Synchronous nasal rhinosporidiosis and inverted papilloma in a paediatric patient in Dodoma, Tanzania: Case report

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ABSTRACT

Nasal rhinosporidiosis is a rare chronic granulomatous disease that is caused by Rhinosporidium seeberi. It affects the mucous membrane of various sites such as nasopharynx, conjunctiva and palate. Inverted papillomas are relatively rare, benign epithelial tumors of the nasal cavity that are locally aggressive, have recurrence tendency and undergo malignant transformation. Both entities are very rare in our setting and this is perhaps the first documented case in Tanzania.

KEYWORDS: Nasal mass, Rhinosporidiosis, Inverted papilloma, Granulomatous, Dodoma, Tanzania

KEY CLINICAL MESSAGE

Nasal rhinosporidiosis and inverted papilloma lesions may resemble the routinely encountered nasal polyps thus high index of clinical suspicion is necessary to establish their diagnoses.

Introduction

Nasal rhinosporidiosis refers to a chronic granulomatous disease of the nose that is caused by Rhinosporidium seeberi.[1-4] The disease affects both human beings and animals and is reported more commonly in hot tropical climates even though it is endemic in India and Sri Lanka.[1,5-8] On the other hand, sporadicity has been reported elsewhere such as Brazil, Africa and Argentina.[6,7,9,10] Despite the disease being very rare in Tanzania, there are some countries that have reported an appreciable number of cases.[8]

Regarding race and sex predilection of rhinosporidiosis, there is no racial predominance reported and in terms of sex of predominance, males are more affected than females with the male to female ratio being 4:1.[1,9-11] The disease also affects those individuals aged 15-40 years.[1,2,12]

The mode of transmission of rhinosporidiosis may be by direct contact with spores and this can be through dust, infected clothing and swimming in stagnant water.[1,8,12-14]

The diagnosis of nasal rhinosporidiosis is usually established by observing the characteristics of the implicated etiological agent in nasal tissue biopsies like sporangia. The sporangia when examined in nasal tissue biopsies may be visible at variable stages of maturation. On the other hand, rhinosporidiosis has a tendency of mimicking other nasal masses as it presents like a polypoidal mass.[1,7,15-17] Therefore a high index of suspicion by clinicians is of paramount importance in instituting the management of patients with nasal masses particularly in this era where the disease is on surge.

The variable clinical presentation of nasal rhinosporidiosis includes an indolent nasal growth, nasal obstruction, intermittent epistaxis, nasal itching and sneezing and yellowish foul smelling nasal discharge accompanied with blood-stained purulent nasal discharge.[1,9,10]

The recommended treatment of choice for nasal rhinosporidiosis remains to be surgical excision of the nasal mass despite the reported high recurrence rate.[3,16,18] Despite being amenable to surgery, there are reported deaths in patients who are not immunocompetent.[19] Whenever accessible electro cauterization of the base of the excised site should be done though cryosurgery can also be used.[20] Systemic therapy with dapsone serves as an important adjuvant therapy.[1,20,21]

To the best of our knowledge, this is perhaps the second reported case of nasal rhinosporidiosis in Central Tanzania and the first case of its unique nature due to synchronicity with inverted papilloma.

Being a rare benign tumor, inverted papilloma was described initially in 1854 by Ward and in 1855 by Billroth.[20,22] This tumor accounts for 0.5-4% of all nasal tumors.[20,23] The disease tends to peak in the 5th to 6th decade [23] with male to female ratio being between 3:1 and 10:1.[20] It is exceptional in the pediatric population by being very rare as only very few cases have been reported.[24] Though inverted papilloma is known to be a benign tumor, yet it is characterized by its possibility of undergoing malignant transformation to carcinoma, local aggressiveness, high risk of synchronous or metachronous malignancy and has the propensity of local recurrence especially if incomplete surgical excision is entertained.[22-24]

The commonest location for inverted papilloma is the lateral nasal wall and the paranasal sinuses. There are other rare anatomical sites being involved by inverted papillomas outside the sinonasal tract such as skull base [25], nasolacrimal duct [26], oropharynx [27.28] and nasopharynx.[29,30]

The exact etiology of inverted papilloma is still debated to date thus unknown. There is a laid hypothesis that Human papillomavirus may be implicated in the development of inverted papillomas; particularly type 11.[31-35] There are other proposed aetiological agents like chronic inflammation, allergy and occupational exposures.[23,33] The treatment of choice remains to be surgical excision of the nasal mass which can be done endoscopically whenever equipment permits. [23,26] Despite adequate treatment of an inverted papilloma, recurrence rate may be as high as 30 – 60 % of cases.[20]

We are therefore reporting a paediatric patient who presented with a synchronous nasal rhinosporidiosis and inverted papilloma and was managed by endoscopic surgical excision of the nasal mass and kept on oral dapsone for 6 months postoperatively.

Case presentation

We are presenting a seven (7) year old male boy who presented at our outpatient otorhinolaryngology clinic at Benjamin Mkapa Hospital which is a zonal referral hospital in Central Tanzania with a 1-year history of left-sided nasal obstruction and intermittent epistaxis for 6 months. He had no history of cheek swelling, pain or numbness, loss or loosening of teeth or alveolar ridge fullness. There were no ophthalmological, otological or neurological complaints reported by the patient.

On physical examination, he had no external nose deformity but rather a friable left-sided obstructive nasal mass. He was not pale and had no any palpable peripheral lymph nodes. Laboratory results showed hemoglobin 11g/dl and elevated erythrocyte sedimentation rate (35mm/hour). A provisional diagnosis of pyogenic granuloma was made and consequently endoscopic surgical excision of the nasal mass under general anaesthesia was done. The surgically excised specimen was sent for histopathology.

Histopathological analysis revealed thick-walled sporangium containing numerous endospores (daughter spores) (Figure 1) and with further sections showing thick walled sporangium with endospores in different stages of development accompanied by mixed inflammatory cells mainly plasma cells (Figure 2). Another cross-section showed a papilla with delicate fibrovascular core admixed with thick walled sporangium, lined by stratified squamous epithelium with minimal surface keratinization (Figure 3). On the other hand, low power micrographs showed papillary arrangement with delicate fibrovascular core admixed with thick-walled

sporangium and the papillae are lined by stratified squamous epithelium with no surface keratinization (Figure 4)

Figure 1: Intermediate power view of thick-walled sporangium containing numerous endospores (daughter spores)

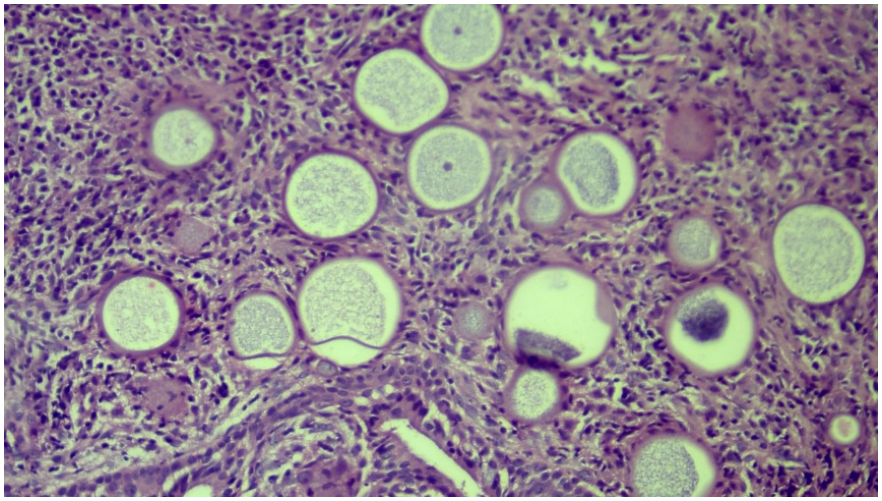
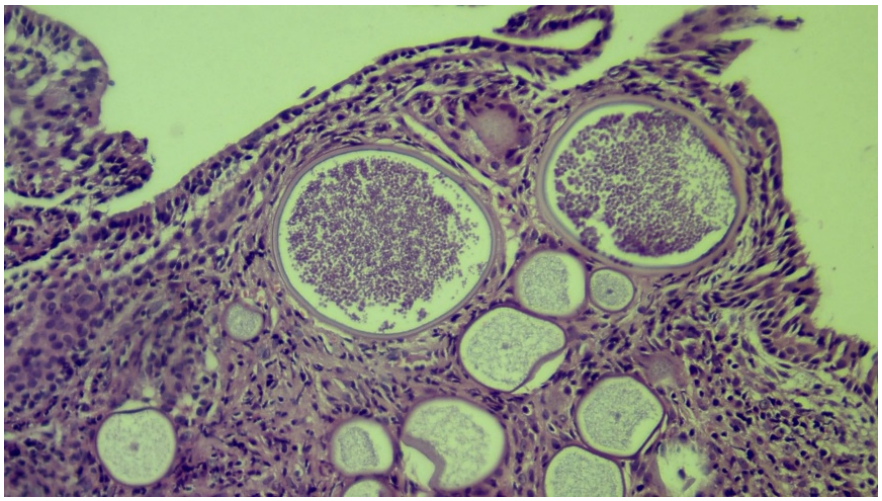


Figure 2: A high-power view of large, thick walled sporangium with endospores in different stages of development accompanied by mixed inflammatory cells mainly plasma cells and lymphocytes.



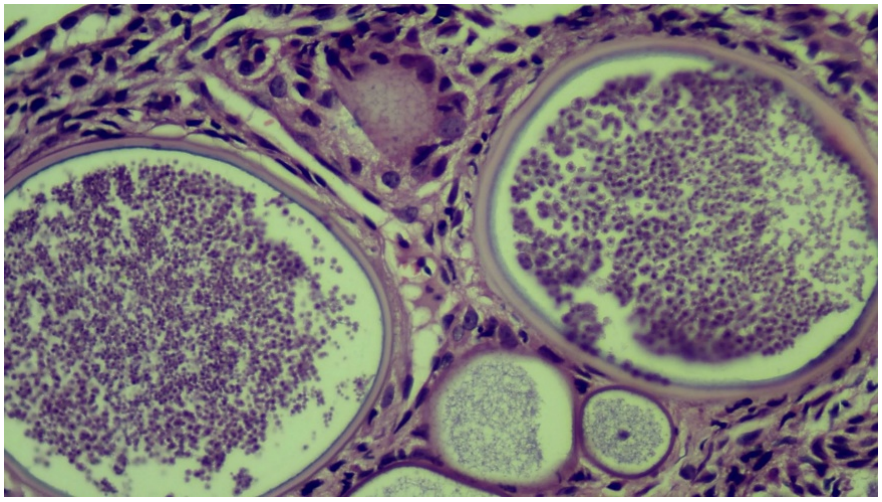


Figure 3: A cross-section showing a papilla with delicate fibrovascular core admixed with thick-walled sporangium, lined by stratified squamous epithelium with minimal surface keratinization

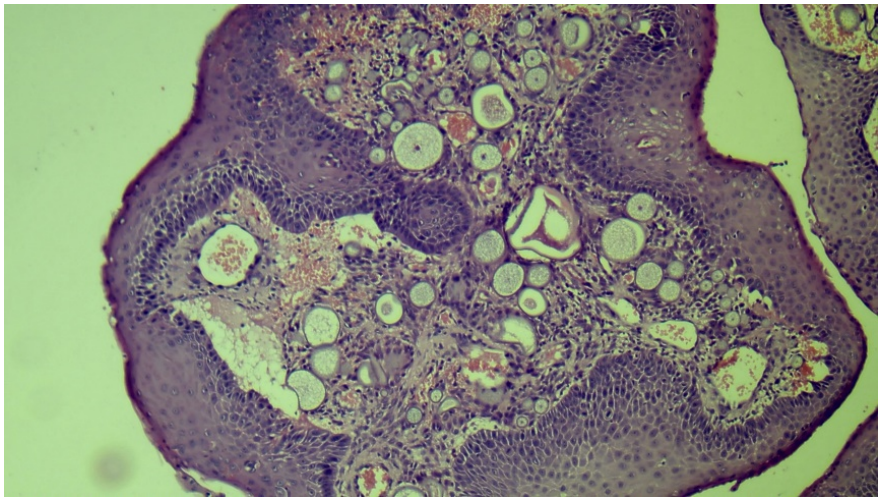
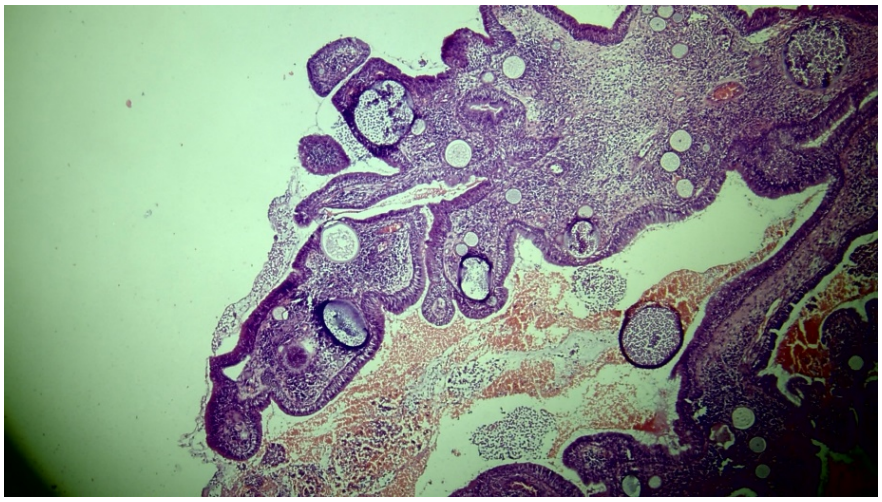
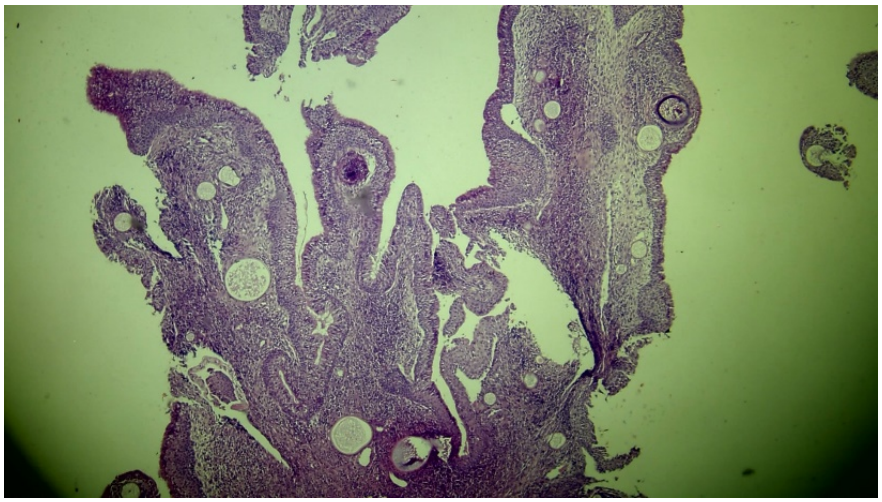
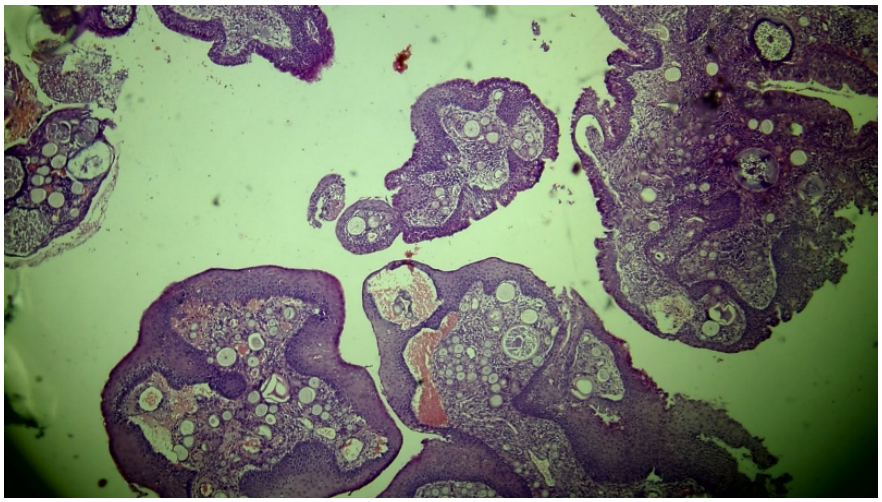


Figure 4: Low power micrographs showing papillary arrangement with delicate fibrovascular core admixed with thick-walled sporangium and the papillae are lined by stratified squamous epithelium with no surface keratinization







The patient was then kept on oral dapsone at a dose of 50mg/day for 6-months and with no residual disease recurrence noted after 6-months of follow up.

Discussion

This case report from Central Tanzania at the largest zonal referral hospital has documented a case of synchronous nasal rhinosporidiosis and inverted papilloma in a paediatric patient and so far the first documented case of synchronous nasal rhinosporidiosis and inverted papilloma both in Central Tanzania and countrywide. Though sporadic, nasal rhinosporidiosis has been reported from about 70 countries with variable geographical features.[12] Migration has attributed to the infrequently isolated cases in other parts of the world.[37,38]

Nasal rhinosporidiosis is reported to be more common in younger age groups and also predominant in men with male to female ratio being 4:1.[1,9-11] Such male predominance has been observed in our case report since the affected patient was a 7-year old boy.

The disease itself, nasal rhinosporidiosis and its causative organism, Rhinosporidium seeberi have been known for over ten decades and it's a rare infective chronic granulomatous disease of the nose.[1,3] On the other hand, attempts to isolate the causative organism in vitro to date has never been successful and its taxonomic rank remains unclear.[39]

Being related to a group of fish parasites referred to as the DRIP clade, most pathologists and microbiologists initially considered it to be fungus on the basis of its characteristic to be stained by fungal stains such as Gomori methenamine silver (GMS) and periodic acid-Schiff (PAS).[17]

Available literatures have shown some authors ending up proposing the class of Rhinosporidium seeberi to be Mesomycetozoa.[14,40] Regarding the natural habitat for Rhinosporidium seeberi, water reservoirs and soil contaminate by wastes are the known habitats and this has been supported by fluorescent in-situ-hybridization techniques.[40] On top of that, other aquatic microorganisms might be relevant to a possible synergistic action in the establishment of natural rhinosporidiosis.[40]

The class Mesomycetozoa has two orders, which are the Dermocystida and the Ichthyophonida. In the order Dermocystida is the family Rhinosporideaceae that includes Rhinosporidium seeberi, Dermocystidium spp. and the rosette agent.[1,40]

Pertaining the route of transmission for Rhinosporidium seeberi, it is still unclear to date on the route of transmission of the organism. Despite the unclear route of its transmission there is a presumed mode of infection from the natural aquatic habitat of Rhinosporidium seeberi through a traumatized epithelium commonly called trans epithelial infection and this is most common in the nasal cavity.[1,10] On the other hand the various modes of spread of Rhinosporidium seeberi includes; auto-inoculation through spillage of endospores from polyps after trauma or surgery, haematogenous spread to distant sites, lymphatic spread and sexual transmission.[10,40]

The notable prevalence of Rhinosporidiosis is marked in rural settings, particularly among people working or in contact with contaminated soil, stagnant water (ponds, or lakes) or sand.[40] In our case report, the patient from a rural area reported a history of contact with contaminated pond water. Moreover, the patient reported a history of contact with feces of infected livestock and used to work in contaminated agricultural fields. Similar risk factors have been documented in the reviewed literatures.[17,40]

Whereas several hundred people bathe in stagnant water, only few develop a progressive pattern of the disease thus implying existence of predisposing factors in the host where the possibility of nonspecific immune reactivity in the host, blood group and HLA types has been suggested as important in the pathogenesis of Rhinosporidium seeberi and also in the establishment of an initial focus of infection.[1,17]

Rhinosporidiosis manifests as tumor-like masses, usually of the nasal mucosa or conjunctivae of humans and animals and patients with nasal involvement often have masses leading to nasal obstruction or bleeding due to polyp formation and it can spread to the nasopharynx, oropharynx, and the maxillary antrum.[4,10] The

patient we are hereby reporting had an isolated friable mass localized in the nasal cavity with no involvement of other anatomical sites such as maxillary sinus. The diagnosis of Rhinosporidiosis is established by observing the characteristic appearance of the organism in tissue biopsies and computerized tomography (CT) scans. The lesion is friable, vascular pedunculated or sessile polyp with a surface studded with tiny white dots due to spores beneath the epithelium, giving a ' strawberry-like ' appearance.[1] The lesion in our case report was similarly friable.

Systemic manifestation of rhinosporidiosis is rare and include multiple mucocutaneous, hepatic, renal, pulmonary, splenic or bone lesions associated with fever, wasting and even death.[1,16,17]

Despite being a rare occasion, spontaneous regression of Rhinosporidial growths has been reported in animals and humans and therefore, medical and/or surgical intervention is necessary.[1,16,17]

The treatment of choice for rhinosporidial growths remains to be wide local surgical excision and this reduced its recurrence rate.[1,12] Surgical removal of the lesion with cauterization of the attachment base is almost curative in at least 90% of the cases.[12,41] Wide local surgical excision may be associated with remarkable morbidity due to hemorrhage and septal perforation and therefore limited surgical excision and adjuvant medical therapies, including antifungals such as griseofluvin and amphotericin B, trimethoprim-sulphadiazine, and sodium stibogluconate have been tried with varied success. All drugs are endospore-static rather than endosporicidal.[1,17]

The only drug appearing to have clinical promise is Dapsone since it arrests the maturation of sporangia and promotes fibrosis in the stroma when used as an adjunct to surgery.[1,40] It could therefore be expected that pre-surgical Dapsone would minimize both hemorrhage by promotion of fibrosis as well as preventing the colonization and infection of new sites after the release of endospores from the surgically traumatized polyps.[42,43] Laser excision is becoming promising as a mainstream treatment of sinonasal rhinosporidiosis in the future.[44] Our patient was kept on dapsone for 6-months after endoscopic nasal mass excision with no recurrence after 6-months of follow up.

Inverted papilloma describes the histological tendency of the epithelium inverting into the stroma. It has a characteristic and intact basement membrane that separates the epithelial component from the underlying connective tissue stroma.[20] Similar to the recurrence tendency being exhibited by nasal rhinosporidiosis, inverted papilloma has recurrence tendency, local aggressiveness or destructive potential[45] and association with sinonasal polyposis.[25] Inverted papilloma has a tendency of malignant transformation where about 9% of inverted papillomas transform to malignant tumors and hereby the most frequent malignant tumor derived from inverted papilloma is squamous cell carcinoma.[46,47] The prognosis of squamous cell carcinoma (SCC) in inverted papillomas is poor with 5- and 10-year survival rate being 39.6% and 31.8% respectively. The poor prognostic indicators of SCC following inverted papillomas include elderly age, infiltration of the skull base or orbital involvement and moderate to poor differentiation histological pattern.[47,48]

Human papillomavirus type 11 has been implicated in the pathogenesis of inverted papillomas. A preponderance of HPV type 6 and 11 has been detected in inverted papillomas compared to types 16 and 18. Low-risk or high-risk co-infections are rare.[31,32] The clinical presentation of inverted papilloma includes nasal obstruction, epistaxis, nasal discharge and recurrent sinusitis and computerized tomography findings depict chronic osteitis and hyperostosis preoperatively.[49] The clinical features of inverted papillomas resemble those of nasal rhinosporidiosis. The main stay of treatment of inverted papilloma is surgical excision of the nasal mass followed by postoperative follow up similar to nasal rhinosporidiosis due to risk of recurrence.[36]

Conclusion

In Tanzania, rhinosporidiosis is non-endemic and in the Central zone, the disease is uncommon thus may pose diagnostic challenges. Sinonasal inverted papillomas are also rare in our settings. Presence of synchronous rhinosporidiosis and inverted papilloma supports the inflammatory theory for pathogenesis of inverted papilloma. It is therefore important for both clinicians and pathologists to have a high index of suspicion when managing patients with nasal masses even from non-endemic areas.

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CONFLICTS OF INTEREST

None declared

AUTHOR CONTRIBUTIONS

ZSA: Performed the surgery, collected information for the case and drafted the initial version of the manuscript. FZ performed histopathology and also provided critical feedback of the manuscript. AAK: Drafted the initial version of the manuscript. All authors read and approved the final version to be published in Clinical Case Reports

ETHICS STATEMENT

This report is in accordance with the Declaration of Helsinki.

CONSENT

The patients' mother gave a written informed consent prior inclusion of the child in this report

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None

DATA AVAILABILITY

The data that support the findings of this report are available from the corresponding author upon reasonable request.

References

1. Abraham ZS, Zerd F, Kahinga AA. Nasal rhinosporidiosis masquerading as pyogenic granuloma in a pediatric patient at a Zonal Referral Hospital in Central Tanzania: Case report. Clinical Case Reports. 2022 Jun;10(6):e5977.

2. Ali GM, Goravey W, Al Hyassat SA, Petkar M, Al Maslamani MA, Hadi HA. Recurrent nasopharyngeal rhinosporidiosis: case report from Qatar and review of the literature. IDCases. 2020 Jan 1;21:e00901.

3. Kindo AJ, Kalyani J, Sundaram S, Kannan S, Kumar AR. Unusual presentation of rhinosporidiosis: a case report. Sri Ramchandra J Med. 2007;1(2):60-1.

4. Chandran A, Sakthivel P, Kumar R, Rajeshwari M. Pharyngeal rhinosporidiosis. BMJ Case Reports. 2020 Jun 1;13(6).

5. Nath D, Khan SA, Sahaya R, Umaro P. Recurrent nasal rhinosporidiosis: a case report. Era's Journal of Medical Research. 2019;6(1):118-20.

6. Morelli L, Polce M, Piscioli F, Del Nonno F, Covello R, Brenna A, Cione A, Licci S. Human nasal rhinosporidiosis: an Italian case report. Diagnostic pathology. 2006 Dec;1:1-4.

7. Sefu U, Fauzia A. Human nasal rhinosporidiosis: a case report from Malawi. Pan African Medical Journal. 2011;9(1).

8. Aliyu D, Sahabi SM. Nasal rhinosporidiosis in a nigerian child: A rare clinical entity. International Journal of Otolaryngology and Head & Neck Surgery. 2014 Jan 9;2014.

9. Saha S, Hoogar MB, Borkar DB, Dhar R, Naik V. Rhinosporidiosis of Nose: Unusual Presentation Masquerading As Pyogenic Granuloma!!-A Case Report.

10. Masilela MM, Selepe MS. Nasal rhinosporidiosis in South Africa: review of literature and report of a case. South African Dental Journal. 2017 Oct;72(9):420-3.

11. Gupta N, Singla P, Pradhan B, Gurung U. Lacrimal sac rhinosporidiosis: case report and review of literature with a new grading system to optimize treatment. Saudi Journal of Ophthalmology. 2019 Jul 1;33(3):283-90.

12. Arias AF, Romero SD, Garcés CG. Case report: rhinosporidiosis literature review. The American Journal of Tropical Medicine and Hygiene. 2021 Feb;104(2):708.

13. Dey AK, Sharma R, Mittal K, Kumar P, Murumkar V, Mitkar S, Hira P. Rhinosporidiosis: a rare cause of proptosis and an imaging dilemma for sinonasal masses. Case Reports in Otolaryngology. 2016 Nov 30;2016.

14. Singh I, Lalrinmawii PD. Recurrent rhinosporidiosis: a case report. J Otolaryngol ENT Res. 2018 Nov 1;10(6):298-300.

15. Ahluwalia KB, Maheshwari N, Deka RC. Rhinosporidiosis: a study that resolves etiologic controversies. American journal of rhinology. 1997 Nov;11(6):479-84.

16. Echejoh GO, Manasseh AN, Tanko MN, Ogala-Echejoh SE, Silas OA, Nimkur TL, Mandong BM. Nasal rhinosporidiosis. Journal of the National Medical Association. 2008 Jun 1;100(6):713-5.

17. Das S, Kashyap B, Barua M, Gupta N, Saha R, Vaid L, Banka A. Nasal rhinosporidiosis in humans: new interpretations and a review of the literature of this enigmatic disease. Medical mycology. 2011 Apr 1;49(3):311-5.

18. Rao BS, Shanthi V, Rao NM, Grandhi B, Muramreddy V, Raguraman S. Nasal polyposis associated with rhinosporidiosis in an 11 year old boy-a rare case report. Int J Res Rev. 2019 May;6(May):18-20.

19. Hussein MR, Rashad UM. Rhinosporidiosis in Egypt: a case report and review of literature. Mycopathologia. 2005 Feb;159:205-7.

20. Jh B, Sood S, Lasic D, Gupta D. A Case of Rhinosporidiosis and Concomitant Inverted Papilloma - A Review of the Literature. Journal of Ear, Nose and Throat2016;1:4–7.

21. Fredricks DN, Jolley JA, Lepp PW, Kosek JC, Relman DA. Rhinosporidium seeberi: a human pathogen from a novel group of aquatic protistan parasites. Emerging infectious diseases. 2000 May;6(3):273.

22. Bielamowicz S, Calcaterra TC, Watson D. Inverting papilloma of the head and neck: the UCLA update. Otolaryngology–Head and Neck Surgery. 1993 Jul;109(1):71-6.

23. El Korbi A, Jellali S, Kolsi N, Bouatay R, Njim L, Berguaoui E, Ferjaoui M, Harrathi K, Koubaa J. Pediatric naso-sinusal inverted papilloma: report of a case and literature review. The Pan African Medical Journal. 2020;37.

24. Jayakody N, Ward M, Wijayasingham G, Fowler D, Harries P, Salib R. A rare presentation of a paediatric sinonasal inverted papilloma. Journal of Surgical Case Reports. 2018 Nov;2018(11):rjy321.

25. Wassef SN, Batra PS, Barnett S. Skull base inverted papilloma: a comprehensive review. International Scholarly Research Notices. 2012;2012.

26. Walijee HZ, Berry S, Quine S, Lane C, Morris DS, Bowman B. Inverted papilloma originating primarily from the nasolacrimal duct: a case report and review of the pertinent literature. Case Reports in Otolaryngology. 2015 Nov 16;2015.

27. Samuel HT, Varghese L, Kurien R, Thomas M. Human papilloma virus induced oropharyngeal inverted papilloma as a precursor to laryngeal papillomatosis in A 1 year old child. International Journal of Pediatric Otorhinolaryngology. 2020 Nov 1;138:110335.

28. Nosanchuk JS. Oropharyngeal inverted papilloma. Archives of Otolaryngology. 1974 Jul 1;100(1):71-2.

29. Low WK, Toh ST, Lim CM, Ramesh G. Schneiderian papilloma of the nasopharynx. Ear, nose & throat journal. 2002 May;81(5):336-8.

30. Ohki M. Nasopharyngeal Inverted Papilloma Invading the Parapharyngeal Space Accompanied by Hearing Loss. Int J Clin Case Stud. 2015;2:106.

31. Lawson W, Schlecht NF, Brandwein-Gensler M. The role of the human papillomavirus in the pathogenesis of Schneiderian inverted papillomas: an analytic overview of the evidence. Head and neck pathology. 2008 Jun;2:49-59.

32. Wang MJ, Noel JE. Etiology of sinonasal inverted papilloma: a narrative review. World journal of otorhinolaryngology-head and neck surgery. 2017 Mar 1;3(01):54-8.

33. Eide JG, Welch KC, Adappa ND, Palmer JN, Tong CC. Sinonasal inverted papilloma and squamous cell carcinoma: contemporary management and patient outcomes. Cancers. 2022 Apr 28;14(9):2195.

34. Buchwald C, Franzmann MB, Jacobsen GK, Lindeberg H. Human papillomavirus (HPV) in sinonasal papillomas: a study of 78 cases using in situ hybridization and polymerase chain reaction. The Laryngoscope. 1995 Jan;105(1):66-71.

35. Sunkara PR, Saraswathula A, Ramanathan Jr M. Etiology of sinonasal inverted papilloma: An update. Laryngoscope investigative otolaryngology. 2022 Oct;7(5):1265-73.

36. Mirza S, Bradley PJ, Acharya A, Stacey M, Jones NS. Sinonasal inverted papillomas: recurrence, and synchronous and metachronous malignancy. The Journal of Laryngology & Otology. 2007 Sep;121(9):857-64.

37. Morelli L, Polce M, Piscioli F, Del Nonno F, Covello R, Brenna A, Cione A, Licci S. Human nasal rhinosporidiosis: an Italian case report. Diagnostic pathology. 2006 Dec;1:1-4.

38. Ali GM, Goravey W, Al Hyassat SA, Petkar M, Al Maslamani MA, Hadi HA. Recurrent nasopharyngeal rhinosporidiosis: case report from Qatar and review of the literature. IDCases. 2020 Jan 1;21:e00901.

39. Shastry A, Abhilasha S, Viswanatha B. Nasal rhinosporidiosis: a prospective study. J Otolaryngol ENT Res. 2018;10(6):373-5.

40. Venkateswaran S, Date A, Job A, Mathan M. Light and electron microscopic findings in rhinosporidiosis after dapsone therapy. Tropical Medicine & International Health. 1997 Dec;2(12):1128-32.

41. Justice JM, Solyar AY, Davis KM, Lanza DC. Progressive left nasal obstruction and intermittent epistaxis. JAMA Otolaryngology–Head & Neck Surgery. 2013 Sep 1;139(9):955-6.

42. Arseculeratne SN. Chemotherapy of rhinosporidiosis: a review. Journal of Infectious Diseases and Antimicrobial Agents. 2009;26(1):21-7.

43. Arseculeratne SN. Recent advances in rhinosporidiosis and Rhinosporidium seeberi. Indian journal of medical microbiology. 2002 Jul 1;20(3):119-31.

44. Chao SS, Loh KS. Rhinosporidiosis: an unusual cause of nasal masses gains prominence. Singapore medical journal. 2004 May 1;45:224-6.

45. Bouatay R, Farhati A, Abdelali M, Korbi AE, Ferjaoui M, Harrathi K, Koubaa J. Diagnostic strategy and therapeutic management of sinonasal inverted papilloma: our experience with review of literature. The Egyptian Journal of Otolaryngology. 2022 Dec;38(1):1-8.

46. Nygren A, Kiss K, von Buchwald C, Bilde A. Rate of recurrence and malignant transformation in 88 cases with inverted papilloma between 1998–2008. Acta Oto-Laryngologica. 2016 Mar 3;136(3):333-6.

47. Gamrot-Wrzoł M, Sowa P, Lisowska G, Ścierski W, Misiołek M. Risk factors of recurrence and malignant transformation of sinonasal inverted papilloma. BioMed research international. 2017 Nov 9;2017.

48. Liang QZ, Li DZ, Wang XL, Huang H, Xu ZG, Wu YH. Survival outcome of squamous cell carcinoma arising from sinonasal inverted papilloma. Chinese Medical Journal. 2015 Sep 20;128(18):2457-61.

49. Yousuf K, Wright ED. Site of attachment of inverted papilloma predicted by CT findings of osteitis. American journal of rhinology. 2007 Jan;21(1):32-6.