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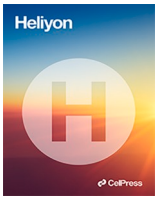

Case report

# Localized light chain amyloidosis involving the lacrimal sac: A case report

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ABSTRACT

Amyloidosis involving the lacrimal sac is extremely rare. In this study, we demonstrated a rare case of localized light chain amyloidosis in the lacrimal sac region. The lacrimal sac lesion presented as infiltrative with bony erosion. Given the slow growth of the lesion and the absence of a blood flow signal inside, we concluded that the lesion was less likely to be malignant. Complete removal of the lacrimal sac lesion combined with simultaneous lacrimal passage reconstruction was performed. The diagnosis of light chain amyloidosis was confirmed by histology. The surgical results were favorable, and no recurrence was observed over one-year follow-up. Our case report enriches the understanding of amyloid deposition in the ocular adnexa.

## 1. Introduction

Amyloidosis is the accumulation of insoluble proteinaceous fibrils that have changed conformations to form beta-pleated sheets extracellularly and presents with variable clinical findings [1]. The incidence of localized amyloidosis is relatively low. The orbit accounts for only 4 % of the focal amyloidosis incidence in the head and neck region, and it involves infiltration of the lacrimal gland, orbital fat, extraocular muscle, and optic nerve [2]. However, there are extremely few instances of nasolacrimal duct obstruction due to localized amyloidosis [3–7]. This study describes a case of lacrimal sac light chain amyloidosis (AL) characterized by bony erosion, which resulted in complete obstruction of the nasolacrimal system. Complete lacrimal sac lesion removal combined with simultaneous lacrimal passage reconstruction was performed and yielded satisfactory results.

## 2. Case presentation

A 31-year-old male visited our outpatient clinic with a primary complaint of left eye epiphora without secretion for more than 6 years. A slow-growing lump, which was present for more than 1 year, was identified overlying the left lacrimal sac. Except for a previous surgery for cyst removal from the left knee, he did not have a history of any other specific systemic or ocular disease. No special treatment was previously administered for the lump.

The appearance of the patient was not evidently abnormal (Supplementary fig. 1A). On examination, the fluorescein dye clearance was impaired with an elevated tear lake. A firm, round, and nontender subcutaneous mass was noted in the left lacrimal sac area on

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palpation. The lump was immobile and had relatively clear boundaries with a diameter of approximately 2.5 cm. Left lacrimal passage irrigation revealed fluid regurgitation from the opposite punctum without secretion reflux. All of the patient's subsequent ophthalmological examinations were normal.

Further adjuvant examinations were performed to reveal the location and properties of the mass. Orbital computed tomography revealed a lacrimal sac mass with bone destruction (Fig. 1A). The characteristic of bony erosion indicated the potential possibility of malignant progression [8]. Contrast-enhanced magnetic resonance imaging (MRI) revealed signal abnormalities suggestive of inflammatory lesion changes (Fig. 1B). A shallow lesion was found in the lacrimal sac region with a limited blood supply by ultrasound B-scan and color Doppler ultrasonography (Fig. 1C and D). The preoperative diagnosis was lacrimal sac amyloidosis based on clinical and radiographic examinations.

During the operation, a transnasal endoscopic approach combined with a percutaneous approach was performed. First, the lacrimal mass was exposed through a transnasal endoscopic approach. The capsule of the mass was found to be incomplete with periosteum invasion. The mass seemed to be fragile and neoplastic bony tissue with poor blood supply. The mass consisted of solid yellowish wax-like tissue (Fig. 2A). The appearance of the mass was consistent with the diagnosis of amyloidosis. In addition, the lacrimal sac was completely disrupted. Then, a percutaneous approach was performed. After complete mass removal, the lacrimal passage was reconstructed by anastomosing the broken ends of the lacrimal canaliculi to the nasal mucosal flap and implanting a lacrimal stent. The surgical specimens were pathologically examined.

Hematoxylin-eosin staining demonstrated red staining of amorphous material with calcification, vascular degeneration, and chronic inflammatory cell infiltration (Fig. 2B). The mass was further confirmed to be amyloid by Congo red staining (Fig. 2C and D). Immunohistochemistry results revealed AL with positive findings for both of the κ and λ monoclonal light chains (Fig. 2E and F). A diagnosis of AL of the lacrimal sac was established. The patient was referred to the nephrology department, and extensive work-up, including immunofixation electrophoresis of urine and serum samples, autoimmune-related laboratory tests, ECG, echocardiography, and abdominal color ultrasound, was performed. The results showed that the serum free κ and λ light chain concentrations were

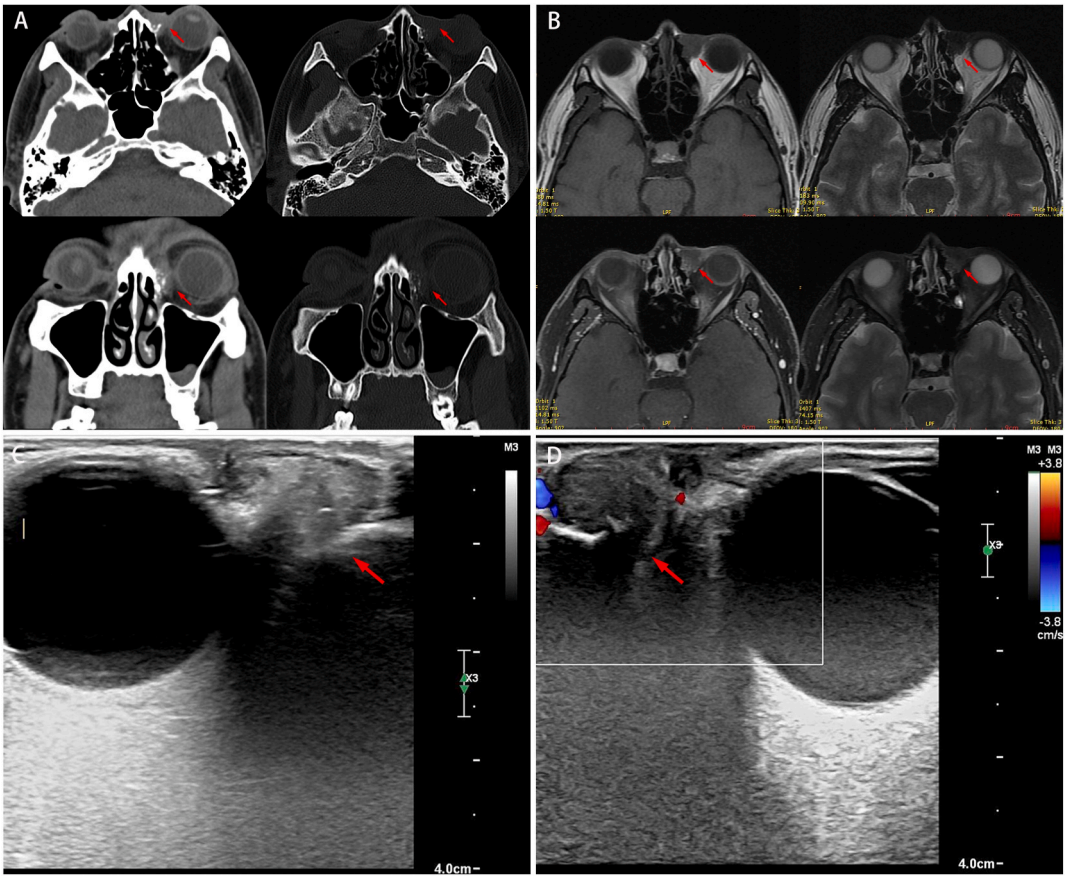


**Fig. 1. Preoperative imaging examination**. A, Orbital computed tomography demonstrated a lesion with nonuniform soft tissue density in the left lacrimal sac region with inhomogeneous calcification. The boundaries of the mass were unclear with bone destruction in the posterior lacrimal crest. B, Orbital contrast-enhanced MRI indicated the lesion was isointense on T1W1 and hypointense on T2W1. The lesion was mildly enhanced on contrast-enhanced T1W1. No obvious signal variations on fat-suppressed T2W1 were observed. C, B-mode ultrasound revealed a hypoechoic lesion with a diameter of 26.2*12.5 mm. D, No significant blood flow signal was found in the lesion by color Doppler ultrasonography. The arrows indicate the lacrimal sac lesion. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

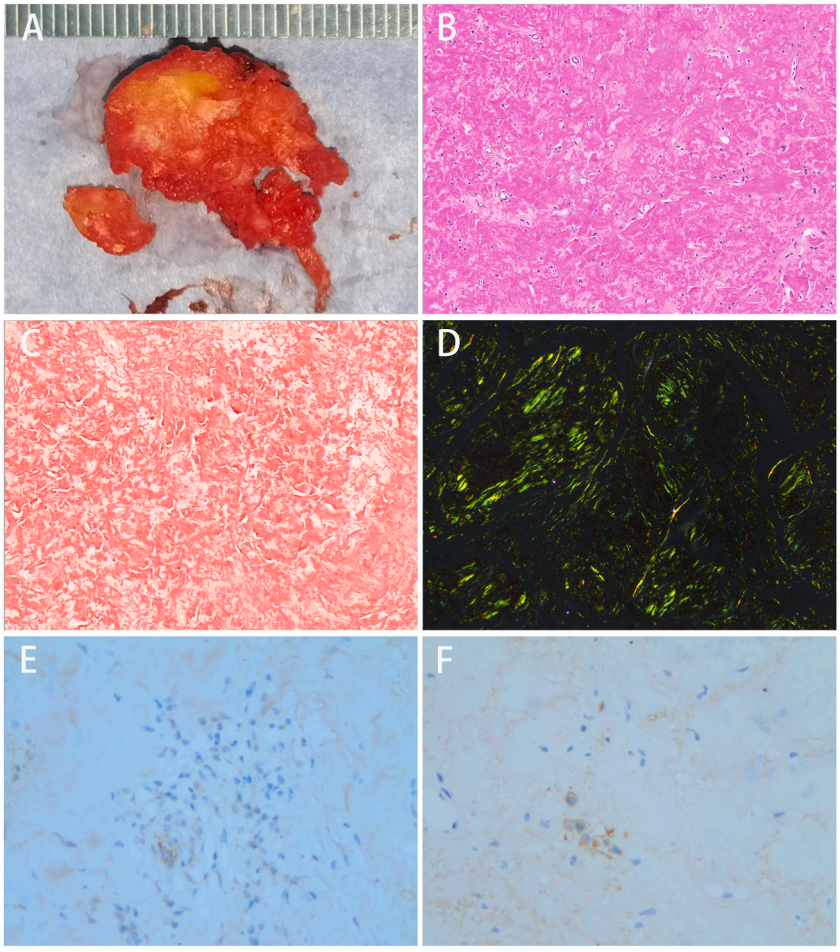


**Fig. 2. Pathological results**. A, Gross photograph of the lacrimal sac lesion. B, Photomicrograph of hematoxylin-eosin staining demonstrated abundant, amorphous material with calcification, vascular hyaline degeneration, and chronic inflammatory cell infiltration (magnification × 10). C, Congo red staining revealed the amyloid protein with a homogeneous salmon-pink appearance (magnification × 10). D, Characteristic apple-green birefringence of amyloidosis on Congo red staining was observed under polarized light (magnification, × 100). E, IHC analysis of κ monoclonal light chains (magnification, × 200). F, IHC analysis of λ monoclonal light chains (magnification, × 200). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

7.84 g/L and 5.41 g/L respectively. Both were within normal limits. No evidence of end-organ damage typical of AL was detected. Whole exosome sequencing (WES) was performed with the leukocytes of peripheral venous blood. The results revealed a mutation in *PDE11A* (c.20_21delGA, p.(Arg7Thrfs*30)), which is not the causative gene of amyloidosis.

The lacrimal stent was removed 6 months after the operation. After one year of follow-up, the symptom of epiphora disappeared, and there was no noticeable discomfort. The patient was satisfied with his appearance (Supplementary fig. 1B). Tear drainage function was normal on the left side, as verified by lacrimal irrigation with sodium fluorescein (Supplementary fig. 1C). No recurrence was observed by CT re-examination.

## 3. Discussion

AL is caused by the production of an abnormal immunoglobulin light chain or fragment by monoclonal plasma cells [9]. It can be localized or systemic. Amyloidosis with localized forms is less common and mainly occurs in AL subtypes. Localized AL is characterized by the absence of circulating monoclonal immunoglobulin light chains as opposed to systemic AL amyloidosis [10]. In localized amyloidosis, κ and/or λ monoclonal light chains are deposited in a localized and restricted anatomic region that resembles a benign tumor [9]. However, amyloidosis involving the lacrimal sac is extremely rare [3–7,11,12]. Delayed or missed diagnoses are often caused by the variety of presentations and symptoms as well as the rarity of the occurrences [13].

The etiology of localized AL is not yet completely clear. According to some studies, the first step could involve long-term reactions of plasma cells with environmental antigens to produce extensive immunoglobulin light chains. Second, macrophages can convert these immunoglobulins into insoluble fibrils. Therefore, localized AL tends to have giant cells [9]. The localized inflammation may be

responsible for the bony erosion in this patient.

Localized amyloid deposits may grow into tumor-like lesions, which presents as bony erosion with unclear margins. It may be misdiagnosed as a granulomatous lesion or lacrimal sac tumor. Usually, a preoperative tissue biopsy may be needed to establish a diagnosis. However, localized amyloid deposit is characterized as indolent, which has a slow growing nature with poor blood supply and only produces site-specific symptoms due to its mass effect [14,15]. For this patient, given the slow growth of the lesion and the absence of a blood flow signal inside, we concluded that the lacrimal sac lesion was unlikely to be a malignant tumor.

Amyloidosis is diagnosed histochemically using Congo red staining and birefringence under polarized light. IHC analysis of the type of specific amyloidogenic protein is vital for differentiating between various forms of amyloidosis. As reported, no patients with nasolacrimal amyloidosis have been diagnosed with systemic symptoms [5]. The findings of this study provide more evidence that periorbital AL can be localized and not associated with systemic disease.

There are a variety of treatment options for amyloidosis, including corticosteroids, radiotherapy, and agents such as melphalan, which result in variable outcomes. In addition, surgery is considered to be the best option for patients with localized amyloidosis for symptomatic relief [16]. The prognosis of patients with localized AL is good, with no progression to systemic amyloidosis [9]. To date, 7 cases of localized amyloidosis involving the lacrimal sac have been reported, 4 of those patients underwent uncomplicated excision of the lesion for biopsy [5,7,11,12], and in the other 3 patients, recurrence was not observed during the short follow up from 6 months to 1 year [3,4,6]. In the present study, complete removal of the lacrimal sac lesion combined with simultaneous lacrimal passage reconstruction was effective and yielded favorable results. No recurrence was observed in subsequent observations during the one-year follow-up. However, a longer follow-up is required to observe the amyloidosis recurrence and to further evaluate the lacrimal drainage system.

## 4. Conclusion

This study demonstrated a rare case of localized AL in the lacrimal sac region. As the lesion presents as bony infiltrative, exhaustive preoperative examinations, including enhanced MRI and color Doppler ultrasonography, should be performed to avoid misdiagnosis. We preformed complete lacrimal sac lesion removal combined with simultaneous lacrimal passage reconstruction. The outcome was satisfactory at the one-year follow-up. Regular follow-up and monitoring of systemic diseases are highly recommended.

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## Ethics statement

This study was approved by Zhongshan Ophthalmic Center's ethics committee with adherence to the Declaration of Helsinki (approval number: 2022YKPJ122).

## Consent for publication

Written informed consent was obtained from the patient for identifiable clinical photographs to be submitted for publication.

## Data availability

Data will be made available on request.

## CRediT authorship contribution statement

**Pengsen Wu:** Writing – original draft, Data curation, Conceptualization. **Lijuan Tang:** Methodology, Data curation, Conceptualization. **Ping Zhang:** Supervision, Methodology, Conceptualization. **Xuanwei Liang:** Supervision, Methodology, Conceptualization. **Rongxin Chen:** Writing – review & editing, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e30035.

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