

Man, 46, With Wrist Laceration

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A right hand-dominant 46-year-old man presents to the emergency department (ED) with a 1-cm laceration of his volar right wrist that occurred after he slipped on a wet floor while carrying a ceramic dish. The patient fell with his hand outstretched and landed on the dish as it broke against the floor. The patient has no pain but complains of tingling in his fingers. Past medical history is negative for diabetes, hypertension, or any neurologic disorders. Social history includes smoking one-half pack of cigarettes per day and drinking 6 to 10 12-oz beers each weekend. He works as a machinist.

Physical examination shows no bony tenderness. There is a 1.0-cm transverse laceration at the base of the hand at the midline of the volar wrist crease. Flexion, extension, and strength of the fingers are intact, as are dull and sharp discrimination to the thumb and other fingers. A cotton-tip applicator is used for gross sensory testing. No other neuromuscular assessment of the hand is performed. An x-ray of the hand to rule out a fracture or ceramic foreign body is negative.

The wound is locally anesthetized with 1% xylocaine without epinephrine. The laceration is irrigated with normal saline solution and closed with 4-0 nylon sutures using conventional bedside-suturing technique. A sterile bandage is applied. After-care instructions include wound care and follow-up with the patient's family physician in 1 week for suture removal.

The patient returns to the ED 4 days later, complaining of increased tingling and weakness of the thumb and index and middle fingers. Repeat neuromuscular examination shows decreased sensation and dull/sharp discrimination, and abnormal static 2-point discrimination of the thumb and index and middle fingers. Based on the location of the laceration, the follow-up provider suspects a median nerve injury. After a telephone consultation with a hand surgeon, the patient is told to come into the office in 2 days.

Subsequent follow-up by the hospital's risk manager indicates that the hand surgeon found a transected

median nerve, requiring surgery to repair it. The patient has resulting deficits in sensation and strength and requires extensive occupational therapy. The risk management team learns that the patient intends to file a malpractice suit.

DISCUSSION

Hand and finger injuries represent about 20% of ED visits and are among the most costly injuries for the employed population.¹ Knife and glass lacerations of the fingers are most common.² Failure to diagnose significant hand and finger injuries is also a major contributor to malpractice claims in the ED.³ It is imperative for the PA or NP working in a high-stress/high-volume environment to perform a thorough neuromuscular and vascular examination when encountering a traumatic hand injury or a laceration. This applies to all frontline practices, including urgent care, ED, and primary care and family practices.

Volar surface lacerations of the wrist and fingers are especially high risk.² Small lacerations (< 2 cm for fingers and < 3 cm for wrist and forearm) may lead a provider to consider the injury minor; however, these have the greatest potential for missed significant deep injuries.² Missed median nerve lacerations can result in major complications if not surgically repaired soon after the injury.⁴

With our case patient, a small glass cut at the volar wrist crease did not cause tendon lacerations or flexor deficits. The patient complained only of mild tingling to the fingers, and a detailed hand-and-finger examination was not performed to isolate further nerve injury.⁴

Although most nerve injuries result in a loss in sensory function, motor function must also be evaluated.⁵ With partial nerve lacerations, subtle loss of motor or sensory function can be missed by the examiner.⁴ It is imperative to conduct a thorough hand examination (outlined in Tables 1 and 2, pages 11e and 12e) to decrease the likelihood of missing a significant nerve or tendon injury.

Sensory testing basics

Nerve laceration vs nerve compression disorder. It is important to distinguish sensory testing for a nerve injury or laceration from testing for a nerve compres-

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TABLE 1
Conducting a Thorough Examination of Nerves in the Hand

Structure	Exam Technique
Radial, median, and ulnar nerve distributions	Light touch to elicit sharp/dull sensation to the dorsal first metacarpal (radial), tip of little finger (ulnar), and tip of thumb (median) (see Figure 1)
Radial, median, and ulnar nerve motor function	Actively touch thumb to opposing fingers
Median nerve and ulnar collateral ligament of thumb (gamekeeper's or skier's injury)	Pincer function: Patient pinches a piece of paper between thumb and proximal interphalangeal joint of index finger while provider attempts to pull it away (see Figure 2)
Median nerve motor function	Touch thumb to little finger against resistance (see Figure 3)
Radial nerve motor function	Hyperextend thumb and wrist against resistance (see Figure 4)
Ulnar nerve motor function	Spread and close fingers against resistance (see Figure 5)

Sources: Kenney and Hammert. *J Hand Surg Am.* 2014⁵; Davenport and Tang. *Tintinalli's Emergency Medicine.* 2016⁸; Madan et al. *Orthop Surg.* 2014.¹⁰

FIGURE 1
Nerve Sensation Distributions

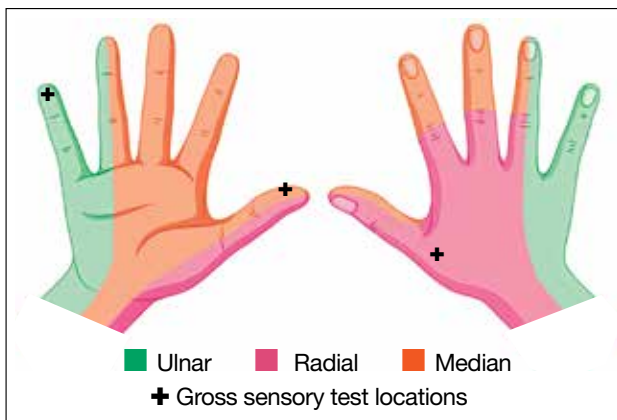


FIGURE 2
Pincer Function



FIGURE 3
Median Nerve Test



FIGURE 4
Radial Nerve Test



FIGURE 5
Ulnar Nerve Test



Photos courtesy of the author

TABLE 2
Conducting a Thorough Examination of Other Structures in the Hand

Structure	Exam Technique
Bones	Palpate thoroughly for tenderness Scaphoid: palpate the anatomic snuff box and apply axial loading and traction to the extended thumb to elicit pain
Digital rotation	For suspected fracture, check for metacarpal and digital rotation. Have the patient make a fist and check the fingers for normal alignment
Tendons	Check active thumb flexion/extension and all joints of the fingers and hand against resistance
Vasculature	Observe color, temperature; assess capillary refill (normal < 3 s), radial pulse, and Allen test
Volar fingertip	Test 2-point discrimination. Normal distance for the static test is < 6 mm; for the moving test, < 3 mm. For older patients, < 6 mm.

Sources: Kenney and Hammert. *J Hand Surg Am.* 2014⁶; Davenport and Tang. *Tintinalli's Emergency Medicine.* 2016.⁸

sion disorder, such as carpal tunnel syndrome. When examining compression neuropathies, light touch, tuning fork vibration, and monofilament testing are used. When a nerve injury or laceration is suspected, light touch and 2-point discrimination are used.⁵ Static 2-point discrimination (also known as the *Weber static test*) will be immediately abnormal if a nerve is lacerated. In a nerve compression disorder, 2-point discrimination is decreased progressively.⁵

Sensory testing evidence

Comparing light touch, monofilament, and 2-point discrimination. As seen with our case patient, testing dull-sharp discrimination using the cotton-tip applicator for “dull” and the broken end of the wooden applicator stick for “sharp” may not be the most complete way to assess sensation in the hand and fingers. The physical examination should include light touch and 2-point discrimination.⁵

TABLE 3
Sensitivity and Specificity of Gauze, Monofilament, Static and Moving 2-Point Discrimination Tests

Sensory test	Sensitivity (%)	Specificity (%)
Gauze	82.5	79
Monofilament	86.7	78.9
Static 2-point discrimination	98.6	79
Moving 2-point discrimination	97.9	79

Source: Bijon et al. *Injury.* 2017.⁷

In one study, tests for sensation compared the gauze test (light touch), the static 2-point discrimination, the moving 2-point discrimination (m2PD; also known as the *Weber dynamic test*),⁶ and the monofilament test. The static and m2PD tests were statistically superior to the gauze and monofilament tests (see Table 3).⁷ Two-point discrimination abnormalities are detected immediately after a nerve is lacerated.⁵ This suggests performing 2-point discrimination, either moving or static, is superior to dull-sensation testing alone (gauze or cotton-tip applicator). This should be included in the motor and sensory examinations of the hand and fingers seen in Tables 1 and 2.

Moving 2-point discrimination test

The m2PD requires a 2-pointed instrument that can maintain a fixed 5 mm of width, such as a bent paperclip or EKG calipers. Commercially available devices specifically for 2-point discrimination can also be used.

When performing the m2PD test, the provider strokes 1 point in the proximal to distal direction in 5-mm increments on the finger and asks whether the patient feels “1 moving point.” The provider then holds 2 points and moves them in the proximal to distal direction in 5-mm increments and asks whether the patient feels “2 moving points.”

The m2PD test is then conducted comparing the ulnar and radial side of the injured finger with the ipsilateral noninjured finger. This should be done at least 4 times.⁸ The test is positive if there is a ≥ 2 -mm difference between the affected and the unaffected side.⁷

Wound exploration

Data from a French insurance company indicate that 10% of ED malpractice claims in 2013 were related to inadequately examined hand lacerations. In an analysis of these claims, Mouton et al found that most injuries resulting in claims affected the thumb or the volar aspects of the fingers. Reasons for malpractice claims included residual stiffness, weakness, sensory deficit, retained foreign body, and wound infection. The researchers concluded that inadequate examination of hand wounds “carries a risk of lasting and sometimes severe residual impairment, and generates considerable societal costs.”³

In particular, small penetrating lacerations from broken glass or a knife should be considered high-risk injuries.² In a study of small (< 2 cm) lacerations of the hand and fingers, 59% of the patients were found to have deep-structure injuries.² Tuncali et al concluded that small lacerations increase the likelihood of missing deeper structural injuries because of failure to examine the wound.² Furthermore, with glass lacerations, examiners tend to prioritize ruling out a foreign body and then fail to examine the wound. If a careful examination of the hand and fingers prompts suspicion of a tendon or nerve injury, referral to hand surgery for direct surgical exploration is indicated.

CONCLUSION

Busy health care providers must be aware that approximately 10% to 15% of the negative outcomes in patient care result from diagnostic errors and are most common in the internal medicine, family medicine,

and emergency medicine clinical environments.⁹ With hand and finger lacerations, small size can give a provider a false sense that the laceration is minor, resulting in a failure to diagnose a deeper injury (eg, tendon or nerve).¹

When evaluating a traumatic injury or laceration to the hand or fingers, it is important to conduct a thorough sensory and motor examination. Experts recommend light touch and 2-point discrimination be included in the sensory exam to avoid missing nerve injuries. If a deeper structural injury is suspected, the patient should be referred to hand surgery and the wound surgically explored.²

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