BMC Endocrine Disorders

CASE REPORT

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Aeromedical evaluation and successful return to flight in a military pilot with lingual thyroid: a case report and follow-up

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Abstract

Background Lingual thyroid is a rare congenital anomaly resulting from the aberrant migration of thyroid tissue during embryonic development. Although frequently asymptomatic, its identification in military aircrew poses particular challenges given the rigorous standards of aeromedical certification.

Case presentation A 37-year-old male military helicopter pilot was incidentally diagnosed with lingual thyroid during routine health screening. The patient remained asymptomatic throughout the clinical course. Comprehensive evaluations—including thyroid function tests, biochemical profiling, cervical magnetic resonance imaging, electronic laryngoscopy, radionuclide scanning, and portable sleep monitoring—confirmed the presence of a lingual thyroid with subclinical hypothyroidism. Imaging demonstrated the ectopic tissue at the tongue base to be the sole functioning thyroid gland. Levothyroxine therapy was initiated, resulting in normalization of thyroid hormone levels. Polysomnography was performed due to the anatomical location of the lesion and excluded obstructive sleep apnea or ventilatory compromise. Given the patient's strong motivation to resume flight duties, a multidisciplinary aeromedical evaluation was conducted. Based on clinical stability, absence of symptoms, and treatment response, the pilot was deemed aeromedically fit. Since June 2021, he has accumulated over 900 flight hours, with preserved thyroid function and no evidence of disease progression on longitudinal follow-up.

Conclusions To the best of our knowledge, this represents the first documented case in China of a military pilot with lingual thyroid successfully certified for continued flying duties. This case suggests that congenital endocrine anomalies may be compatible with high-demand occupational roles in select cases, pending comprehensive individual evaluation and risk-based aeromedical assessment. It further supports the adoption of a risk-stratified, non-invasive management paradigm in aviation medicine, with implications for enhancing both flight safety and personnel retention.

Highlight box

• This is the first reported case in China of a military pilot with a lingual thyroid who was certified fit to fly after comprehensive endocrine and aeromedical assessment.
• The patient exhibited subclinical hypothyroidism, remained asymptomatic, and responded well to levothyroxine therapy.

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• Over a 4-year follow-up period, thyroid Function stayed stable, and the pilot safely logged more than 900 flight hours.
• This case suggests that concealed congenital endocrine anomalies may be compatible with flight duties in select cases, pending comprehensive individual evaluation.
• It highlights the importance of individualized, risk-based assessment and longitudinal monitoring when managing rare endocrine anomalies in safety-critical occupations.

Keywords Lingual thyroid, Subclinical hypothyroidism, Aeromedical evaluation military aviation medicine

Introduction

Ectopic thyroid is an exceedingly rare congenital anomaly resulting from abnormal embryological development and migration of thyroid tissue, with an estimated incidence of approximately 1 in 100,000 individuals [1]. Among these cases, over 90% involve the lingual region, while ectopic thyroid tissue has also been reported in other sites within the head and neck, such as the trachea, axilla, and palatine tonsils, as well as distant locations including the heart, thymus, pancreas, and adrenal glands [2, 3]. Patients typically present with local compressive symptoms such as dysphagia or dyspnea, or are evaluated due to abnormal thyroid function [4, 5].

Military pilots represent a highly specialized occupational group who must endure extreme physiological conditions, including hypoxia and high gravitational (G) forces during flight. As a result, the medical standards for aircrew are especially stringent, and any condition potentially affecting cardiopulmonary or neurological function warrants careful scrutiny. However, there are currently no well-established guidelines—either domestic or international—regarding the aeromedical assessment or flight fitness determination for aircrew with lingual thyroid.

In this report, we present a rare case of a Chinese military helicopter pilot diagnosed with lingual thyroid. Following comprehensive multidisciplinary evaluation, the patient was ultimately certified as fit to fly. This case provides a valuable reference for the management of similar congenital thyroid anomalies in aviation medicine and highlights key considerations in aeromedical decision-making.

Case presentation

A 37-year-old active-duty Chinese military helicopter pilot with 2,700 flight hours was admitted for evaluation following the incidental discovery of a lingual thyroid identified six months earlier. During routine imaging on December 5, 2020, while undergoing rehabilitation, a cervical MRI revealed an abnormal signal in the oropharyngeal region measuring approximately 2.7 × 2.1 cm. Fiberoptic laryngoscopy showed a rounded, raised lesion above the epiglottis that moved with swallowing. Concurrent thyroid ultrasound failed to detect thyroid-like echogenicity in the normal anatomical location.

On December 10, 2020, the patient was referred to the Department of Otolaryngology–Head and Neck Surgery at our hospital for further evaluation. A repeat thyroid ultrasound again confirmed the absence of orthotopic thyroid tissue. Contrast-enhanced MRI of the neck (Fig. 1A) revealed a well-defined mass located at the base of the tongue, measuring 2.58 × 2.2 × 3.2 cm, with multiple internal nodules (up to 0.6 cm in diameter) and no evidence of enlarged cervical lymph nodes. Additionally, fiberoptic laryngoscopy (Fig. 1B) revealed a semi-circular, mucosa-covered protuberance at the tongue base, corroborating the imaging findings. To Further characterize the lesion, a radionuclide thyroid scan using $^{99m}TcO_4^-$ (5 mCi) was performed (Fig. 1C). The scan demonstrated no radioactive uptake in the normal thyroid bed, but showed significant tracer accumulation in the oropharyngeal region, a finding consistent with an ectopic lingual thyroid. Laboratory tests revealed elevated TSH (15.637 mIU/L; reference 0.40–6.71 mIU/L), while free and total thyroid hormone levels were within normal limits, indicating subclinical hypothyroidism. The patient was started on levothyroxine at 25 μg/day. Based on serial thyroid Function monitoring, the dosage was gradually increased to 75 μg/day. On April 28, 2021, thyroid Function tests showed TSH at 2.619 mIU/L, with normal FT3, FT4, TT3, TT4, TPO-Ab, and TG-Ab levels. Throughout the disease course, the patient reported no pharyngeal foreign body sensation, dysphagia, speech or breathing difficulty, cough, hemoptysis, fatigue, sleepiness, alopecia, or weight gain. He also denied palpitations, hyperhidrosis, irritability, or increased appetite.

For aeromedical certification, he was admitted to the Department of Endocrinology, Air Force Medical Center, on May 31, 2021. Upon admission, the patient exhibited normal physical capacity, good in-flight tolerance, and stable mood, appetite, and sleep. Vital signs were unremarkable: blood pressure 112/73 mmHg, height 168 cm, weight 63 kg, and BMI 22.3 kg/m². Physical examination of the heart, lungs, and abdomen was unremarkable. Laboratory testing, including thyroid function and biochemical panels, showed no abnormalities. Tumor marker CA72-4 was slightly elevated at 22.55 U/mL. Repeat cervical MRI revealed interval shrinkage of the lingual thyroid compared to December 2020, with increased signal heterogeneity. Portable sleep monitoring showed a

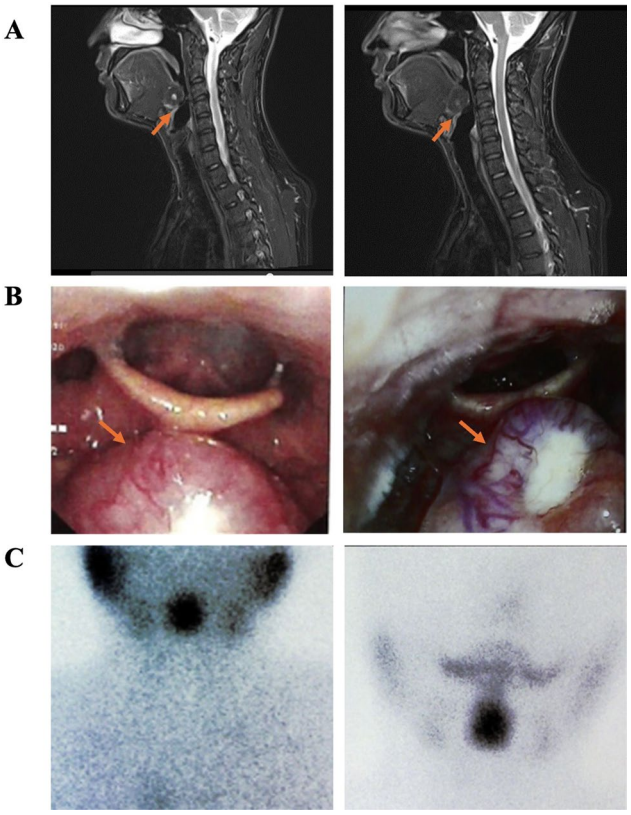

Fig. 1 Multimodal diagnostic evaluation of ectopic lingual thyroid in an active-duty Air Force pilot.**A** MRI showing a well-defined mass at the base of the tongue with heterogeneous signal intensity and internal nodularity, indicating ectopic thyroid tissue. **B** Video laryngoscopy demonstrating a mucosa-covered, well-vascularized protrusion at the tongue base, aiding morphological assessment and differentiation from malignancy. **C** Radionuclide thyroid scan with $99mTcO_4^-$ showing absent uptake in the normal thyroid bed and intense radiotracer concentration in the oropharyngeal region, confirming the presence of a lingual thyroid. The right panel shows a magnified view of the uptake focus

Respiratory Event Index (REI) of 6.1, lowest oxygen saturation of 91%, > 3% desaturation index of 5.2, and average oxygen saturation of 95%. Maintenance of wakefulness testing showed sleep onset during all four test sessions. Consultations with Otolaryngology and Sleep Medicine departments confirmed the absence of obstructive sleep apnea or ventilatory impairment. Based on the comprehensive assessment (Table 1), the patient was deemed fit to fly in accordance with aeromedical standards.

Discussion

Ectopic thyroid is a rare congenital anomaly caused by abnormal migration during embryonic development of the thyroid gland, with an estimated prevalence of approximately 1 in 100,000 individuals [6–8]. The lingual region is the most common site of ectopic thyroid tissue, accounting for over 90% of cases. In 70–80% of patients with lingual thyroid, the ectopic tissue represents the only functional thyroid tissue in the body, and these individuals frequently exhibit varying degrees of hypothyroidism [9]. Due to the non-specific nature of early symptoms, diagnosis may be delayed or missed, highlighting the importance of careful evaluation of midline neck masses, especially those located at the base of the tongue [8].

This case is particularly notable as it involves an active-duty military pilot, a population subject to strict aeromedical standards due to extreme operational demands. Routine screening identified a lingual mass, and subsequent imaging and thyroid function tests confirmed a diagnosis of lingual thyroid with subclinical hypothyroidism, with the ectopic tissue serving as the sole functioning thyroid gland. Unlike in the general population, clinical management of military pilots must not only ensure disease control but also assess the impact of the condition on operational readiness. In this case, the patient exhibited no pharyngeal foreign body sensation, dysphagia, dysphonia, or dyspnea. After six months of levothyroxine therapy, his thyroid function normalized, and follow-up MRI revealed a reduction in the size of the lingual mass. No obstructive findings were noted on sleep studies or laryngoscopic evaluations, and tumor markers were within normal limits. Following comprehensive multidisciplinary aeromedical evaluation, and in light of the patient's strong motivation to return to duty, he was certified fit to fly. In making this decision, our team carefully weighed the potential flight safety risks of hypothyroidism—such as fatigue, slowed reaction time, mood changes, musculoskeletal symptoms, and the rare risk of myxedema coma—against favorable factors including well-controlled thyroid function, excellent adherence to treatment, outstanding flight record, lower G-load exposure as a helicopter pilot, and the strategic importance of retaining an experienced aviator.

To our knowledge, this is the first reported case in China of a military pilot with lingual thyroid who was successfully managed conservatively and returned to active flight status. This individualized, guideline-informed approach balanced operational safety with personnel retention, and the pilot has since safely completed 900 flight hours without adverse symptoms. Serial follow-up assessments, including thyroid function tests and laryngoscopy, have shown stable findings, underscoring the safety and effectiveness of the individualized aeromedical decision-making process used in this case.

This case highlights that lingual thyroid should not be considered an absolute contraindication to flight duty, particularly when symptoms are minimal, thyroid function is stable, and comprehensive risk assessment has been performed. Currently, Chinese military physical standards do not specifically address lingual thyroid. Similarly, the U.S. Air Force waiver guide does not exclude congenital anomalies per se but emphasizes

Table 1 Timeline of diagnosis, treatment, and aeromedical clearance in a military helicopter pilot with ectopic lingual thyroid

Stage	Date	Findings/Test	Results/Description
Initial Discovery	Dec 5, 2020	Cervical MRI	Abnormal oropharyngeal signal (2.7 × 2.1 cm)
		Video Laryngoscopy	Round protruding mass on the superior surface of the epiglottis with motion during swallowing
		Thyroid Ultrasound	No thyroid-like echogenicity was detected in the thyroid region
Diagnostic Evaluation and Treatment	Dec 10, 2020 Subclinical hypothyroidism	Repeat Cervical MRI	No visualization of the thyroid gland on contrast-enhanced MRI. A mass at the base of the tongue suggestive of ectopic thyroid, measuring approximately 2.58 × 2.2 × 3.2 cm, with multiple small nodules, the largest measuring approximately 0.6 cm. No bilateral cervical lymphadenopathy.
		Video Laryngoscopy	Dome-shaped elevation at the base of the tongue
		Thyroid Ultrasound	No thyroid-like echogenicity was detected in the thyroid region
		Radionuclide Thyroid Scan ($^{99m}TcO_4^-$)	No uptake in the thyroid bed; focal uptake in the oropharynx
		Laboratory Tests (TSH, FT3, FT4, etc.)	TSH elevated to 15.637 mIU/L
		Levothyroxine Therapy	Started at 25 µg/day and increased to 75 µg/day
Re-assessment following initial treatment	Apr 28, 2021	Thyroid Function Panel	TSH: 2.619 mIU/L; FT3, FT4, TT3, TT4, TPO-Ab, and TG-Ab all within normal ranges, indicating successful correction of subclinical hypothyroidism after levothyroxine therapy
Aeromedical Evaluation	May 31, 2021	Tumor Marker CA72-4	Mildly elevated at 22.55 U/mL
		Follow-up MRI	Lingual mass decreased in size, with increased signal heterogeneity
		Sleep Monitoring	REI: 6.1; Lowest SpO_2: 91%; Avg SpO_2: 95%
		Maintenance of Wakefulness Test	Sleep onset observed in all 4 sessions
		Otolaryngology & Sleep Medicine Consultation	No obstructive sleep apnea or ventilatory impairment; fit-to-fly
Follow-up and Return to Flight	Since June 2021	Long-term Follow-up	Patient has safely completed over 900 flight hours with no flight-related symptoms. Serial thyroid function tests and laryngoscopy findings have remained stable throughout follow-up.

risk-based assessment tailored to the individual and their mission requirements [10].

While this case provides valuable insights into individualized aeromedical decision-making, it is constrained by its single-case design and the lack of long-term comparative data. Continued monitoring is essential, and broader conclusions will require future cohort-level studies. Moreover, the reliance on portable sleep monitoring—although sufficient in this instance to exclude clinically significant sleep apnea—may underestimate respiratory events compared with full polysomnography. In addition, the psychological impact on the pilot and his personal perspective were not explored in depth, yet such factors could offer a more comprehensive understanding of managing rare anomalies in high-demand occupations. Addressing these aspects in future research would help to enhance both the clinical and operational relevance of findings in similar contexts.

Conclusion

In conclusion, for military aircrew with rare congenital or developmental endocrine disorders, individualized assessment strategies must be adopted to determine actual flight safety risk. Conservative, non-invasive management should be prioritized whenever feasible, and long-term follow-up with dynamic functional and imaging assessments is essential to ensure ongoing safety. This case demonstrates that carefully selected and closely monitored individuals with congenital endocrine anomalies can be safely returned to flight status under appropriate medical oversight and may inform future considerations in aeromedical policy.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12902-025-02041-9.

Supplementary Material 1

Acknowledgements
NA.

Authors' contributions
P.L. designed the study, collected and analyzed clinical data, and wrote the main manuscript text. L.W. assisted with data analysis and literature review. L.X. and L.D. contributed to data collection and interpretation. D.W. and C.Y. prepared the figures and tables. D.Z. supervised the project and revised the manuscript. All authors reviewed and approved the final version of the manuscript.

Funding
This study was supported by Capital's Funds for Health Improvement and Research (2024-4-5122) and Young talent program of Air Force Medical Center (22BJQN005).

Data availability
Due to the involvement of active-duty military personnel and associated confidentiality regulations, the detailed clinical data supporting this case report are not publicly available. Summary data may be provided upon reasonable request and with appropriate clearance.

Declarations

Ethics approval and consent to participate
This study was conducted in accordance with the ethical standards of the institutional and national research committees and with the 1964 Helsinki Declaration and its later amendments. Written informed consent for publication of the patient's clinical details and clinical images was obtained. All patient-related information presented in this article has been fully anonymized, ensuring that no personally identifiable data are disclosed, and patient privacy is strictly protected.

Consent for publication
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Competing interests
The authors declare no competing interests.

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Received: 8 April 2025 / Accepted: 29 August 2025
Published online: 01 October 2025

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