmos and diplopia (Table 1). In the cases identified in our literature review, the diagnostic work-up included imaging, biopsy and histopathological examination. Bone erosion was documented in only one of those cases [7], whereas all identified reports demonstrated either an IgG4/IgG ratio ≥40% or elevated serum IgG4 concentrations, neither of which was documented in our patient. Although these patients received systemic immunosuppressive treatment, the atypical sinonasal location complicated classification according to the current ACR/EULAR criteria, and diagnostic certainty remained limited in several reported cases.

Table 1. Systematization of similar cases described in the literature.

	Case 1 [6]	**Case 2 [7]**	**Case 3 [8]**
Age	33-year-old	44-year-old	49-year-old
Gender	Male	Female	Female
Localisation	Right pterygopalatine fossa, infratemporal and masticatory space extension	Right nasal cavity, ethmoid sinus, maxillary sinus and orbit	Right maxillary, ethmoid and frontal sinuses
Symptoms	Decreased visual acuity, headache, right otalgia	Right eye swelling, limited downward rotation of the right eye, diplopia on downward gaze of both eyes, pressure pain	Right-sided facial pressure, thick mucoid nasal discharge and severe frontal headache
IgG4/IgG ratio	50%	40%	N/A
IgG4 blood level	N/A	N/A	>0.500 g/L
IgG4-positive cell count/HPF	Up to 67/HPF	~50 cells/HPF	N/A
Treatment	Surgery + high-dose steroid therapy along with rituximab	Surgery + rituximab along with prednisone acetate	Surgery
Results	N/A	Smooth mucosa in the sinuses and no obvious masses	Improved symptoms but not completely resolved

During the early stages of the disease, the most common symptoms can be nasal congestion, rhinorrhoea and headaches—unspecific symptoms that can be interpreted as simple sinusitis. Cao et al. draw attention to the fact that IgG4 rhinosinusitis can be mistaken for a banal chronic sinusitis and treated with nasal corticosteroid sprays for a long time [7]. Using CT and MR imaging might not be helpful at this stage, as there are no specific signs that suggest the nature of the inflammation. It is indeed difficult to take into account this rare pathology when the chronic rhinosinusitis is clinically so much more frequent, but physicians should consider this differential diagnosis when the patient's rhinosinusitis is unresponsive to classic local treatment with corticosteroid nasal sprays.

Moreover, to fully assess the suspected disease, a PET scan that is more sensitive for the extent of the inflammation should be performed, followed by biopsy. In our case, the PET scan was performed 4 months after the surgery to evaluate the whole body for IgG4 lesions. Only the left maxillary sinus still presented high metabolic activity for FDG, which was considered compatible with postoperative healing tissue.

Due to its systemic nature, IgG4-RD can affect multiple organs at the same time, in both typical and atypical locations. Previous reports have also described sinonasal disease occurring together with typical organ involvement, supporting the concept that the paranasal sinuses may represent another manifestation of IgG4-RD, as reported by Yoshikawa et al. [9]. In their case, the diagnosis was confirmed by the histopathological result and the response to corticosteroid treatment of all lesions, even though IgG, IgG4 and IgE levels were normal. These findings underline the fact that co-existing rhinosinusitis is likely to be part of the systemic disease, rather than an unrelated inflammatory process.

Allergic reactions can also be linked to IgG4-RD, with allergic rhinosinusitis rates of >20% in patients with IgG4-RD [10]. In our case, the patient has allergic asthma and is receiving corticosteroid and beta-2 agonist treatment, with moderate airflow obstruction on spirometry. A large cohort study compared patients presenting IgG4-RD and allergic rhinosinusitis and/or chronic rhinosinusitis (case group) with patients presenting just IgG4-RD (control group). The study demonstrated that the case group had higher disease activity and a stronger atopic profile [11]. This strengthens the idea that IgG4-RD and allergic pathologies may share similar immunological pathways and that patients suffering from IgG4-RD stand a higher risk of developing atopic reactions.

The differential diagnosis of tumour-like IgG4-associated rhinosinusitis includes several inflammatory and malignant conditions. Although malignancy was initially suspected based on imaging findings, histopathological examination redirected the differential diagnosis toward fibroinflammatory and lymphoproliferative disorders. Eosinophilic rhinosinusitis is an inflammatory condition characterized by a dense eosinophilic infiltrate of the sinonasal mucosa. Takano et al. [10] reported that eosinophilic infiltration may also be present in the sinonasal mucosa of patients with IgG4-RD, suggesting a possible overlap between these two entities. Granulomatosis with polyangiitis (GPA), an ANCA-associated vasculitis defined by small vessel wall inflammation, can share clinical and histopathological features, such as abundant plasma cell infiltration and obliterative phlebitis. However, GPA demonstrates significantly fewer IgG4-positive plasma cells in the affected tissue [10]. Fungal rhinosinusitis may also present an important plasma cell infiltrate but is characterized by increased mucus secretion and interstitial oedema, rather than the interstitial fibrosis seen in IgG4-RD [12]. In our case, PAS staining for fungal rhinosinusitis was performed and proved to be negative.

Given the unilateral tumour-like presentation, sinonasal lymphoma should also be considered in the differential diagnosis. Although extranodal head and neck lymphomas most commonly arise within Waldeyer's ring, involvement of the paranasal sinuses has also been reported [13]. Certain B-cell lymphomas, particularly marginal zone (MALT) lymphoma, can mimic IgG4-RD because both entities exhibit a dense lymphoplasmacytic infiltrate. Nevertheless, finding sheets of CD20+ B cells or immunoglobulin light chain restriction favours a diagnosis of lymphoma over IgG4-RD [14]. In contrast, our case showed only rare CD20-positive B lymphocytes, arguing against this pattern.

The treatment for IgG4 rhinosinusitis should be patient-oriented and based on their clinical condition. In some less severe cases, watchful waiting is appropriate, but when the nervous system is involved, more aggressive strategies must be taken into account, like mass debulking and immunosuppressant therapy. Corticosteroids remain first-line treatment, whereas B-cell-depleting agents such as rituximab and inebilizumab represent

second-line treatment [6,15]. Given the fact that our patient presented neurological symptoms, surgical treatment was justified, followed by dexamethasone 8 mg once daily (OD) for one week. This treatment approach represents a deviation from standard IgG4-RD management, which further alleviated the residual symptoms of facial pain and pressure after the surgical debulking. However, given the short treatment duration, this response cannot be considered specific for IgG4-RD. Extended immunosuppressant treatment was not considered appropriate at this stage, and clinical surveillance was preferred due to the absence of systemic organ involvement on PET-CT, the patient's asymptomatic status and the normal serology results. This conservative approach may not be suitable for all destructive or neurological presentations, and early systemic immunosuppressive therapy should be considered, even in the absence of systemic disease.

This case has several limitations. An important limitation is the absence of serum IgG4 levels and other supportive laboratory investigations, including ANCA antibodies and C-reactive protein. As the possibility of IgG4-RD was raised retrospectively, following histopathological examination, and was not initially considered in the differential diagnosis, IgG4 levels were not tested, limiting a more comprehensive diagnostic evaluation. This highlights the importance of considering IgG4-RD in the differential diagnosis of atypical fibroinflammatory sinonasal lesions for a more complete diagnostic work-up. The absence of ANCA testing represents a limitation, as granulomatosis with polyangiitis could not be completely excluded serologically. However, the presence of storiform fibrosis, obliterative phlebitis and a dense IgG4-positive plasma cell infiltrate, together with the absence of necrotizing granulomas or vasculitic changes, favoured IgG4-RD over GPA. In addition, there is a relatively short follow-up period. Although the patient was evaluated by the Haematology Department and annual clinical surveillance was recommended without systemic immunosuppressive therapy, longer follow-up is required to better assess disease progression and the need for future treatment. Furthermore, the use of the IgG4/CD138 ratio instead of the conventional IgG4/IgG ratio represents a methodological limitation that restricts direct comparison with the existing literature, as the two immunohistochemical ratios are not interchangeable. In our institution, the IgG4/CD138 ratio was used, as it allows estimation of the proportion of IgG4-positive plasma cells among the total plasma cell population.

4. Conclusions

Sinonasal involvement with IgG4-positive plasma cell infiltration is uncommon and may represent a diagnostic challenge, particularly when presenting as an isolated tumour-like lesion. In our patient, the combination of storiform fibrosis, obliterative phlebitis and a dense IgG4-positive plasma cell infiltrate was highly suggestive of IgG4-related rhinosinusitis; however, the atypical, isolated location and the absence of several supporting diagnostic parameters preclude a definitive diagnosis of IgG4-RD. This case highlights the importance of considering IgG4-RD in the differential diagnosis of destructive sinonasal lesions while recognizing the diagnostic limitations of isolated IgG4-positive plasma cell infiltrate.

Author Contributions: Conceptualization, A.M.B.; Methodology, H.I.Ș.; Software, S.M.N.; Validation, V.-E.T. and A.R.; Formal Analysis, C.L. and M.I.L.; Investigation, E.B.; Resources, A.M.B. and S.L.; Data Curation, S.L.; Writing—Original Draft Preparation, A.M.B.; Writing—Review and Editing, A.G. and S.A.; Visualization, A.E.B.; Supervision, A.G. and S.A.; Project Administration, V.-E.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of CF Clinical Hospital (protocol code 15/03.08.2026, approved on 3 August 2026).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patient to publish this paper.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding authors.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Fokkens, W.J.; Lund, V.J.; Hopkins, C.; Hellings, P.W.; Kern, R.; Reitsma, S.; Toppila-Salmi, S.; Bernal-Sprekelsen, M.; Mullol, J.; Alobid, I.; et al. European Position Paper on Rhinosinusitis and Nasal Polyps 2020. *Rhinology* **2020**, *58*, 1–464. [CrossRef] [PubMed]
2. Chin, C.J.; Scott, J.R.; Lee, J.M. Diagnosis and management of chronic rhinosinusitis. *Can. Med. Assoc. J.* **2025**, *197*, E148–E154. [CrossRef] [PubMed]
3. Lanzillotta, M.; Mancuso, G.; Della-Torre, E. Advances in the diagnosis and management of IgG4 related disease. *BMJ* **2020**, *369*, m1067. [CrossRef] [PubMed]
4. Wallace, Z.S.; Naden, R.P.; Chari, S.; Choi, H.K.; Della-Torre, E.; Dicaire, J.F.; Hart, P.A.; Inoue, D.; Kawano, M.; Khosroshahi, A.; et al. The 2019 American College of Rheumatology/European League Against Rheumatism classification criteria for IgG4-related disease. *Ann. Rheum. Dis.* **2020**, *79*, 77–87. [CrossRef] [PubMed]
5. Moteki, H.; Yasuo, M.; Hamano, H.; Uehara, T.; Usami, S.-i. IgG4-related chronic rhinosinusitis: A new clinical entity of nasal disease. *Acta Otolaryngol.* **2011**, *131*, 518–526. [CrossRef] [PubMed]
6. Bertolini, M.; Buono, F.; Galli, A.; Bagnasco, D.; Guastini, L.; Feltri, M.; Canevari, F.R.M. Are there atypical sites of IgG4 related disease in head and neck region? Personal experience and literature review. *Eur. Arch. Otorhinolaryngol.* **2025**, *282*, 3395–3404. [CrossRef] [PubMed]
7. Cao, C.; Liang, Q.; Feng, C.; Guo, S. IgG4-Related Disease Involving the Paranasal Sinus Orbit: A Case Report. *Ear Nose Throat J.* **2025**, *104*, 278S–283S. [CrossRef] [PubMed]
8. Almohammadi, H.; Almslam, M.S.; Almslam, A.S.; Alotaibi, N. A Rare Case of Chronic Rhinosinusitis With Elevated Levels of Immunoglobulin G4. *Cureus* **2023**, *15*, e42246. [CrossRef] [PubMed]
9. Yoshikawa, T.; Minaga, K.; Hara, A.; Sekai, I.; Otsuka, Y.; Takada, R.; Kamata, K.; Watanabe, T.; Kudo, M. A unique profile of serum cytokines in type 1 autoimmune pancreatitis and chronic rhinosinusitis. *Asian Pac. J. Allergy Immunol.* **2024**, *42*, 154–158. [CrossRef] [PubMed]
10. Takano, K.; Kamekura, R.; Okuni, T.; Yamamoto, K. New insights into chronic rhinosinusitis associated with IgG4-related disease. *Auris Nasus Larynx* **2024**, *51*, 356–360. [CrossRef] [PubMed]
11. Shi, Q.; Ning, X.; Li, H.; Ma, X.; Wang, K.; Bian, W.; Zhang, Y.; Xia, J.; Zheng, X.; Liu, Y.; et al. Characteristics of IgG4-related disease complicated with allergic rhinitis or chronic rhinosinusitis: A large cross-sectional cohort study. *Sci. Rep.* **2022**, *12*, 12039. [CrossRef] [PubMed]
12. Piao, Y.; Zhang, Y.; Yue, C.; Wang, C.; Zhang, L. Immunoglobulin G4–related chronic rhinosinusitis: A pitfall in the differential diagnosis of granulomatosis with polyangiitis, Rosai-Dorfman disease, and fungal rhinosinusitis. *Hum. Pathol.* **2018**, *73*, 82–88. [CrossRef] [PubMed]
13. Döger, F.K.; Ekinci, B.; Başal, Y. Clinicopathological Features of Extranodal Head and Neck Lymphomas. *Diagnostics* **2026**, *16*, 1168. [CrossRef] [PubMed]
14. Deshpande, V.; Zen, Y.; Chan, J.K.; Yi, E.E.; Sato, Y.; Yoshino, T.; Klöppel, G.; Heathcote, J.G.; Khosroshahi, A.; Ferry, J.A.; et al. Consensus statement on the pathology of IgG4-related disease. *Mod. Pathol.* **2012**, *25*, 1181–1192. [CrossRef] [PubMed]
15. Mahajan, A.; Tinianow, A.; Katz, G. IgG4-Related disease: From diagnosis to remission. *Best. Pract. Res. Clin. Rheumatol.* **2025**, *39*, 102108. [CrossRef] [PubMed]