Title

Development of Pilomatrixoma at the Vaccination Site: A Rare Complication of COVID-19 Vaccination — A Case Report

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Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Patient: Male, 65-year-old
Final Diagnosis: Pilomatrixoma
Symptoms: Mass in the left arm
Clinical Procedure: —
Specialty: Dermatology

Objective: Unknown etiology

Background: Pilomatrixoma, pilomatricoma, or calcifying epithelioma of Malherbe, is a common benign tumor that arises from the base of the hair follicle. Pilomatrixoma has previously been reported at vaccination sites. This report is of a 65-year-old man with an 18-month history of an enlarging pilomatrixoma of the left upper arm at the vaccination site, following a first COVID-19 vaccination.

Case Report: The case involves a 65-year-old man who developed a left shoulder mass 1.5 years ago. The mass appeared at his COVID-19 vaccine site 3 months after receiving the first dose. The mass measures 3 cm in diameter, was mobile, and exhibited no signs of infection in the physical examination. Surgical excision was performed, and pathology confirmed the mass as a pilomatrixoma, characterized by basaloid cells and keratinization. Three months after surgery, no recurrence was observed.

Conclusions: This report has presented an association between vaccination injection sites and pilomatrixoma aligning with previous findings. Enhanced awareness about this condition can substantially improve pilomatrixoma diagnosis accuracy and reduce unnecessary examinations and treatments. Furthermore, we recommend that, along with clinical symptoms, ultrasound imaging be considered a valuable diagnostic tool for pilomatrixoma, with histopathological results to confirm the diagnosis.

Keywords: COVID-19 Vaccines • Pilomatrixoma • Diagnosis • Case Reports

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Background

Pilomatrixoma is a non-cancerous, benign neoplasm derived from hair follicle stem cells in the dermis layer of the skin [1,2]. It is also known as calcifying epithelioma of Malherbe or pilomatricoma. Pilomatrixoma is most common in patients younger than 20 years old, with a slight female predilection [1,2]. The average age of patients is around 16 years [2]. The most common regions where this lesion occurs are the head and neck [2].

Because of its rarity and various morphology, the diagnosis of pilomatrixoma can be challenging. Only 12.5% to 55.5% of cases are correctly diagnosed [2]. To differentiate pilomatrixoma from other diseases, such as epidermal inclusion cyst (EIC), granuloma, lipoma, foreign body reactions, epitheliomas calcified cysts, giant cell tumor, and lymphatic malignancies, imaging methods, especially ultrasound examination, are remarkably effective in providing information about calcifications, shadowing, and hypoechoic rim [2,3]. However, the final diagnosis should be made based on histopathological findings [3].

The histopathological presentation of pilomatrixoma is a nodulocystic tumor located within a capsule in the dermis and subdermis layers of the skin [1,2]. The tumor is typically painless, solitary, and firm [1,2]. The size of the tumor typically ranges from 4 to 35 mm in diameter [4]. The tumor usually consists of basaloid hair matrix cells and eosinophilic anucleate shadow cells [1,2,4,5]. Varying amounts of ossification, calcification, and keratinization can be observed in the stroma. Infiltration of multinucleated giant cells with foreign bodies is commonly found [1,2,4,5].

When pilomatrixoma is accurately diagnosed, treatment becomes a straightforward and highly effective process. The most common approach is surgical excision of the tumor, with a minimal risk of recurrence [1-10].

The cause of pilomatrixomas remains unclear, but there is evidence indicating the involvement of genetic factors, particularly activation of the Wnt pathway triggered by a mutation in the beta-catenin gene (CTNNB1) [11]. External factors such as trauma were also found to be contributing factors [2,5,6]. Mechanical trauma can potentially disrupt dermal integrity and the vascular microenvironment, leading to the formation of pilomatrixoma [6].

Previous reports in the medical literature have indicated associations between pilomatrixoma and traumas from certain vaccines, including those for Bacille Calmette-Guérin (BCG), influenza, and hepatitis A [7-9]. There have also been a few cases linking COVID-19 vaccination to the development of pilomatrixoma [3,10].

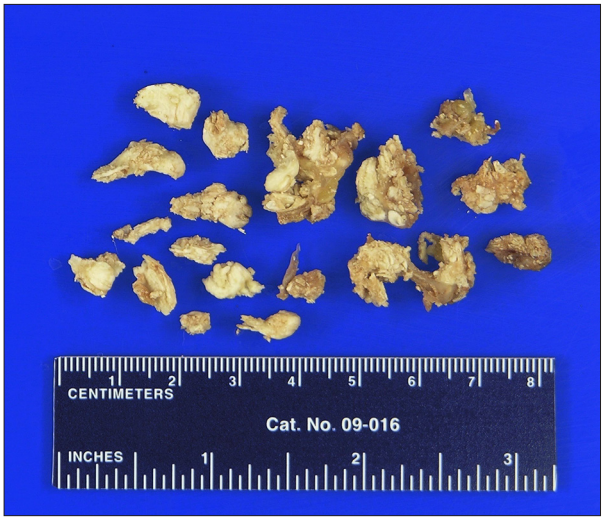

Figure 1. Gross Anatomy of the tumor. Fragments of hard soft tissue with cheesy material.

In this report, we present the case of a 65-year-old man with an 18-month history of a growing pilomatrixoma on the left upper arm, precisely at the site of his COVID-19 vaccination, following administration of a first vaccine dose.

Case Report

The clinical presentation describes a 65-year-old man with a history of hypertension, high cholesterol, obstructive sleep apnea, and psoriasis who presented with a left lateral shoulder mass that has been slowly growing for about 1.5 years.

The patient reported that the mass appeared at the exact vaccine site 3 months after receiving the first dose of the Pfizer-BioNTech COVID-19 mRNA vaccine. Physical examination revealed a freely mobile 3-cm mass/cyst in the left upper lateral shoulder with no signs of infection or abscess. The impression was a left upper-extremity mass/lump, and possible diagnoses included an epidermal inclusion cyst (EIC), granuloma, or lipoma.

The patient expressed interest in surgical intervention, and an excision under local anesthetic was performed. Intraoperatively, a 3-cm cystic lesion containing sebum-like material without a capsule was identified and excised. There was no sign of reoccurrence at the 3-month postoperative checkup.

The pathology report revealed that the lesion was a pilomatrixoma. The microscopic examination showed disrupted fragments of soft tissue with solid nests of basaloid cells undergoing abrupt trichilemmal-type keratinization and multinucleated giant cell reaction, consistent with the diagnosis of pilomatrixoma (**Figures 1, 2**).

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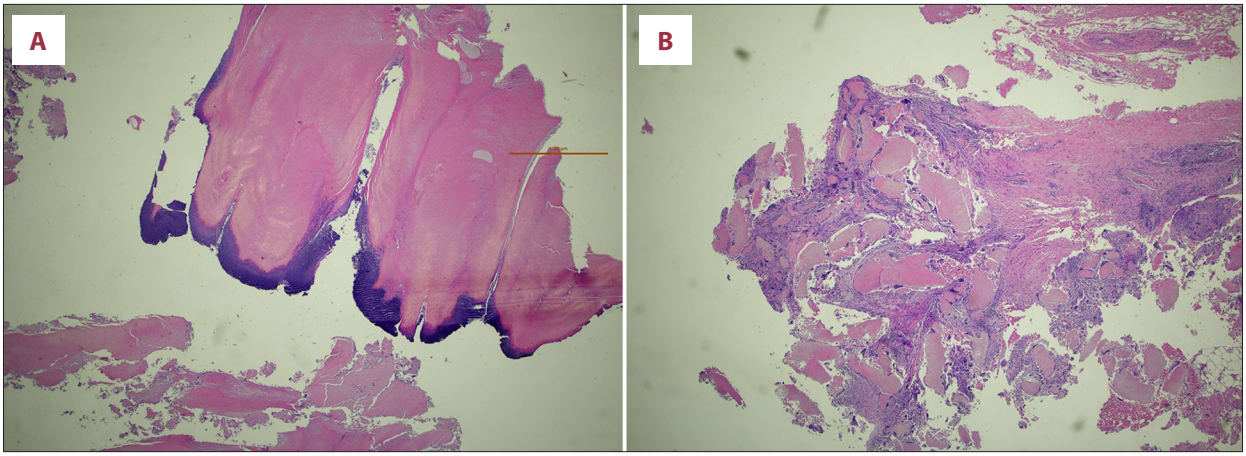

Figure 2. (**A, B**) **Histopathology of the tumor confirmed the lesion was a pilomatrixoma.** Low-power photomicrograph of the histopathology of a vaccination site-associated benign pilomatrixoma in a 65-year-old man. Fragments of dermal tissue include basaloid cells (dark blue) derived from the hair follicle that forms the cyst wall. The pilomatrixoma contains acellular keratin (pink). There is a granulomatous inflammatory response to keratin but no acute inflammation or abscess formation. Hematoxylin and eosin (H&E). Magnification ×20.

In summary, the patient presented with a slowly growing shoulder mass that appeared after COVID-19 vaccination, and it was later diagnosed as a pilomatrixoma, which was surgically excised. There was no sign of reoccurrence at the 3-month postoperative checkup.

Discussion

There have been previous reports of development of pilomatrixomas at injection sites from various vaccines, such as influenza, hepatitis A, and Bacille Calmette-Guérin (BCG) [7-9]. Notably, this association does not appear to be specific to a particular vaccine type. Vaccine injection can potentially disrupt dermal integrity and the vascular microenvironment, leading to pilomatrixoma formation [6].

As discussed in the Background section above, the diagnosis of pilomatrixoma can be challenging, with only 12.5% to 55.5% of cases correctly diagnosed [2]. Lack of awareness among physicians is an important factor contributing to this underdiagnosis of pilomatrixoma [2,3,7]. Considering the extensive vaccination efforts against various diseases, it is obviously beneficial to consider the potential occurrence of pilomatrixoma at vaccine injection sites during the diagnosis. Raising awareness about this condition can also help prevent unnecessary examinations and treatments.

Two prior cases together with the case we are reporting demonstrate an association between the injection site from COVID-19 vaccine and pilomatrixoma [3,10]. This is consistent with the previous findings from other vaccines [7-9]. Given the widespread distribution of COVID-19 vaccines and the emerging need for booster shots, it is important to be aware of the possibility of pilomatrixoma development caused by COVID-19 vaccines.

The 2 previously reported cases were women ages 30 and 43, respectively [3,10]. The current case involves a male patient aged 65. While we lack information on the specific COVID-19 vaccine administered to the 30-year-old woman, it is noteworthy that both the current case and the 43-year-old patient received the Pfizer-BioNTech COVID-19 mRNA vaccine [3,10].

Conclusions

Diagnosis of pilomatrixoma can be challenging, with only 12.5% to 55.5% of cases correctly identified [2]. A lack of awareness among physicians significantly contributes to the underdiagnosis of pilomatrixoma [2,3,7]. This report has presented an association between a vaccination site and pilomatrixoma. Awareness about this condition during diagnosis can potentially improve the accuracy and reduce unnecessary examinations and treatments.

Furthermore, we recommend that, along with clinical symptoms, ultrasound imaging be considered a valuable diagnostic tool for pilomatrixoma, with histopathological results to confirm the diagnosis [2,3].

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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