Anatomical Changes in Retronychia and Onychomadesis Detected Using Ultrasound

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The nail, a fast-growing organ, is sensitive to changes in the germinal matrix,[1] and, as would be expected, a severe systemic illness can affect the growth rate of the ungual matrix, which occasionally results in temporary growth arrest (Beau's line). Thus, recovery from growth arrest can be associated with onychomadesis, also called nail shedding, a condition that indicates the separation of the nail plate from the nail matrix area,[2] after a (4- to 8-week) period of latency after systemic insult. The length in the long axis of the furrow represents the exact duration of the disease that has affected the matrix. The keratinized nail bed alone fills the gap between the old and new nail plate. In the case of onychomadesis, its manifestations are transient and resolve within several months.[3]

Retronychia is a rare complication of onychomadesis characterized by posterior embedding of the nail. Clinically, retronychia appears 3 to 6 months into the course of severe inflammatory or systemic disease as persistent or chronic proximal paronychia when there is disrupted nail growth.[3–5] Retronychia may be difficult to diagnose and simulates an ungual tumor when it is associated with onychomadesis.

We present sonographic images of onychomadesis and retronychia obtained in three cases. The sonographic examinations were performed using a variable-frequency ultrasound probe (frequencies from 7 to 15 MHz) and high-resolution ultrasound equipment (Philips HDI 5000, Bothell, WA). This imaging technique proved useful for the observation of the nail unit components and its abnormalities.[6–10]

Thus, on ultrasound, the normal nail plates are shown as bilaminar and continuous hyperechoic structures, and the matrix area is detected as a hypoechoic zone in the proximal nail bed. The original position of the origin of the nail plates is normally located at the level of the proximal half of the distal phalanx and the dermis of the proximal nail fold and is hyperechoic[7] (Figure 1).

Case 1

A 56-year-old man presented with a 6-month history of Guillain Barré syndrome that required intensive care unit hospitalization, mechanical ventilation, and high-dose steroid treatment. After this condition the patient developed onychomadesis of the right thumb and middle finger (Figure 2A) and the left thumb and index finger (Figure 3A).

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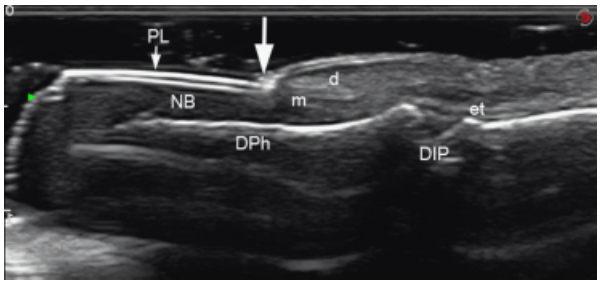

Figure 1. Normal sonographic anatomy of the nail unit (longitudinal view). Notice the level of origin of the nail plates (arrow) distant from the distal interphalangeal joint (DIP). PL, plates; NB, nail bed; m, ungual matrix; et, extensor tendon, DPh, distal phalanx; d, dermis in the proximal nail fold.

Clinically, nail plate fragments in the left thumb and index finger disappeared, and there was deformity of the nail plates of the right thumb and middle finger. Erythematous swelling led us to suspect an ungual tumor in the proximal nail fold of the left index finger.

Ultrasound examination revealed thickening of the proximal nail bed and anechogenicity (left index finger) and intense hypoechogenicity (right thumb and middle finger, left thumb) in the central portion of the ungual matrix. In the left index finger, the proximal fragment of the nail plates and the rest of the components of the nail unit were found to be in an abnormal position, displaced posterior to the level of the distal interphalangeal joint (DIP). Superficial to the ectopic nail unit, there was abnormal hypoechoic tissue within the dermis. The patient had cut the distal fragment of the nail plate of the left index finger off by himself. In the right thumb and middle finger, the nail plates were composed of two or three longitudinal overlapping hyperechoic fragments. An anechoic pseudo-bullous area was also detected in the ventral plate of the distal fragment in the right thumb and middle finger and in the left thumb. In the left index finger, a hypoechoic area was located in the only fragment of the nail plates that was detected in the proximal nail fold region. There was no discernable tumor in the left index finger, and color Doppler ultrasound showed greater blood flow in the proximal nail bed of all the fingers (Figures 2B and 3B).

Case 2

A 33-year-old woman presented with a history of a 1-year major depressive disorder and a partial onychectomy of the medial aspect of the right toenail (Figure 4A) caused by onychocryptosis 2 months before to the ultrasound examination; the pain and erythema in the medial aspect of the toenail had persisted after onychectomy.

On sonography, two misaligned fragments of nail plates were detected in the medial aspect of the nail unit: a proximally located and shorter fragment measuring 4.6 mm in the longitudinal axis and 6.2 mm in the transverse axis that was located

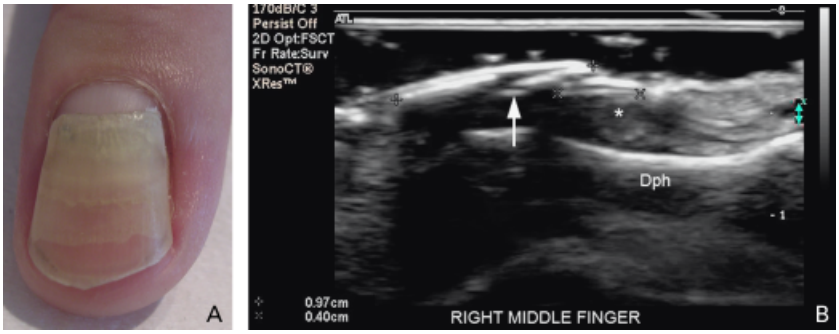

Figure 2. Onychomadesis. (A) Clinical picture of the right middle finger. (B) Ultrasound (in longitudinal view) shows two fragments in the nail plates; one proximally located measuring 4.0 mm (between × markers) and one distally located (between + markers) measuring 9.7 mm. An anechoic pseudobullous disruption of the ventral plate in the distal fragment is also visible (arrow). Enlargement of the proximal nail bed is shown (∗). Dph, distal phalanx.

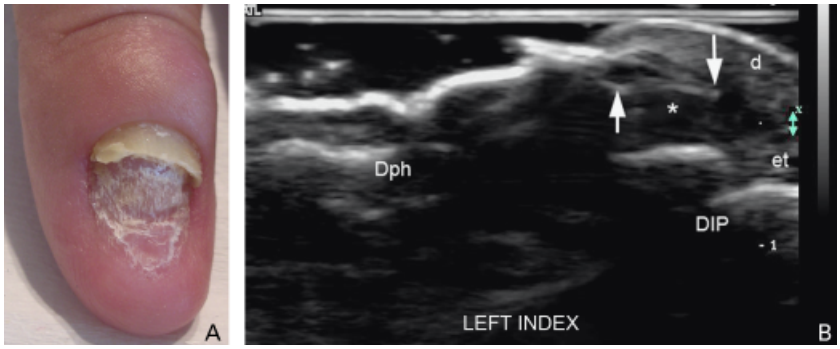

Figure 3. Retronychia. (A) Clinical picture of the left index finger shows erythema and swelling of the proximal nail fold associated with deformity of the ungual region. The patient had previously removed the distal fragment of the nail plate himself. (B) Ultrasound in longitudinal view shows abnormal posterior location of proximal nail plate that reaches the level of the distal interphalangeal joint (DIP) joint (arrow pointing downward). An hypoechoic region between both plates is also visible (arrow pointing upward). There is anechogenicity in the nail matrix region (*) and the dermis (d) of the proximal nail fold is hypoechoic. Abbreviations: et, extensor tendon insertion, Dph, distal phalanx.

underneath another fragment of the nail plates and a longer fragment that measured 11.9 mm in the longitudinal axis and 8.3 mm in the transverse axis. Both fragments of the nail plates showed a bilaminar hyperechoic structure. Additional thickening and hypoechogenicity of the medial side of the nail bed was detected. Hypoechoic tissue suggestive of granulomatous and inflammatory changes was observed in the medial aspect of the lateral nail fold. Color Doppler showed slightly increased blood flow in the medial aspect of the nail unit and the respective lateral nail fold that surrounded the hypoechoic tissue. No fragments of the plates were detected within the lateral or posterior nail folds. The distance between the origin of the plates and the DIP joint was considered to be normal (9.8 mm) and was symmetrical with the contralateral side (Figure 4B).

Case 3

A 22-year-old woman presented with a history of a third-degree burn on the fourth and fifth fingers (Figure 5A) 8 months before the ultrasound examination. Clinically, there was asymptomatic embedding of both nails in the posterior folds.

On sonography (Figure 5B), both fingernails presented posterior retraction of the nail units. On these fingers, the distance between the origin of the plates and the DIP joint (base of the distal phalanx) was shorter than on the contralateral side (3.9–6.2 mm on the fourth finger and 1.4–3.7 mm on the fifth finger). Thickening and hypoechogenicity of the skin layers in the posterior nail fold of these fingers were also detected, as well as thickening of the lateral

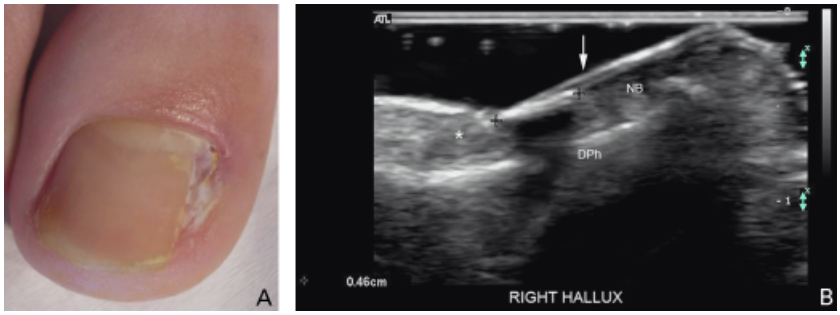

Figure 4. Onychomadesis. (A) Clinical picture of the right toenail 2 months after a partial onychectomy. (B) Ultrasound (longitudinal view) shows a 4.6-mm shorter toenail and proximally located fragment of the plates (between markers) that was located beneath a longer fragment of the nail plates (vertical arrow).

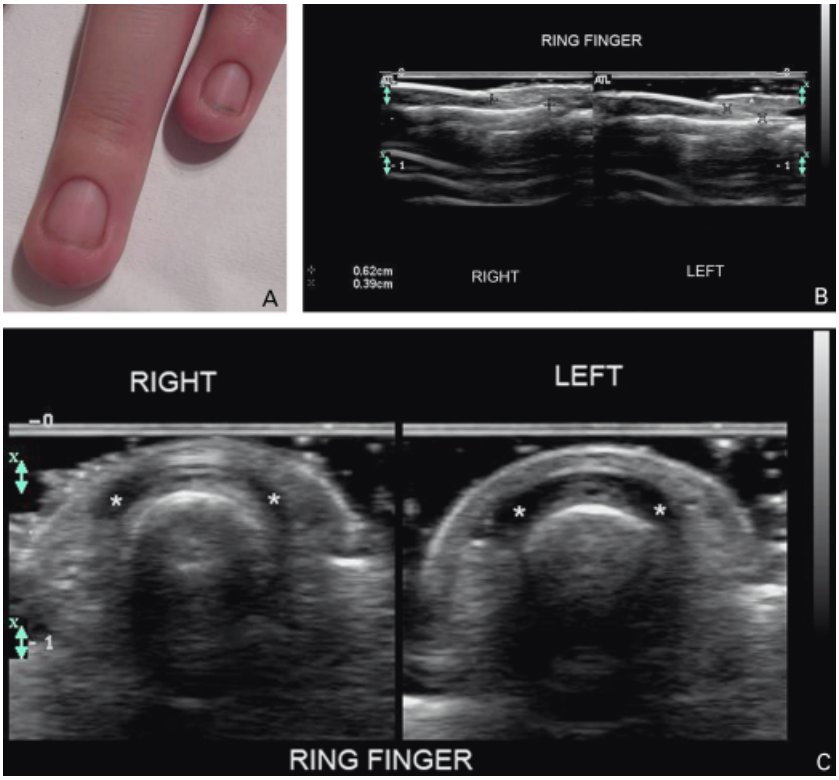

Figure 5. Retronychia. (A) Clinical picture shows posterior embedding of the nail in the ring and little fingers of the left hand. (B) Ultrasound (side-by-side comparison in longitudinal view) of the right (+) and left (×) ring and little fingers, respectively, demonstrating a shorter distance between the origin of the ungual plates and the base of the distal phalanx at the distal interphalangeal (DIP) joint level (between markers) on the left side. Thickening and hypoechogenicity of the proximal nail fold (*) is detected on the left side. (C) Ultrasound (side-by-side comparison in transverse view) of the ring finger shows thickening of the lateral wings (*) of the ungual matrix on the left side.

wings of the ungual matrix. No significantly greater blood flow in the nail units or the lateral and proximal nail folds was detected (Figure 5C).

The Institutional Ethics committee (Clinica Servet) approved the report of these cases, and the patients signed a consent form.

Discussion

The ingrown nail (onychocryptosis) is one of the most common nail pathologies and mainly affects the lateral nail folds because of the outward growth of the nail.[11–13] In contrast, in retronychia, the whole nail unit is embedded into the proximal nail fold region.

Retronychia usually develops within a framework of inflammatory changes and granulation tissue formation in the proximal nail fold region. Thus, using variable frequency ultrasound, we clearly visualized the anatomy of the corresponding alterations within the nail unit and excluded tumors or arthropathies that may also be associated with chronic inflammation.

Previous studies performed without the benefit of imaging methods suggested that the pathogenic mechanism for retronychia was the embedding of the old (prepathogenic event) fragment of the nail plate into the proximal nail fold region, which the newly growing nail plate then pushed upward and backward.[4,5] This physiopathologic approach implies an indirect mechanism (retrograde transmission of the forward nail growth motion) for the production of retronychia.

Using variable-frequency ultrasound, a noninvasive imaging method, we can demonstrate that

retronychia is the result of a direct mechanism. The new fragment (the one embedded in the proximal nail fold region as part of a complete posterior displacement of the nail unit) is the result of the development of traction generated by inflammatory and granulation tissue and probably involved in the posterior translation (backward motion) of the whole nail unit.

These findings explain the lack of improvement in the nail after the patient (case 1) had removed the distal fragment in the left index finger. It remains to be determined whether the retropulsion of the nail unit is the result of low interstitial pressure or the product of an active mechanism, such as a fibroblastic reaction.

The areas of anechogenicity or intense hypoechogenicity seen in the central portion of the nail matrix in retronychia suggest liquefaction, producing a fluid content, supporting the presence of inflammation and tissue digestion. Because the lateral wings of the matrix appear to be less affected in the most severe form of retronychia than the central part (case 1), they may represent the potential substrate for the eventual recovery of the process. The lateral wings of the ungual matrix may show variable degrees of inflammatory changes, as the sonographic enlargement in the posterior retraction of the nail unit secondary to burn injury illustrated (case 3). The additional presence of intense hypoechogenicity of the proximal segment of the nail bed seems to represent inflammatory and granulation tissue infiltration. In onychomadesis, inflammatory changes or granulation tissue on the lateral folds may make the recovery process of the nail unit difficult, which may explain the persistence of the symptoms in case 2.

Ultrasound would also provide chronologic data on onychomadesis, making it possible to establish the date of the original insult. This could be done by correlating the length of the nail plates (new and old fragments) with the normal rate of growth for each finger (0.94 mm/10 days or 2.8 mm/30 days in the right middle finger).[14] Nevertheless, this possibility requires further investigation, but it would be particularly useful to determine the most likely causal agent when multiple and continuous potential factors (including drugs) are being considered. Retronychia or retroparonychia is a rare entity, and the suggested management is surgical, consisting of avulsion of the proximal and distal fragments of the nail plates. Conversely, expectant observation has been reported to result in local recurrence.[4,5] Because the pathophysiology of retronychia is complex and evolving, and the treatment (if surgical) could be cosmetically aggressive, it may be important to complement the clinical evaluation with a noninvasive ultrasound. This addition will provide important presurgical data on the nail unit position. Information concerning the stage of the adjacent inflammatory process and the status of the components of the nail unit can optimize therapeutic choices and cosmetic results.

The three cases presented herein represent different stages of retronychia and onychomadesis and could help the understanding of the pathophysiology of these entities.

Conclusion

Ultrasound imaging allows noninvasive, clear visualization of nail components in real time. In the present cases, the pathogenic mechanism in retronychia was established, and detailed descriptions of the anatomical changes in the nail and periungual regions in onychomadesis and retronychia were obtained.

This imaging technique effectively excluded tumoral entities and hidden complications. Lastly, anatomical knowledge of these entities may allow better planning of their management.

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