Treatment of Subungual Exostosis: A Case Report

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ABSTRACT

Background

Subungual exostosis is a rare benign osteocartilaginous tumor that occurs beneath the nail, often affecting the great toe (hallux). It typically presents as a painful, growing subungual mass causing nail deformity. Trauma or chronic irritation is thought to play a role in its etiology.

Case

We report a case of a 14-year-old boy with a one-year history of a painful subungual mass on the right great toe following trauma. The lesion gradually enlarged, causing nail elevation, erythema, and difficulty in daily activities. Examination revealed a firm, fixed nodule under the nail plate. Radiographs demonstrated a pedunculated bony outgrowth from the dorsal distal phalanx. Conservative management for six months failed to relieve symptoms. The patient underwent surgical excision under digital block anesthesia. The nail fold was carefully elevated, and the exostosis was removed en bloc using an osteotome and rongeur. Histopathology confirmed mature trabecular bone with a cartilaginous cap, consistent with subungual exostosis.

Outcome

Recovery was uneventful. The nail was preserved with minimal deformity, and no recurrence was noted at 12-month follow-up. This case highlights the importance of recognizing subungual exostosis and the efficacy of complete surgical excision.

Conclusion

Timely diagnosis and surgical treatment of subungual exostosis can alleviate pain and prevent nail deformity. Our literature review emphasizes trauma as a common precipitating factor and supports complete lesion excision (including the base) to minimize recurrence.

Keywords

Subungual exostosis, Great toe (hallux), Nail deformity, Trauma

INTRODUCTION

Subungual exostosis (SE) is an uncommon, benign bone tumor characterized by a nodular outgrowth of trabecular bone beneath the nail plate [1]. When this bony overgrowth occurs under the nail bed, it is often referred to as *Dupuytren's exostosis*, named after Guillaume Dupuytren, who first described the lesion in 1847 [2]. Hutchinson later reported the first case in the hand (finger), noting the distinctive nail elevation associated with this exostosis [3]. SE most frequently affects the distal phalanx of the toes, with a strong predilection for the great toe. Historical reviews indicate its rarity – for example, a 1992 literature review found only ~203 reported cases at that time [4]. More recent analyses have identified roughly 500 cases in total, about 84% of which involve the toes (hallux in 70–80% of cases) [5]. Because of its infrequency, SE is often misdiagnosed initially as more common conditions (such as ingrown toenail, pyogenic granuloma, wart, or osteochondroma), leading to delays in proper management [6].

The exact etiology of subungual exostosis remains unclear. The leading hypothesis is that it represents a reactive process [7] triggered by chronic irritation, trauma, or infection, which induces cartilaginous metaplasia and subsequent endochondral bone formation [8]. Multiple studies have noted a history of prior trauma (either acute injury or repetitive microtrauma) in a large proportion of patients. In one pediatric series of 40 patients, 17.5% had definite or possible trauma antecedents and a subset had antecedent infection, supporting the trauma/inflammation hypothesis [9]. Infection or chronic irritation

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(such as pressure from ill-fitting shoes) may act as precipitating factors in some cases [10, 11]. Notably, subungual exostosis is histologically distinct from conventional osteochondroma: SE is typically capped by fibrocartilage rather than hyaline cartilage [7 ,8], and it often arises away from the growth plate region. It has not been associated with malignant transformation [8], reinforcing its benign nature. Interestingly, a recurrent chromosomal translocation t(X;6) has been identified in some SE lesions, suggesting a possible neoplastic (tumorigenic) component to their development [12], although the clinical significance of this finding remains under investigation.

Clinically, subungual exostosis usually presents in adolescents and young adults, with some series noting a slight female predominance [5]. However, pediatric cases may show a male predominance [9]. Patients often report a slowly enlarging mass under the nail that causes pain, tenderness, and nail deformity. The overlying nail may become elevated or dystrophic, and complications such as onycholysis (nail plate separation) or secondary infection can occur if the lesion is left untreated [13]. Diagnosis is aided by radiography: a typical radiograph reveals a bony protuberance arising from the dorsal aspect of the distal phalanx. Biopsy or excisional histology is recommended to confirm the diagnosis and distinguish SE from other osseous or cartilaginous lesions. Here we present a case of subungual exostosis in an adolescent patient, detailing the clinical presentation, surgical treatment, and outcome. We also review the relevant literature to contextualize this case and discuss optimal management strategies.

CASE REPORT

Patient Presentation: A 14-year-old boy presented with a painful mass under the nail of his right great toe. The patient recalled a direct trauma to the toe about 12 months prior (a heavy object fell on his toe), after which a small bump gradually developed under the nail. Over the past year, the lesion slowly enlarged. He reported progressive pain exacerbated by pressure from shoes and activities such as walking and sports. The growing mass caused visible nail elevation and deformity, with surrounding redness and mild swelling. The discomfort and nail changes were significant enough to interfere with his daily activities and athletic participation.

Physical Examination: The nail of the right hallux was elevated and deformed by an underlying mass. A firm, non-mobile nodule (~1 cm in diameter) was palpable beneath the nail plate, centered on the dorsal midline of the distal phalanx. The overlying nail was partially lifted away from the nail bed by the lesion, and the nail bed appeared erythematous but intact. There was no active drainage or ulceration. The lesion was tender to pressure but without severe acute inflammation. The remainder of the foot examination was unremarkable, and no other masses or similar lesions were found elsewhere.

Imaging: Plain radiographs of the affected toe were obtained in multiple views. These revealed a well-defined, pedunculated bony outgrowth arising from the dorsal aspect of the distal phalanx of the great toe,

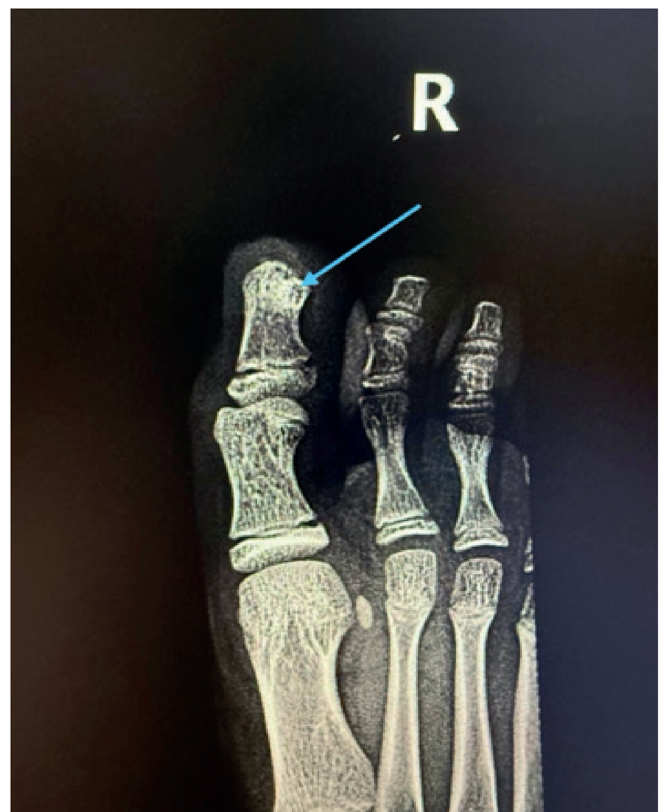

Figure 1: Preoperative anteroposterior (dorsoplantar) radiograph of the right great toe showing a subungual exostosis arising from the dorsal distal phalanx. The exostosis (blue arrow) is visible as a bony protuberance on the distal phalanx, causing elevation of the nail plate. Such lesions most often involve the hallux (big toe) and appear as outgrowths from the dorsal aspect of the distal phalanx.

consistent with a subungual exostosis. No other bony abnormalities were noted in the toe. The mass appeared to have continuity with the underlying bone cortex, and a slight "haziness" at its periphery was noted, suggestive of a cartilaginous cap on the lesion. There were no signs of aggressive bone changes or osteolysis to suggest malignancy. The radiographic findings confirmed the clinical impression of subungual exostosis.

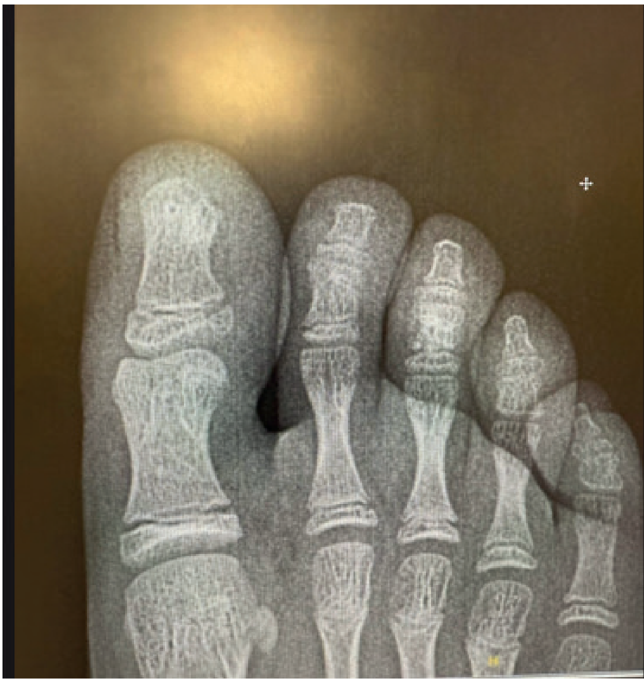

Figure 2: Oblique radiograph of the right great toe providing another view of the subungual exostosis (arrow). The oblique perspective highlights the continuity of the lesion's cortex with that of the underlying distal phalanx, a characteristic feature of subungual exostosis. A thin, slightly indistinct margin can be seen capping the lesion, corresponding to the fibrocartilaginous cap that is typically present on these exostoses. This feature helps differentiate subungual exostosis from other bony tumors like osteochondroma, which instead have a hyaline cartilage cap.

Non-Operative Management: Initially, a trial of conservative management was attempted elsewhere. The patient had been treated with periodic nail trimmings, footwear modifications, and analgesics. Topical treatments (including an over-the-counter wart medication, under the assumption the lesion might be a wart) were also tried for several weeks. However, these measures did not reduce the mass or alleviate the symptoms. Over six months of observation, the lesion continued to enlarge, and pain persisted. Given the failure of non-operative measures and the progressive nature of the exostosis, surgical intervention was planned.

Surgical Treatment: The patient underwent excision of the subungual exostosis under local anesthesia. A digital nerve block of the great toe was administered using 2% lidocaine without epinephrine. A pneumatic tourniquet was applied at the base of the toe to provide a bloodless field. The nail was preserved; instead of a full nail avulsion, the proximal nail fold was gently separated and retracted to expose the dorsal aspect of the distal phalanx. A longitudinal incision (~1 cm) was made directly over the bony mass at the nail bed. Careful dissection was performed to expose the exostosis, which was found attached to the dorsal distal phalanx by a narrow bony stalk. Using a small osteotome and rongeur, the exostosis was resected at its base, along with a thin margin of adjacent periosteum and any fibrocartilaginous cap tissue. Caution was taken to protect the germinal matrix of the nail bed during the excision. After removal, the surgical site was thoroughly irrigated with saline to clear bone dust and debris. The remaining bone surface of the distal phalanx was smooth, and no residual spurs were palpable. The overlying soft tissues (nail bed and skin) were then approximated. The nail plate, which had been elevated for exposure, was placed back into position. The incision was closed with a few interrupted absorbable sutures, ensuring the nail bed was well-aligned to minimize deformity. A sterile dressing was applied, and the tourniquet was released. The excised specimen was sent for histopathological analysis.

Pathology: Gross examination of the excised tissue showed an irregular osseous fragment measuring approximately 10 × 8 mm, with a lobulated surface. Histological analysis revealed mature trabecular (cancellous) bone covered by a cap of cartilaginous tissue. The cartilage cap demonstrated endochondral ossification at the interface with the underlying bone. No atypia or malignancy was seen. These findings were consistent with a benign osteocartilaginous lesion, confirming the diagnosis of subungual exostosis. The presence of a fibrocartilaginous cap is a typical feature of subungual exostosis and helps distinguish it from a conventional osteochondroma. The surgical margins appeared clear of lesion tissue under the microscope, suggesting complete resection.

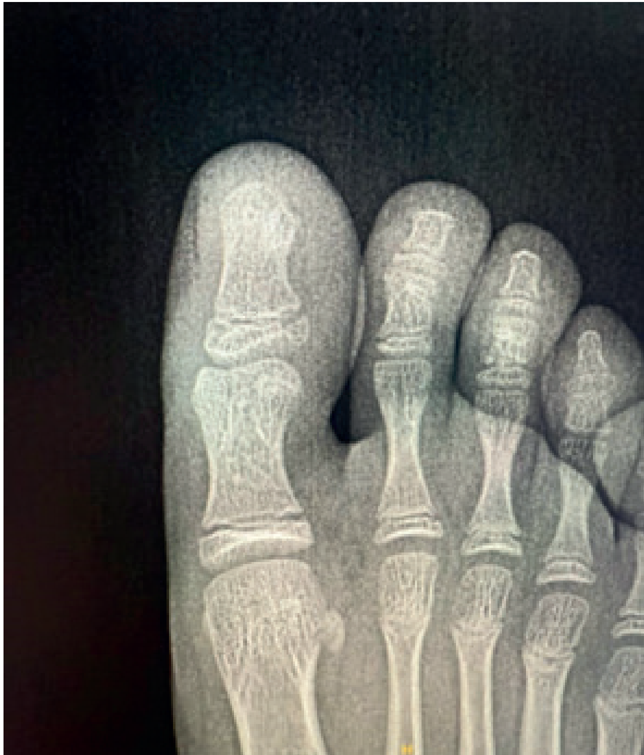

Figure 3: Post- operative radiograph

Postoperative Course: The patient's recovery was uneventful. The toe was dressed and protected, and he was advised to keep the foot elevated for the first 48 hours and to limit weight-bearing on the forefoot for about two weeks. At the two-week follow-up, the wound had healed well with no signs of infection (Figure 3). The nail plate remained in place, and though slightly ridged from the recent surgery, it showed signs of re-adhering to the nail bed. The patient reported immediate relief of the pressure pain that had been present preoperatively. By three months post-surgery, the nail had largely grown out normally with only minor residual deformity. At the 12-month follow-up, the cosmetic appearance of the nail was good – the nail was fully attached with only minimal ridging – and the patient was completely pain-free. There was no evidence of recurrence of the exostosis on examination. The patient had returned to normal activities and sports without restriction.

DISCUSSION

Comparison with Literature: This case illustrates classic features of subungual exostosis and aligns with many findings from the literature. Our patient was an adolescent (14 years old) with a lesion on the hallux, which is typical for SE. Adolescents and young adults represent the most commonly affected age group [4, 14], and the great toe is the single most frequent location for these lesions [8, 15, 16]. Our patient's history of antecedent trauma (a crushed toe injury) one year prior to the lesion onset is also consistent with the hypothesized etiologic link to trauma which is supported by studies have noted that trauma (acute or repetitive) often precedes the development of subungual exostosis. These observations support the idea that localized injury or chronic irritation may induce reactive bone and cartilage proliferation in the distal phalanx, ultimately forming the exostosis. However, not all cases have an identifiable trigger, indicating that other factors (such as genetic predisposition or spontaneous osteocartilaginous proliferation) can also contribute. The identification of a characteristic t(X;6) translocation in some lesions suggests a neoplastic element, although the lesion behaves benignly and has not been known to undergo malignant transformation.

Our case also underscores the importance of proper diagnosis. Initially, the lesion was mistaken for a wart and treated with topical remedies, a common pitfall given that subungual exostoses can present as a firm, sometimes verruca-like nodule. Yousefian et al. note that subungual exostosis may be clinically confused with viral warts or other causes of nail dystrophy, especially early on [13]. Unlike a wart, however, an exostosis has a bony consistency and will show a characteristic bony outgrowth on X-ray. In our case, radiographs were diagnostic, revealing the pedunculated bony mass. Radiographically, SE is typically seen as a bone spur arising from the dorsal distal phalanx, often with a slight hazy outline due to its cartilage cap [7]. This classic radiologic appearance was observed in our patient's imaging (Figures 1–2). The differential diagnosis for such a presentation includes osteochondroma, which is a true bone tumor usually connected to the growth plate and with a hyaline cartilage cap. Several features help distinguish subungual exostosis from an osteochondroma: SE tends to occur on the dorsal aspect of the distal phalanx away from the epiphysis, often has a fibrocartilaginous cap, and is not associated with syndromes like hereditary multiple exostoses. In contrast, osteochondromas have a hyaline cartilage cap and typically arise from metaphyseal regions of long bones (they are quite uncommon in distal phalanges). In our case, the pathology confirming a fibrocartilage cap strongly supported the diagnosis of subungual

exostosis, correlating with known characteristics of this lesion.

Treatment Considerations: The definitive treatment for subungual exostosis is surgical excision of the lesion [17]. Non-surgical measures (e.g., filing the mass, changing footwear, topical treatments) generally do not succeed because the lesion is a true bone growth. Our patient underwent complete excision of the exostosis with preservation of the nail. The surgical approach in this case – lifting the nail fold and directly excising the lesion – can be considered a "direct approach" without full nail removal. In the literature, there is no single agreed-upon surgical technique, but the principle is to remove the entire exostosis including its base to prevent recurrence. **Li et al.** emphasized that *"excision of the entire lesion, including the fibrocartilaginous cap, is crucial for prevention of local recurrence"* [18]. Our approach achieved that by chiseling the lesion off at its base on the bone.

Different surgical techniques have been described, often tailored to the lesion's size and involvement of the nail bed. For smaller exostoses with minimal nail involvement (classified as Type I in some series), a marginal excision via a small incision at the nail edge, without removing the nail plate, can be effective [9]. For more extensive lesions that significantly lift or destroy the nail bed (Type III lesions), some authors recommend temporary removal of the nail plate to allow full visualization and removal of the tumor, followed by careful nail bed repair. In our case, the lesion was large enough to deform the nail, but we were able to access it by partially elevating the nail fold rather than completely avulsing the nail. This likely helped to preserve nail integrity postoperatively.

Outcomes in the literature are generally favorable with surgical treatment. The most common complication is onycholysis or permanent nail deformity, especially if the nail bed is extensively damaged during surgery. Suga et al. (2005), in a review of 16 cases, reported that patients who had a direct approach with nail plate removal often experienced postoperative nail deformities (onycholysis), whereas those treated with a more conservative "fish-mouth" incision (incising around the lesion and preserving more nail bed) had better nail outcomes but a couple of cases of recurrence [19]. Basar et al. (2014) took an individualized approach based on whether the lesion was protruding through the nail bed or not: they used a fish-mouth incision for lesions not breaching the nail and a direct nail removal approach for those that did. They reported no recurrences and good cosmetic results with this strategy [20]. Similarly, Malkoc et al. (2016) described excising the exostosis via an "L"-shaped incision through the nail bed after temporarily removing the nail plate; importantly, they reattached the nail afterward. In their series, this method resulted in no recurrences or cases of onycholysis [21]. These studies suggest that meticulous surgical technique can minimize complications: preserving as much of the nail bed as possible prevents onycholysis, and ensuring complete removal of the exostosis (down to its base) prevents recurrence.

Our patient's outcome is in line with these reports. We achieved a full excision and the nail was largely preserved, resulting in no recurrence at one year and only minor nail changes. Recurrence of subungual exostosis after excision is relatively uncommon. When recurrence does occur, it is usually due to incomplete removal of the lesion (residual proliferative cartilage can continue to ossify) [8, 11, 19, 21]. Miller-Breslow et al. noted that most recurrences tend to manifest within the first year post-surgery [8]. In our case, the 12-month follow-up showed no regrowth, which is a strong indicator of cure. We also did not observe any post-surgical onycholysis or infection. The patient's nail grew back normally, which reflects careful handling and repair of the nail bed. This case reinforces the recommendation from prior studies that the surgeon should remove the lesion at its base and take care to minimize trauma to the nail matrix [22-25]. By adhering to these principles, one can achieve both eradication of the tumor and preservation of nail function/appearance.

CONCLUSION

Subungual exostosis is an uncommon benign tumor of bone that should be considered in patients with a persistent subungual mass and nail deformity. This case highlights that a careful history (noting prior trauma) and radiographic evaluation are crucial for diagnosis. Complete surgical excision of the exostosis, including its cartilaginous cap and base on the distal phalanx, is the treatment of choice and leads to symptom resolution. Our patient's successful outcome – with full pain relief, nail preservation, and no recurrence at one year – underscores the effectiveness of prompt surgical management. Based on our experience and the literature review, we recommend early intervention

once a subungual exostosis is diagnosed, as this prevents progressive nail destruction and alleviates pain. During surgery, meticulous technique is required: the nail bed should be handled gently to minimize postoperative onycholysis, and the entire lesion should be removed to avoid recurrence. Long-term follow-up (at least 12 months) is advised to monitor for any regrowth, given that recurrences, though infrequent, typically occur within the first year if the excision was incomplete. In summary, awareness of this rare condition and an interdisciplinary approach (involving primary care, dermatology, and orthopedic/foot surgeons) can lead to timely diagnosis and definitive treatment. This ensures optimal functional and cosmetic outcomes for patients with subungual exostosis.

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