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COMPARATIVE ANALYSIS OF THE OCCURRENCE OF BO LINES AFTER SPORTS INJURIES AND COVID-19

Abstract

Introduction: Beau's lines (Beau's grooves, Beau's lines) are one of the most common types of onychodystrophy. Beau's lines occur for many reasons, both external and internal.

Internal factors include: side effects of chemotherapy, serious illnesses (myocardial infarction, pulmonary embolism, shock, high fever), metabolic disorders, eczema, psoriasis, especially if the rash is located on the back of the hands, uncontrolled use of potent drugs, infectious diseases that disrupt the function and nutrition of the nail matrix, general intoxication of the body, stress and past neuropsychiatric diseases, a symptom of latent skin pathologies, rheumatism, pemphigus, diabetes mellitus, malaria, Raynaud's disease.

Materials and methods: The article presents a clinical case of a patient who developed Beau's lines as a result of a sports injury to the distal phalanx of the fingers and subsequently contracted COVID-19.

Results: Patient T suffered a sports injury to the distal phalanx in 1987. Five to six weeks after the injury, a specific deformation of the nail plates, similar to a washboard, was observed during examination. Transverse arcuate grooves were observed across the entire surface, crossing the nail plate from one edge of the nail fold to the other, which were identified as Beau's lines. In 2021, patient T suffered from a severe form of COVID-19 with extensive lung damage and was in intensive care for 2 weeks.

Conclusion: Damage to the nail plate in the form of Beau's lines is possible both in cases of trauma and in severe conditions of the body. When Beau's lines appear and trauma to the nail bed is ruled out, an in-depth examination is necessary to rule out severe pathology. The time of appearance of Beau's lines in trauma differs from the time of their appearance in severe COVID-19 and averages 5-6 weeks.

Keywords: nail damage, Beau's lines, COVID-19, nail plate injury, post-infectious nail changes, traumatic nail injury, clinical case report.

Introduction

Bo-Reylev's arched stripes, which appear as transverse linear depressions in the nail plates on the upper and lower extremities, were first described by French military surgeon Joseph Honoré Simon Bo in the mid-19th century, who noticed this symptom in many wounded soldiers. He attributed this nail pathology to a temporary halt in nail growth as a result of trauma and stress.

Normally, the nail matrix, which is capable of growth due to the keratinocytes of the epidermis of the thickened proximal part of the nail bed, is located under the root of the nail. It lies on the underlying dermis, which contains numerous vessels, as well as collagen and elastic fibres that firmly attach it to the periosteum of the distal phalanx of the finger. Newly formed matrix cells are quickly incorporated into the root of the nail (without the formation of keratogialin) and are transformed into horny scales, ensuring the continuous slow movement of the nail plate along

the nail bed at an average speed of 0.1 mm/day (on the hands). Active division of matrix cells not only ensures the growth of the nail plate, but also guarantees the constancy of the chemical composition of the hard keratin of the horny scales of the nail. The white crescent of the nail (or nail lunula) marks the boundary of its growing part [1,2].

The appearance of Bo's lines indicates a violation of the trophism of the nail plate due to a number of reasons, both external and internal. External causes include: previous inflammation or trauma to the posterior nail fold, damage to the nail skin (cuticle, epinohia), inflammation in the upper part of the fingers and nail area, fungal nail infection, heavy physical exertion, prolonged exposure to low temperatures.

Internal causes include: side effects of chemotherapy, serious illnesses (myocardial infarction, pulmonary embolism, shock, high fever), metabolic disorders, eczema, psoriasis, especially if the rash is located on the back of the hands, uncontrolled use of potent drugs, infectious diseases that disrupt the

function and nutrition of the nail matrix, general intoxication of the body, stress and past neuropsychiatric diseases, a symptom of latent skin pathologies, rheumatism, pemphigus, diabetes mellitus, malaria, Raynaud's disease. The appearance of Beau's lines has been described in children who have had measles, scarlet fever and other childhood infections.

In recent years, the appearance of Beau's lines has been noted in patients who have had SARS-Cov2 infection, especially in severe cases of the disease, with lung damage and immune system reactions.

Dermatologists differentiate Beau's lines from onychomycosis, psoriasis of the nails, and lichen planus in order to identify and correct the underlying pathology. If necessary, dermatoscopy is also performed to rule out fungal nail infection.

Mechanical damage to the nail in the nail matrix area after a sports injury leads to a blockage

of its natural nutrient channels, which impairs the trophism of the onychoblasts and inhibits their division rate. This leads to a disruption in the chemical composition of the hard keratin of the nail, dystrophy and its deformation. In other words, Bo lines appear as a result of the spontaneous cessation of normal hard keratin synthesis. As a result, mechanical Bo lines appear [4,5]. The severity of nail deformation reflects the nature of the pathology.

Thus, the mechanism of Bo lines in sports injuries is caused by the rupture and subsequent regeneration of the tendon using a special device that ensures the distal phalanx of the finger (Malletfinger) is placed in a normal position. These processes, as stress factors, lead to a disruption in the trophism of the nail matrix, suppression of the division activity and synthetic activity of onychoblasts.



Figure 1 – Photo of Beau's lines on the nail plates 35 days after COVID-19

Beau's lines may appear 1-2 weeks after an infectious or other disease that leads to a disruption in the supply of nutrients to the growth zone of the nail plate (Figure 1). Scientists believe that the appearance of Beau's lines against the background of COVID-19 can be explained by a temporary cessation of nail matrix growth. In April 2021, a group of scientists from Italy and Mexico published a review article in which they attempted to compile known cases of nail changes associated with COVID-19. The average age of the patients they examined was 53.5 years (ranging from 37 to 89 years). Four of the patients were women. On average, nail lesions developed 56 days after the diagnosis of COVID-19 (ranging from 2 to 112 days) [5,6,7,8,9].

In addition, the following nail changes were identified in patients with COVID-19:

- Red half-moon sign.

A convex red crescent-shaped band bordering the distal edge of the nail bed (i.e., closer to the outer edge of the nail plate). These red crescents persisted in patients for a month or more, expanding slightly during that time. No other skin manifestations may be observed.

Tammaro et al., who published a description of the "red crescent sign" in June 2020, emphasize that polydactyl erythronychia (red streaks on all fingers) is not surprising in itself, as it occurs in Kawasaki disease, lupus erythematosus, Darier's disease, primary amyloidosis, and transplant rejection. However, in all these cases, the red streaks are longitudinal lines (in Kawasaki disease, they are transverse), while in COVID-19, erythronychia takes the form of a crescent along the edge of the

lunula. There are no other diseases that cause similar lesions.

Scientists suggest that this unusual lesion develops due to damage to microvessels or is associated with a procoagulant state (on the verge of thrombus formation) triggered by the immune system's response to viral invasion.

- Misa lines.

This is the name given to horizontal whitish lines that cross the entire nail plate. The main cause is abnormal protein production in the nail bed due to a systemic disease.

- Onychomadesis.

This is a rare pathology in which the nail plate separates from its bed, but it starts from the proximal edge of the nail (the one closer to the body). Among the causes of onychomadesis are systemic diseases that disrupt the blood supply to the nail, as well as infections such as syphilis, scarlet fever, and enterovirus infections. In this case, scientists believe that the cause of onychomadesis in COVID-19 is a disruption in the nutrition of the nail, inhibiting its growth.

- Orange nails

This is a rare condition, but it has been reported in an elderly patient with COVID-19. Sixteen weeks after her recovery, orange spots appeared on the tips of her fingernails. Gradually, as the nails grew, the orange stripe shifted towards the distal edge of the nail, repeating the shape of the lunula, which indicates the systemic nature of the pathology.

It should be noted that all of the above nail lesions, except for the red crescent, occur in patients with Kawasaki disease, which is also vascular in nature.

The appearance of Beau's lines in the case of trauma to the distal phalanges of the fingers allowed us to compare the history of the appearance of Beau's lines in the same patient T., who subsequently suffered from a severe form of COVID-19 in 2020.

While playing volleyball in 1987, the patient injured his left hand, striking the nail plates of the distal phalanges of both hands. The blow was so severe that it led to a rupture of the extensor tendons of the middle finger of the left hand. The distal phalanx hung down in the shape of a hammer, known as mallet finger. The damaged joint was treated conservatively using a plastic splint made of fast-setting Protacryl plastic of our own design for 5 weeks.

Five to six weeks after the injury, examination revealed a specific deformation of the nail plates, similar to a washboard. Transverse arcuate grooves were observed across the entire surface, crossing the nail plate from one edge of the nail fold to the other.

At the same time, they did not differ in colour from healthy nails. The grooves always appeared in the lunula area of the nail, at the edge of the posterior nail fold, and as the nail grew, they moved forward towards its free edge, where they disappeared without a trace. These arcuate grooves were identified as Beau's lines.

In 2021, the same patient, suffering from COVID-19, was hospitalised in the intensive care unit of the Almaty City Infectious Diseases Hospital with 80% lung damage. Due to the severity of his condition, the patient remained in the intensive care unit for 24 days. Rehabilitation was carried out under the supervision of doctors using appropriate medical care and simultaneous oxygen support. After inpatient treatment, the patient regained his physical fitness by taking daily morning walks, starting with 50-60 steps and increasing to 10,000. He regained the 12 kg he had lost in weight within 3 months. After 5-6 weeks, the nail plates on his hands and feet began to grow with characteristic transverse wavy lines, resembling a washboard. It should be noted that the changes in the nail plate described in patient T. with Covid-19 were similar to those seen in sports injuries.

Conclusion

Let us try to summarise the above and bring together the possible causes of nail damage in coronavirus infection. As mentioned above, onychodystrophy detected in coronavirus infection is associated with a violation of the trophism of the nail bed matrix due to damage to the endothelium of the capillaries and their microthrombosis [10,11, 12].As a result, there is a delay or temporary cessation of nail plate growth due to a decrease in the division and synthetic activity of onychoblasts.

In Covid-19 patients, this is generally due to a disruption in the synthesis of connective tissue components in the body, as evidenced by respiratory arrest and sudden death as a result of insufficient lung function, which are air-filled connective tissue sacs. It is also known that the severity of COVID-19 correlates with ferropenia (a decrease in serum iron) in the blood, which can cause nail damage.

Thus, a comparative analysis of onychodystrophy in the same patient with a sports injury and COVID-19 indicates different aetiologies and similarities in the pathogenesis of its occurrence. It should be noted that in the absence of external influences on the nail plates, the appearance of Beau's lines may indicate a serious process that requires in-depth diagnostic investigation and differential diagnosis.

Conclusions

1. Nail lesions in the form of Beau's lines in COVID-19 are rare. However, a number of authors point to nail changes in COVID-19.

2. A unique case of nail damage in a patient with a distal phalanx tendon rupture and then COVID-19 allowed us to conclude that the pathogenesis of Beau's lines is similar.

3. Most often, skin and nail damage develops some time after infection or even after COVID-19 has already been contracted. This is because nails grow slowly, at a rate of 2-5 mm per month, so the

affected area only becomes noticeable after some time.

4. No special treatment is required for onychodystrophy in COVID-19. However, in the case of trauma, in particular, a rupture of the extensor tendons of the fingers, an original treatment method has been developed – the use of a splint of our own design, based on the use of recently invented plastics. This method allows for effective restoration of the anatomy and function of the damaged fingers without surgical intervention. All of the listed signs of onychodystrophy disappear as the affected area grows and is trimmed.

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