# Carpal tunnel syndrome and associated nail changes: Review and examples from the author's practice

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Carpal tunnel syndrome (CTS) is commonly seen by general practitioners and often presents with neurologic symptoms of nocturnal pain and paresthesia along the median nerve distribution. Approximately 20% of patients also present with cutaneous findings (ulcerations, blistering, sclerodactyly, nail dystrophy) characterizing a severe form called necrotic CTS. Necrotic CTS can also be associated with bone changes (acro-osteolysis). In the author's practice, combined nail and skin findings are not an uncommon presentation of CTS, although this form remains overlooked and underreported in the dermatological textbooks and studies. This manuscript aims to review the literature on CTS cases, with a specific focus on using associated nail findings as diagnostic clues. The literature review along with a few additional recent cases from the author's practice demonstrate that CTS is frequently accompanied by a variety of nail changes including koilonychia, longitudinal fissuring, Beau's lines, onychomadesis, melanonychia, nail thickening, hyperkeratosis, and ischemic ulcerations with paronychia. Furthermore, when these changes are limited to the second and third fingernails, they should prompt the diagnosis of CTS. Once suspected, diagnostic evaluation is not difficult and surgical management can resolve cutaneous findings and prevent irreversible changes such as acro-osteolysis. (J Am Acad Dermatol 2020;83:1724-9.)

***Key words:*** acro-osteolysis; carpal tunnel syndrome; diagnostic clue; index fingernail; middle fingernail; nail changes; nail dystrophy; surgical decompression; topical nitroglycerin.

Carpal tunnel syndrome (CTS) is a relatively common condition seen often by general practitioners.[1-3] It affects 0.1% to 0.6% of the general population, and there is a 10% chance that an individual will develop CTS in his/her lifetime. CTS arises because of compression of the median nerve within the carpal tunnel, which affects the axonal transport and, ultimately, the median nerve's sensory, motor, and autonomic neural functions.[4-7] The characteristic clinical presentation includes pain but, more commonly, paresthesia at night involving the thumb, index, and middle fingers.[5,8] Diagnosis is usually made clinically but the workup may include electrodiagnostic studies (nerve conduction studies or electromyography) and magnetic resonance imaging.

As mentioned, longstanding median nerve compression can lead to autonomic dysfunction of the nerve itself, which has been postulated to play a role in the development of ischemic and cutaneous changes in the hands and digits that are characteristic of a severe variant called necrotic CTS.[9-12] Cutaneous findings are otherwise uncommon in nonischemic/nonnecrotic types of CTS.[9,10,13-17]

Bouvier et al[10] were the first to describe the severe necrotic CTS. Several other publications from Europe described cases of severe necrotic CTS in association with dermatologic changes such as ulcerations, blistering, hypohidrosis, vasospasm, Raynaud phenomenon, and irritant contact dermatitis.[10,18-26] However, not very many studies before the 2000s

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reported on the specific nail changes as a consequence of severe CTS.[3,9-11,19-21,25,27]

Although scarcely reported, nail findings in CTS are not uncommon in our experience; they should be recognized by dermatologists, who may be the first care providers for some patients. In this review, we focus on CTS and its effects on nails, including the important diagnostic clues. We provide clinical pictures with brief descriptions of a few recent examples from our experience in the clinic (Figs 1 and 2 and Supplemental Fig 1; available via Mendeley at https://data.mendeley.com/datasets/tzts29b9zv/draft?a=f871e39d-7708-4380-ae26-29e0489d6cda).

**CAPSULE SUMMARY**

- Nail lesions limited to the second and third fingers should suggest carpal tunnel syndrome. Clinical findings are variable and encompass mild and severe nail abnormalities.
- Necrotic carpal tunnel syndrome is a severe variant that presents with ulcerative skin and nail lesions, paronychia, and bone resorption.

## METHODS

The PubMed database was searched for related literature using a combination of key words *carpal tunnel syndrome*, *nail*, *nail changes*, and *nail dystrophy*. All studies involving the effect of the CTS on nails were obtained, translated, and reviewed for evidence.

## RESULTS

Our search found 27 studies reporting 43 cases of cutaneous and nail changes as a consequence of CTS (Table I[28-30]). Approximately 72% of the patients were women (31/43), and the rest were men (12/43). The mean patient age was 54.27 years, and the greatest number of cases involved the right hand (19/43). In most cases, the nail changes involved the first, second, and third digits (26 times) or the second and third digits (19 times). A single digit was affected least often; the second digit was more commonly involved (9 times) compared with the third digit (2 times). More recent studies in 2005, 2010, and 2014 reported cases in children and 1 young adult.[31] Nail findings were very different, ranging from severe abnormalities such as periungual/subungual ulcerations with nail thickening and discoloration to very mild lesions such as Beau lines or leukonychia (Supplemental Table I; available via Mendeley at https://doi.org/10.17632/ndwmxymfkn.1).

## DISCUSSION

The vasomotor dysfunctions of the median nerve as a consequence of its mechanical compression can lead to trophic changes of the skin and nails.[9,32,33] In addition to mechanical compression,[25] inadequate vascularization to the distal phalanges is also implicated.[15] Vascular study results may be normal in some cases, possibly because of the low sensitivity of currently available capillaroscopy and photoplethysmography devices for detecting the minimal and/or temporary changes in the microcirculation.[7] Proof of vascular changes is occasionally captured, as in the case reported by Leger et al,[16] who demonstrated temporary vasospasms. Moreover, it is important to note that median nerve sensory deficits may also lead to trauma and thermal burns, contributing to blistering and ulcer formation.[11,12,34] Nonetheless, mechanical compression and ischemic injury are major contributors to cutaneous findings,[10,11,14,15,25] which


**Fig 1. A**, Carpal tunnel syndrome. A 65-year-old woman affected by diabetes and chronic kidney disease and receiving dialysis, with a recently worsened nail "infection" of a few months. She had a similar problem on the other hand that resulted in amputation of the distal phalanx of the third finger. She complains of paresthesia of the fingertips. Clinical examination shows onycholysis, digital swelling, and subungual crust. **B**, The follow-up clinical examination at 3 months after surgery. **C**, The follow-up clinical examination at 1 year after surgery.

*Abbreviations used:*

CTS: carpal tunnel syndrome

may be present even in the absence of the most commonly encountered CTS signs and symptoms, including the neurologic complaints (Supplemental Table II[35,36]; available via Mendeley at https://doi.org/10.17632/vg5f62mmv7.1).[7,34]

In most cases, the nail changes involved all 3 digits on either or both hands (the first, second, and third digits: 26 times), or 2 digits on either or both hands (the second and third digits: 19 times). When only 1 digit was affected, it was most commonly the second digit (9 times) or the third digit (2 times). The thumb was not always affected (19 cases) because of the variation in its innervation.[25,37] In milder forms of CTS, nails present with Beau lines, melanonychia, koilonychia, and onychomadesis, whereas in severe CTS, nails become thickened and keratotic, with peri- and subungual ischemic lesions, paronychia, and possibly even acro-osteolysis.[11] In all cases, it was the specific anatomic distribution rather than the morphology of the nail changes that suggested the diagnosis (Figs 1 and 2 and Supplemental Fig 1).[38,39] Patients with severe CTS are usually manual workers or have

**Fig 2.** Thinning and onychorrhexis limited to the second and third fingernails in a patient with a mild case of carpal tunnel syndrome.

**Table I.** Cases of carpal tunnel syndrome and associated nail changes

| Authors and year | Sex | Age, y | Localization of CTS/nail changes | Nail changes | Acro-osteolysis (yes/no) |
|---|---|---|---|---|---|
| Pfister, 1954[19] | M | 52 | Right second digit | Deformed, thickened, white-yellow discoloration, loosening, onycholysis/onychomadesis | No |
| Lagrot et al, 1966[24] | F | 59 | Right second and third digits | Ulcerations, no nail findings described | No |
| Amschler and Hartmann, 1979[3] | F | 49 | Right second and third digits | Necrotic ulcers, onycholysis, nail growth disturbance | Yes |
| Bouvier et al, 1979[10] | F | 55 | Right third digit | Subungual and periungual ulcers | No |
| | M | 76 | Left second and third digits | Gangrene resulting in spontaneous resorption | Yes |
| | M | 60 | Right third digit | Subungual ulceration, onychomadesis | Yes |
| Treves et al, 1980[13] | F | 76 | Right second digit | Periungual ulcerations | No |
| Adoue et al, 1984[17] | F | 60 | Right-hand median nerve distribution (unspecified) | Diffuse periungual ulcerations in the median nerve distribution, no nail findings described | No |
| Aratari et al, 1984[9] | F | 68 | Left first, second, and third digits | Periungual ulcerations, Beau lines, longitudinal melanonychia, hyperkeratotic cuticle | No |
| Geffray et al, 1984[26] | F | 65 | Bilateral second and left third digits | Nail dystrophy, ulcerations | Yes |
| | F | 67 | Bilateral second digits | Nail dystrophy, ulcerations | Yes |
| DiFonzo et al, 1986[22] | F | 53 | Left first, second, and third digits | Onycholysis and subungual hyperkeratosis/crusts | No |
| Neau et al, 1987[23] | F | 78 | Left second and third digit | Ulcerations, no nail findings described | Yes |
| Pavesi et al, 1988[20] | F | 62 | Left second digit | Cuticle hyperkeratosis, periungual necrotic ulcerations | Unknown |
| | F | 55 | Right first, second, and third digits | Onychomadesis 3 times, dystrophy | Unknown |

Continued

**Table I.** Cont'd

| Authors and year | Sex | Age, y | Localization of CTS/nail changes | Nail changes | Acro-osteolysis (yes/no) |
|---|---|---|---|---|---|
| Besson et al, 1989[21] | M | 72 | Right first and second digits | Bullous lesions, necrotic lesions, no nail findings described | Unknown |
| | F | 75 | Bilateral second and third digits | Necrotic lesions, nail atrophy, vesicular lesions, nail destruction | Yes |
| | F | 68 | Right second digit | Ulcers, no nail findings described | Unknown |
| | F | 41 | Left second and third digit | Bullous lesions, necrotic lesions, no nail findings described | Unknown |
| Cox et al, 1992[18] | F | 62 | Right first, second, and third digits | Ulcers, anhidrosis, no nail findings described | No |
| | M | 75 | Right second digit | Ulcer, no nail findings described | Unknown |
| | F | 51 | Right second and third digits | Blisters, no nail findings described | Unknown |
| Baran et al, 1993[37] | F | 24 | Left second, third, and fourth digits | Nail tenderness, nail pain upon pressure, digit absorption; contour surface and color of the nails otherwise normal | Yes |
| Stinchi et al, 1995[27] | F | 59 | Right first, second, and third digits | Mild paronychia, leukonychia, Beau lines | No |
| Tosti et al, 1993[11] | F | 58 | Right first, second, third, and fourth digits | Thickened, dark brown and yellow-brown discoloration; irregular, grossly deformed nail plate surface; hyperkeratosis, Beau lines | Yes |
| Romani et al, 1997[25] | F | 60 | Bilateral first, second, and third digits | Brown discoloration, longitudinal ridging, hyperkeratosis of the nail plate, onycholysis and cuticle hypertrophy, paronychia | Yes |
| Requena et al, 2004[38] | M | 65 | Bilateral second and third digits | Dystrophic nails | Yes |
| | F | 73 | Bilateral second and third digits | Burns, ulcers, shortening of the affected digits, no nail changes described | Yes |
| Natale et al, 2005[15] | M | 63 | Bilateral first, second, and third digits | Hyperkeratosis, onycholysis, cuticle hypertrophy, paronychia resulting in autoamputation | Yes |
| Leger and Lavalle, 2005[16] | M | 66 | Right second digit | Necrotic ulceration | No |
| Van Meir and De Smet, 2005[28] | F | 12 | CTS of bilateral hands (all 5 patients) | Not described | No |
| | F | 6 | | Not described | No |
| | M | 2.5 | | Not described | No |
| | F | 5 | | Not described | No |
| | M | 6 | | Not described | No |
| Khan and Saeed, 2008[14] | F | 63 | Bilateral second and third digits | Dystrophic nails | Yes |
| Cho et al, 2010[29] | M | 21 | Bilateral first, second, and third digits | Koilonychia | No |
| Foti et al, 2011[7] | F | 76 | Left second and third digits; right first, second, and third digits | Blisters, clubbed shiny fingernails | Unknown |
| Perdan-Pirkmajer et al, 2011[41] | F | 85 | Bilateral second and third digits | Periungual ulceration, dystrophic nails | Yes |
| Kamondi et al, 2011[30] | F | 67 | Right first, second, and third digits | Dystrophic nails, hyperkeratotic cuticles, brownish discoloration | Unknown |
| | F | 52 | Left first, second, and third digits | Dystrophic nails | Unknown |
| | F | 81 | Right first and second digits | Subungual ulceration, nail discoloration | Unknown |
| Maldonado Garcia et al, 2014[31] | M | 10 | Right second and third digits | Subungual ulcer with nail atrophy | Yes |

*F*, Female; *M*, male.

occupations and hobbies that require extensive use of their wrists and hands.[25,40]

Management options for CTS include wrist splints and corticosteroid injections for mild disease. Skin and nail necrotic lesions may benefit from topical application of a nitroglycerin patch at the base of the finger. However, surgical decompression is the only definitive treatment.[10,11,14-16] The majority of the patients experience improvement and even complete resolution of skin and nail findings within several months of surgical treatment. However, bone changes usually represent a late finding of severe CTS and are irreversible even after transection of the transverse ligament.[15]

The surgical release of a carpal tunnel is usually done in an outpatient setting under local anesthesia and involves either open carpal tunnel release or endoscopic carpal tunnel release. The former approach is performed by cutting through the volar surface of the wrist and the flexor retinaculum,[41] whereas the latter approach involves making 2 smaller incisions on the palm and wrist, inserting an endoscope through 1 incision to visualize the procedure and inserting a cutting instrument through the second incision to cut the flexor retinaculum. The endoscopic surgical approach can also be performed with a single small incision.[42-46]

This review shows that patients with CTS may first consult a dermatologist because of nail changes even in the absence of classic neurologic complaints of numbness and tingling. Thus, it is important for dermatologists to consider this diagnosis in patients with nail lesions limited to the second and third fingers, that is, along the median nerve pathway (Supplemental Fig 2; available via Mendeley at https://doi.org/10.17632/pbr7r2wpyn.1). The diagnostic evaluation is not difficult, and surgical management cures nail and skin lesions and prevents irreversible changes such as acro-osteolysis.

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