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Orbital and peri-ocular paraffinoma: case series and literature review

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Abstract

Background Paraffinoma is a rare and intriguing condition in medicine. In this disorder, an orbital lipogranulomatosis reaction is caused by the penetration of mineral oils (particularly paraffin) into the tissues surrounding the eye.

Methods In this report, we discuss six cases of paraffinoma affecting the eye socket following sinus surgery. For previous cases literature review, we obtained articles from searching in the PubMed, Scopus, Scholar Google and, Science of Web databases.

Results After the reporting of 6 paraffinoma cases and literature review, the data related to the disease were categorized into the categories of disease definition, differential diagnosis, clinical manifestation, radiological manifestation, and histopathological diagnosis and treatment methods.

Conclusions Paraffinoma is a rare and time-delayed diagnosis after various surgeries and therefore may challenge the physician to make the correct diagnosis at first. It is necessary for ophthalmologists to consider this diagnosis in cases of masses around the eyelid and orbit in patients with a history of sinus and nose surgery in other differential diagnoses.

Keywords Paraffinoma, Foreign-body reaction, Sinus endoscopy, Complication, Dacryocystorhinostomy

Background

Paraffin is a substance composed of mineral hydrocarbon chains that has various medical uses. Due to its non-degradable nature in body tissues, the immune system's response to it manifests as the accumulation of lymphocytes and macrophages, leading to granulomatous reactions around the substance in the tissue. This pathological diagnosis is known as paraffinoma. During clinical

examination and various imaging modalities of the orbits, the accumulation of this oil appears as circular or elliptical masses in the tissues surrounding the eyes and eyelids [1]. This condition has been recognized following the use of paraffin-containing substances in various surgeries, particularly sinus and nasal surgeries [2].

In this report, we present six rare cases of paraffinoma following endoscopic sinus surgery and also review previous cases reported with the diagnosis of paraffinoma in different areas and parts of the body.

Methods

This study is a retrospective case series combined with a literature review. We analyzed patient data from Khalili Hospital, covering the period from 2010 to 2023. The report adhered to the ethical principles outlined in the

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declaration of Helsinki. All participants in this study completed an informed consent form for participation, publication of information, and use of images in the article. The study was approved by the Shiraz university of Medical Sciences Institutional Review Board (IRB) with the ethical approval number IR.SUMS.MED.REC.1403.121.

The retrospective case series involved reviewing medical records of patients who were diagnosed with Paraffinoma at Khalili hospital. Data collected included demographic information, clinical presentation, treatment methods, and outcomes. All patient identifiers were anonymized to maintain confidentiality.

Literature Review: A comprehensive literature review was conducted using PubMed and Scopus databases. The search was performed using the following keywords: "Orbital Paraffinoma", "Eyelid Paraffinoma", and "Peri-ocular Paraffinoma". Articles were included if they were published in English, involved human subjects, and focused on facial Paraffinoma. Review articles, case reports, clinical trials, and observational studies were included. Two independent reviewers screened the articles for relevance, and discrepancies were resolved by consensus or by a third reviewer. Data extraction from selected articles included study design, sample size, interventions, and outcome.

Case presentation

Patient 1

A 45-year-old woman diagnosed with chronic sinusitis involving the maxillary and ethmoid sinuses underwent endoscopic sinus surgery for sinus and nasal drainage. Six



Fig. 1 H&E staining. oval-shaped empty spaces (Black arrow) surrounded by lymphohistiocytic aggregation (White arrow)

months post-operation, she presented with complaints of multiple small nodules beneath the lower eyelids of both eyes.

In the biopsy performed via anterior orbitotomy, the nodules were excised as much as possible. A yellowish mass measuring $0.5 \times 0.5 \times 0.5$ centimeters was reported, and on histopathological microscopy, oval-shaped empty spaces (due to the removal of paraffin oil during slide preparation) surrounded by lymphohistiocytic aggregation were observed (Fig. 1).

Patient 2

A 60-year-old man with a history of chronic maxillary and ethmoidal sinusitis underwent dacryocystorhinotomy (DCR) surgery along with nasal packing containing tetracycline ointment one year ago. The surgery was uneventful, and the nasal packing with tetracycline ointment was removed two days post-surgery. After one year, the patient presented to the eye department with complaints of palpating a firm and mobile mass beneath the lower eyelid of the left eye, which had been increasing in size over the past three months (Fig. 2).

With biopsy performed via anterior orbitotomy, a mass measuring $3 \times 2 \times 2$ centimeters in dimensions and yellow in color was excised. Microscopic examination of the biopsy revealed several cavities and cysts containing fatty materials and showed a reaction consistent with lipogranulomatous infiltration with the presence of foamy histiocytes and multinucleated giant cells within the tissue. The diagnosis of paraffinoma was confirmed.

Patient 3

A 25-year-old woman diagnosed with ethmoidal and frontal sinusitis underwent endoscopic sinus surgery for sinus and nasal drainage. At the end of the nasal surgery, an oil pack was placed. After 5 months post-surgery, the patient presented with three circular masses above the left eye. During the subsequent surgery, these masses were excised from the eyelid, and the pathology report was similar to previous cases, confirming the diagnosis of paraffinoma. However, these masses had a pseudo-capsule in pathology (Fig. 3).

Patient 4

A 62-year-old woman with a similar history of sinus and nasal surgery presented after 6 months with a mass above the eyelid. During the subsequent surgery, a mass measuring $2 \times 1.5 \times 1.5$ centimeters was excised from the eyelid tissue. The pathology report confirmed the diagnosis of paraffinoma.

Patient 5

A 29-year-old woman presented with a complaint of a yellowish mass above the left eye's eyelid 18 months after



Fig. 2 (A) Left lower lid mass. (B) Intraoperative view. (C) En-bloc excision of paraffinoma



Fig. 3 (A) Intraoperative View. (B) Excised pearl like paraffinoma



Fig. 4 Yellowish discoloration Skin due to paraffinoma

sinus surgery (Fig. 4). In the pathology report, inflammatory cells surrounding variably sized tissue cavities were observed in the excised mass.

Patient 6

A 36-year-old woman presented with complaints of swelling around the upper and lower eyelids of the right eye one year after undergoing endoscopic surgery for maxillary and ethmoidal sinuses. The masses were excised in piecemeal fashion and sent for pathology. The microscopic evaluation confirmed the diagnosis of paraffinoma. After 6 months again the patient came with similar mass which underwent excision with similar pathology report.

A summary of all the information regarding the patients reported in Table 1 has been provided.

Discussion

In this study, efforts were made to address ten fundamental questions regarding paraffinoma by examining previously known cases of paraffinoma and six recent presenting cases.

In cases of paraffinoma, which sinuses have been mostly targeted in previous surgeries?

In the reported cases so far, paraffinoma tends to develop after endoscopic surgeries related to the sinuses around the eyes. Among these, the most commonly reported sinuses involved are the ethmoid sinus and the maxillary

sinus [3, 4]. The lower rate of reported frontal sinus surgery may be due to lesser frequency of evacuation of this sinus and tighter boundaries between this sinus and orbit.

In our patients, five individuals underwent surgery on the sinuses, all of which included the ethmoid sinus, and one case followed dacryocystorhinostomy surgery. Since the lacrimal fossa is in close proximity to the ethmoid sinus cells and damage to ethmoid air cells can occur during dacryocystorhinostomy, it seems that injury to ethmoid air cells and subsequent lamina papyracea compromise are the most common pathophysiology involved in the development of paraffinoma.

How is the time interval for the onset of the disease?

In previous reported cases, patients typically present with a single or multiple painless, firm masses above or below the eyelid approximately 6 to 12 months after sinus surgery for chronic sinusitis or sinus polyps [5–7]. It appears that a few months' interval after sinus surgery is necessary for the inflammatory reaction around the paraffin in the tissue to clinically manifest as a mass. This delayed manifestation can pose challenges in the accurate diagnosis of the disease.

In the current study, there is a time interval of 5 to 18 months between surgery and the onset of disease manifestations. This delay in symptom onset can be investigated from two perspectives. Paraffinoma is a delayed hypersensitivity reaction, and on the other hand, lesions sometimes form in deeper parts of the orbit, requiring more time for manifestations to be identifiable in the more anterior parts.

Which are the identified risk factors associated with the development of orbital paraffinoma?

Most sinus surgeries have been performed without any complications during or after the procedure [8, 9]. However, among the common complications of sinus surgery in paraffinoma cases, mention can be made of orbital wall injury or sphenopalatine artery injury during surgery, or the formation of hematoma around one eye immediately after completing sinus surgery [10]. It appears that an important factor in the occurrence of this problem has been the surgical technique and the use of paraffin derivatives during the procedure, with age not playing a

Table 1 Characteristics of patients with paraffinoma secondary to previous surgery

| Cases | Age | Sex | Type of previous surgery | Targeted sinuses | Interval of disease onset | Paraffinoma location |
|-------|-----|-------|--------------------------|-------------------------|---------------------------|-----------------------------------|
| 1 | 45 | Woman | Sinus surgery | Maxillary and ethmoidal | 6 months | Lower eyelid |
| 2 | 60 | Man | Dacryocystorhinostomy | Maxillary and ethmoidal | 12 months | Lower eyelid and orbit |
| 3 | 25 | Woman | Sinus surgery | Ethmoidal and frontal | 5 months | Upper eyelid |
| 4 | 62 | Woman | Sinus surgery | Ethmoidal | 6 months | Upper eyelid |
| 5 | 29 | Woman | Sinus surgery | Ethmoidal | 18 months | Upper eyelid |
| 6 | 36 | Woman | Sinus surgery | Maxillary and ethmoidal | 12 months | Upper and lower eyelids and orbit |

significant role in causing this complication due to variation in the age of reported cases. However, the occurrence of paraffinoma after sinus and nasal surgeries is more common due to the frequent use of oil packs to reduce nasal bleeding. After the use of oil-containing packs, this substance is dispersed in the surrounding tissues and ultimately manifests as a subcutaneous mass or even granuloma [2, 11–13]. Reported cases of paraffinoma have decreased in recent years, which is likely due to advancement in surgical technique and the availability of newer hemostatic materials, along with increased awareness of this condition.

How does paraffinoma manifest clinically?

In previous reported cases, patients typically present with a single or multiple painless, firm masses above or below the eyelid approximately 6 to 12 months after sinus surgery and seek medical attention. During examination, masses of various sizes are palpable in the upper or lower eyelids. In some cases, these masses may increase in size over time and may even cause visual impairment, similar to the condition reported previously [9]. Other manifestations of paraffinoma include inflammation, bruising, or

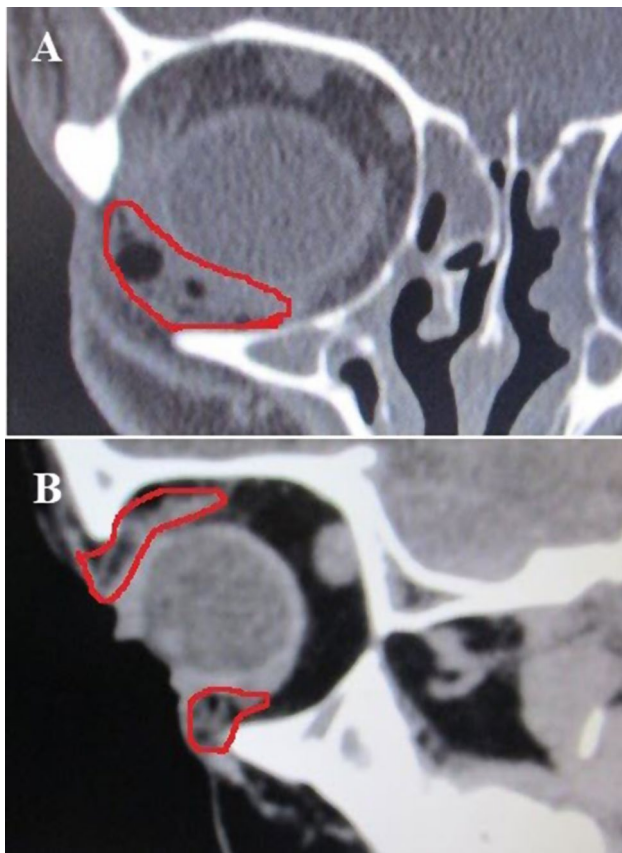


Fig. 5 (A) Coronal Orbital CT scan show are of round hypodense are within eyelid which correspond to paraffinoma. (B) Sagittal images show extension into anterior orbital cavity

long-term swelling of the eyelids with ptosis of the upper eyelid [10]. Sometimes, these paraffin-containing masses cause acute inflammatory tissue reaction and appear as purulent or serous discharge. Pressure effects due to the accumulation of this substance in the tissue may lead to diplopia and restriction of eye movements [9]. In patients visiting our center, the most common manifestation was a mobile, firm mass in the upper or lower eyelid.

All reported cases in this study presented with masses in the eyelid and anterior orbit. This manifestation has been the most common reason for patient referral in previous studies, also.

What are the differential diagnoses of this condition?

Differential diagnoses of these lesions include orbital lymphoma, lipogranuloma, orbital granulomas associated with Wegener's disease, and sarcoidosis [5, 8, 12, 14, 15].

How extensive is the involvement of paraffinoma in eye and facial tissues?

There are multiple reports of paraffinoma occurring in other body tissues, including the knees, lungs, and other areas [16, 17]. It may even result from facial fat injections for cosmetic purposes [14, 18, 19]. In cases of paraffinoma, involvement of muscle tissue in addition to subcutaneous soft tissue has also been observed [20].

In the recent study, 4 patients presented with paraffinoma in their eyelids, and 2 patients had paraffinoma extending beyond the eyelids to the orbit.

How is the diagnostic appearance of the lesion in imaging?

In MRI of the orbit, these masses appear as hyper intense on T1-weighted images with clear margins and moderate enhancement with contrast administration [21, 22]. In CT scans, these lesions appear as masses with clear margins and similar density to surrounding soft tissue, sometimes with a calcified rim [23, 24]. In the cases reported by us, CT scan images showed a well-defined mass with density similar to surrounding tissue in the eyelid and within the patient's orbit (Fig. 5).

In patients undergoing CT scans, checking the density of the mass using Hounsfield units helps in more accurate diagnosis of the lesion. In cases suspicious for paraffinoma, it is better to define a narrow window (window width of 50 to 350 Hounsfield units) on the CT scan to better identify paraffinoma lesions [25].

What are the diagnostic views of the lesion in pathology?

After performing a diagnostic biopsy of these eyelid masses and conducting pathological examinations, the diagnosis of paraffinoma in pathology is characterized by clear spaces and cavities within the tissue with an accumulation of cells, including chronic inflammatory cells

such as lymphocytes and macrophages, and vacuolated areas around these cavities [5, 26].

In electron microscopy, accumulations of transparent structures are observed in the cytoplasm of macrophages [27]. Transparent and vacuolated spaces within the tissue are due to the washing out of paraffin mineral oil during the tissue slide preparation process. Performing immunohistochemistry tests and cellular markers such as CD68, CD143, CD3, and CD20 also help in accurate diagnosis [5, 28].

Paraffinoma is regarded as a form of delayed hypersensitivity reaction. The leakage of paraffin from nasal packing through compromised boundaries between the nasal cavity and the orbit triggers this reactive hypersensitivity. Given the close anatomical relationship between the lacrimal fossa and the ethmoid sinus cells, and the potential for damage to the ethmoid air cells during dacryocystorhinostomy, it appears that injury to the ethmoid air cells and subsequent compromise of the lamina papyracea are the most common underlying mechanisms in the development of paraffinoma.

What are the treatment options proposed so far?

Several treatment methods have been used so far, which fall into two categories: medical therapies, radiofrequency, and surgical treatments. In cases of paraffinoma in the face, the use of steroids to reduce the lipogranulomatous inflammatory reaction has been reported [2]. Uchida et al. have used intralesional triamcinolone injection and oral prednisolone 20 mg/day in the paraffinoma area of the face [27]. Other drugs such as allopurinol, imiquimod, minocycline, 5-fluorouracil, and isotretinoin have also been used in previous cases [28, 29]. One of the newer methods in paraffinoma treatment is radiofrequency [30]. The heat generated by the electric current can melt paraffin droplets in the tissue and disperse them, preventing their accumulation in the tissue [30]. In a study by Kim et al., a 21-gauge radiofrequency probe with a maximum power of 20 watts under local anesthesia was applied as a 1-minute electric current with a 3-minute massage of the treatment area, yielding good results in treatment [2]. Some previous articles emphasize the necessity of surgical intervention for paraffinoma treatment, ensuring complete removal of all masses from the tissue [19]. Sometimes, it may not be feasible to remove all lipogranulomatous reactions in a single surgical session, necessitating multiple sessions [15].

Patients in this study all underwent surgical treatment. Four patients had limited lesions (3 lesions or fewer), while 2 patients had numerous and multiple lesions that could not all be removed. Only the lesions that were clinically significant were excised.

How much is the likelihood of recurrence of paraffinoma after treatment?

After procedure, and the presence of remaining small particles in the tissue may lead to recurrence. Of the 6 patients, 2 had numerous and multiple lesions that could not be completely removed, and only the lesions that were clinically significant were excised.

One of these two patients (Case 6) returned one year after the initial surgery with the recurrence of paraffinoma masses in all four eyelids. Upon examination and comparison of imaging studies, it appears that in this patient, lesions that were not clinically significant previously have grown, and lesions located in the midpalpebral areas have shifted anteriorly.

Therefore, it is recommended that after treating paraffinoma using the mentioned methods, it is better for the patient to undergo periodic follow-up examinations and imaging studies to detect recurrences more quickly. Additionally, it is advisable to discuss the higher likelihood of recurrence and the need for future treatments with patients who have multiple lesions or lesions that have extended to more central areas of the eyelid.

Conclusion

Paraffinoma is a rare diagnosis that often presents with delayed onset following various surgeries, which may initially challenge physicians in making an accurate diagnosis. It is essential for ophthalmologists to consider this diagnosis in patients with masses around the eyelids and orbit who have a history of sinus and nasal surgeries, along with other differential diagnoses in mind.

Abbreviations

| | |
|-----|----------------------------|
| CT | Computed tomography |
| CD | Cluster of differentiation |
| DCR | Dacryocystorhinostomy |

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Not applicable.

Author contributions

Nasser Owji, Behzad Khademi prepared conception and design Elham Sadeghi, Fatemeh Ebrahimi, Farima Safari did data acquisition. Fatemeh Ebrahimi, Afroz Feili, Zahra Zia prepared data analysis and figures Zahra Zia, Afroz Feili, Mohammad Hassan Jalalpour performed manuscript drafting and revisions. Behzad Khademi, Zahra Zia did final approval of manuscript.

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Data availability

Data is provided within the manuscript.

Declarations

Ethics approval and consent to participate

The study was approved by the Shiraz university of Medical Sciences Institutional Review Board (IRB) with the ethical approval number IR.SUMS.MED.REC.1403.121. The study adhered to the tenets of the Declaration of Helsinki. All participants in this study completed an informed consent form for participation, publication of information, and use of images in the article.

Consent for Publication

Informed consent was obtained from every patient for the publication of this report and accompanying images.

Competing interests

The authors declare no competing interests.

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