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Paediatric head and neck granulomatous lesion diagnostics - a case report

Abstract
Granulomatous lesions of the head and neck in children remain diagnostically challenging because there are no standardised protocols for their diagnosis. We discuss two paediatric cases managed at the Department of Oral and Maxillofacial Surgery of a tertiary care centre in South India. The first is a 10-year-old boy with a left submandibular swelling of four months' duration arising from an odontogenic focus, where excisional biopsy confirmed granulomatous lymphadenitis. The second is a 7-year-old boy who presented to the Emergency Department with a one-week-old left buccal swelling; contrast-enhanced CT revealed osteomyelitis with cortical erosion and deep tissue involvement. Auditing both cases, we found that the diagnostic process was complicated by the inherent need for a multidisciplinary approach and the scarcity of robust, evidence-based guidance in the existing literature. Drawing on these cases and verified published evidence, we discuss the importance of a formal multidisciplinary team pathway incorporating Paediatric Infectious Disease.

Keywords: *granulomatous lymphadenitis; paediatric head and neck; diagnostic flow; tuberculous lymphadenitis; osteomyelitis; GeneXpert; oral and maxillofacial surgery; multidisciplinary team; FNAC; immunohistochemistry.*

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I. Introduction

The hallmark of granulomatous inflammation is a distinctive type of tissue reaction characterized by macrophage activation and formation of organized aggregates of activated macrophages, epithelioid histiocytes, and multinucleated giant cells against persisting stimuli resisting phagocytosis. Causes of granulomatous inflammation can be infectious, non-infectious, or neoplastic and can include lymphoproliferative disorders. [1,2]

Granulomatous disease of the mouth is a diagnostic dilemma because of the misleading presentation of the disease. Buccal and cervical regions can present with swelling, induration and thickening, but neither of those signs is reliable enough to make a diagnosis. In addition, the etiological cause of the lesion cannot be assumed from its physical appearance or the region of origin. Diagnostic approach requires integrating clinical, imaging, histopathological and microbiological/molecular investigations. [3]

Another difficulty associated with this issue is the time taken from the presentation of symptoms, imaging, and tissue sampling to histopathology and microbiology results. These delays can happen in a setting with high patient volume due to premature conclusion of diagnosis, compartmentalized departmental management and under-utilization of molecular diagnostic. The following are two paediatric cases that depict some of these diagnostic difficulties.

II. Case Presentations

2.1 Case 1: Granulomatous Lymphadenitis in a 10-Year-Old Boy

The first case involves a 10-year-old boy under the Department of OMFS. The patient's parent presented with gradual swelling of the left lower jaw area for four months. A swelling measuring 1.5 × 1.5 cm was observed next to tooth 36. After performing an endodontic procedure in 36, the swelling persisted and the tooth was extracted.

Following extraction, there was a solitary swelling measuring 3 × 4 cm in the left submandibular region accompanied by redness and increase in local temperatures. There was cervical lymphadenopathy at Level IB, II, III, and IVB on both sides; Level IB nodes measuring 3 × 1.5 cm, rubbery, and non-movable.

There was dull and throbbing pain in the region that occurred intermittently. The patient did not have a fever. Family history revealed tuberculosis in his paternal grandmother, who was under anti-tubercular therapy.

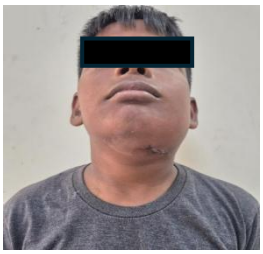
Preoperative image of the 10-year-old

Neck CT Scan (04 January 2025): Presence of several large cervical lymph nodes; the largest one measuring 1.1 cm at the carotid level. There was no cortical erosion.

USG neck - 17 January 2025: Enlarged submandibular and jugular nodes with the largest being 3.0 × 1.3 cm showing increased peripheral vascularity on Doppler.
USG guided FNAC: Suggestive features of granulomatous inflammation.

Investigation	Value	Notes
IGRA	Negative	17 January 2025
Truenat MTB PCR	Not detected	08 January 2025
AFB Stain (Sputum)	No AFB seen	08 January 2025
CRP	Negative	15 January 2025
Hb / WBC / Platelets	12.3 / 10,040 / 440,000	Normal differential
SGOT / SGPT	57 / 43	Mildly elevated

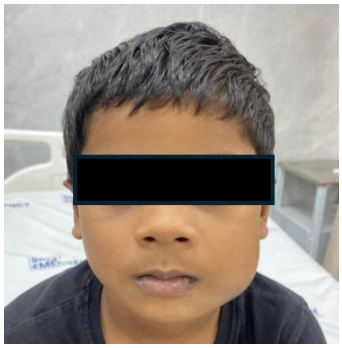
Excisional biopsy done under GA through Risdon's approach. Level IB lymph node was excised and sent for histopathological analysis which showed granulomatous lymphadenitis, left submandibular region (ICD: I88.9).



Postoperative image of the 10-year-old

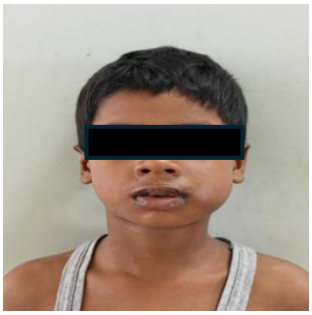
The patient was shifted to ENT with pending biopsy report for ?TB lymphadenopathy.

2.2 Case 2: Buccal Space Collection with Mandibular Osteomyelitic Changes in a 7-Year-Old Boy
A 7-year-old male child was admitted under the Department of OMFS. His mother complained of swelling in his left cheek for 1 week with gradual onset, mild pain and difficulty in mastication without fever or weight loss or any history of tuberculosis in the family.
On examination, there was a 5 × 4 cm hard and nonfluctuant swelling on the left side of his face with local warmth and tenderness with slight discharge of pus from the gingival crevice of 74 & 75 teeth.



Preoperative image of the 7-year-old

USG (13 January 2026): Ill-defined hyperechoic collection of 1.6 x 1.4 x 1.2 cm near left parotid with 7 mm fistulous tract; reactive cervical lymphadenitis.
CECT (13 January 2026): Peripherally enhancing hypodense lesion of 4.1 x 2.2 x 3.9 cm deep to masseter with cortical erosion at molar level, destruction of alveolar process, involvement of masseter and necrotic Level II/III nodes. Features suggestive of osteomyelitis with abscess deep to masseter.



Postoperative image of the 7-year-old

Excision of soft tissue and bone biopsy with tooth 75 extraction under general anaesthesia was performed. Granulation tissue and bony dehiscence was seen. Small portions of soft tissue and bone biopsies taken. Diagnosis on discharge: Cellulitis and abscess of mouth (ICD K12.2).

III. Discussion

3.1 Overview of Flow Difficulty Concept
The problem of 'diagnostic flow difficulty' refers to systemic, structural, and cognitive barriers that prevent the progression of the patient from initial presentation to final diagnosis and management in a timely manner. The challenge is especially pertinent to paediatric granulomatous head and neck diseases due to the lack of molecular diagnostic tools, and multidisciplinary nature of treatment.

3.2 Difficulties Encountered
3.2.1 Negative Molecular Diagnostics Without Exclusion of Disease
In Case 1, IGRA, Truenat MTB PCR, and AFB smear have all been negative. However, these tests do not exclude the possibility of tuberculosis infection. Standard Ziehl Neelsen staining of fixed tissue has very poor sensitivity, due to a combination of low bacterial burden, tissue necrosis, and degradation of mycolic acid in the process of fixation. [2] DNA fragmentation in formalin-fixed tissue limits the sensitivity of PCR, while mycobacterial culture – the gold-standard test for diagnosis – can only be done on un-fixed tissue. [4,5] GeneXpert was found to have sensitivity of 90.36% in a retrospective study in cervical TB lymphadenitis, far superior to AFB smear (14.72%) and culture (16.67%). [14]

3.2.2 Histopathology Without Simultaneous Microbiological Processing

In both the above cases, only histopathology was sent on tissue obtained. The best practice involves sending fresh tissue samples for mycobacterial culture, GeneXpert testing, and bacterial cultures. Fixation in formalin, which is ideal for histopathology, makes the tissue unsuitable for culture and limits PCR sensitivity; there is an inherent workflow conflict here.

3.2.3 Lack of a Defined Diagnostic Algorithm

There is no defined diagnostic algorithm for pediatric cervical lymphadenopathy or head and neck granulomatous disease in either case record. The institution benefits in an endemic TB area with high odontogenic disease prevalence by developing a diagnostic pathway that includes imaging indications, tissue acquisition, molecular diagnostic implementation, and specialty referral criteria.

IV. Evidence-Based Strategies to Improve Diagnostic Flow

4.1 Structured Diagnostic Algorithm

A diagnostic algorithm is supported by current literature. Firstly, a detailed history regarding exposure to TB infection and the clinical examination of the nodes – including size greater than 2cm, firm and matted consistency – will require further diagnostic work up. [7] Ultrasonography is the primary imaging tool in evaluation of superficial cervical nodes; US guided fine needle aspiration cytology is obtained from the most representative node, and sonographic features can exclude the necessity for tissue sampling in some indeterminate cases. [8,9] Suspected cortical bone erosion or involvement of deep spaces necessitates the use of Contrast enhanced computed tomography (CECT) as additional anatomic localization. [10] During tissue acquisition, samples should be simultaneously routed to histopathology, mycobacterial culture, and GeneXpert. In case of non-diagnostic FNAC, an excision biopsy with mandatory dual routeing of samples – one fresh to the microbiology lab, one formalin-fixed to the histopathology lab – should take place. [12,13]

4.2 Molecular Diagnostic Integration: GeneXpert / CBNAAT

GeneXpert MTB/RIF test is suggested by the WHO as a diagnostic test for extra pulmonary tuberculosis and is preferred over AFB smear as a front-line test. [13] Superiority of this test in detection of cervical lymph node TB is shown in a retrospective study, where sensitivity of the test is 90.36% while culture shows 16.67% and AFB smear 14.72%. [14] GeneXpert test should be performed on fresh nodal tissue in all children with granulomatous changes in FNAC or histopathology regardless of smear results or IGRA testing. Allocation of fresh tissue sample to the microbiology lab at the time of OMFS excision needs to be included in institutional protocols.

4.3 Immunohistochemistry as a Diagnostic Adjunct

Histopathological presentation of tuberculosis and Hodgkin's lymphoma (HL) is overlapping; in TB-endemic regions, granulomatous reaction in HL may mask Reed-Sternberg cells and result in delayed diagnosis. Chandra et al. described the case of a 10 year old boy who was diagnosed with TB lymphadenitis based on FNAC findings; despite anti-TB treatment during nearly two years, his lymphadenopathy persisted and required three FNAC and two excision biopsy until immunohistochemistry confirmed classical Hodgkin lymphoma (mixed cellularity, CD30 and PAX-5 positive) in the same node which was previously CBNAAT positive for MTB. [15] Nonresponse to ATT requires prompt repetition of biopsy and immunohistochemistry using markers of CD15 and CD30 which should be routinely ordered along with histopathology in all granulomatous pediatric head and neck lesions.

4.4 Multidisciplinary Team (MDT) Framework

Management of granulomatous head and neck disease in childhood is necessarily multidisciplinary in nature. The introduction of more coordinated front-loaded diagnostic strategies, involving early referral to a setting where a multidisciplinary approach is available, has been shown to dramatically decrease time to diagnosis. [16] Both of these cases are illustrations of problems arising in situations where care coordination systems break down: the need for follow-up of biopsy results post-discharge was left unclear, the infectious diseases group was isolated from pre-operative diagnostic discussions, and there is no system for submitting fresh nodal tissue for GeneXpert analysis. A properly devised MDT pathway would guarantee automatic notification of Paediatric Infectious Diseases in cases where granulomatous inflammation has been detected on FNAC/histology, joint discussion of the case prior to discharge when biopsy results are pending, follow-up of results post-discharge with assigned responsibility to a specific specialist, and an algorithm for initiating ATT, coordinated with the RNTCP national programme.

4.5 Family and Contact History in Paediatric TB Diagnosis

Close contact with TB is one of the most important independent risk factors for pediatric TB. In Case 1, there was a known TB contact in the form of paternal grandmother on ATT. According to the WHO guidelines, all child contacts of smear-positive TB patients should be investigated and, if necessary, initiated on isoniazid preventative therapy. [17] Systematic recording of contact history should become an obligatory trigger for molecular testing of any child with granulomatous head and neck disease.

4.6 Avoiding Negative IGRA Bias

In Case 1 we observe the use of negative IGRA to reduce suspicion for tuberculosis — a common diagnostic pitfall in areas endemic for TB. The child had granulomatous inflammation on FNAC, lymphadenopathy at four nodal levels, and a household TB contact — still, a negative IGRA seems to have been one of the reasons why fresh tissue was not submitted for GeneXpert analysis. All types of immunologic tests for TB – tuberculin skin test (TST), interferon-gamma release assay (IGRA), and antigen-specific tests – are insufficiently sensitive to confirm or rule out active TB and are not recommended for use in diagnostic algorithms. [16] The insufficiency is even higher in children, in whom extrapulmonary TB is pauci-bacillary and immunoresponse might be reduced due to age or malnutrition. In a retrospective study of paediatric granulomatous lymphadenopathy, mycobacterial infection has been established as the leading cause of disease, with accurate diagnosis dependent on integration of clinical, histopathological, and additional criteria, rather than any particular test. [18] Negative IGRA in a child with granulomatous inflammation should trigger GeneXpert on fresh tissue — not reassurance.

4.7 Odontogenic Granuloma as a Distinct Entity

Both cases had an odontogenic etiologic factor — periapical disease at tooth 36 in Case 1 and teeth 74/75 in Case 2. The mandible is the most common site for granulomatous disease in head and neck pathology studies. [2] OMFS surgeons should keep a low threshold for workup of granulomatous inflammation in paediatric patients with non-resolving odontogenic swelling.

V. Summary Comparison of Cases

Parameter	Case 1	Case 2
Age / Sex	10-year-old male	7-year-old male
Chief Complaint	Left submandibular swelling, 4 months	Left cheek swelling, 1 week
Antecedent Cause	Odontogenic (tooth 36, RCT, extraction)	Odontogenic (teeth 74, 75 periapical)
Initial Presentation	OMFS OPD	Emergency Department
Key Imaging	USG: submandibular LN; FNAC: granulomatous	CECT: osteomyelitis with abscess deep to masseter
IGRA / AFB / PCR	All negative	Not documented
Operative Procedure	Excisional biopsy, Risdon's approach, Level IB	Biopsy soft tissue + bone; extraction tooth 75
HPE	Granulomatous lymphadenitis (ICD I88.9)	Pending at discharge (ICD K12.2)
Key Flow Difficulty	Negative molecular results; no GeneXpert on fresh tissue; pending result at discharge	No pre-op granulomatous differential; pending histology at discharge

VI. Conclusion

In both cases, the problem was not lack of technology — GeneXpert has been available in our setting since January 2018. What was missing was a protocol defining the moment when fresh tissue should be submitted to microbiology, ownership of the biopsy results post-discharge, and the point where a child with granulomatous inflammation and a household TB contact triggers a referral to infectious diseases specialists.

Fresh tissue specimens for GeneXpert testing must be reserved at the time of surgical excision prior to formalin fixation. Any signs of granulomatous inflammation on histopathology need to automatically prompt IHC

testing for CD15, CD30, and CD68. Pending biopsy specimens at the time of discharge need to be under the ownership of a specific specialty with clearly defined follow up. Most importantly, however, the oral and maxillofacial surgeon who biopsies these children is not just an operative surgeon but often a last resort in a TB endemic environment.

Further prospective studies in paediatric OMFS and ENT clinics can assess whether the above conclusions are true and provide evidence for that. Until then, perhaps, one may want to consider using the current case report as a starting point.

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