

# Post-Traumatic Eczema

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The skin, with its large surface area directly exposed to the environment, is particularly vulnerable to occupational and environmental trauma. The National Institute for Occupational Safety and Health (NIOSH) has estimated that 1,070,000 to 1,650,000 injuries to the skin occur yearly in the workplace, with an estimated rate of 1.4 to 2.2 per 100 full-time workers.<sup>2</sup> Table 1 lists the leading causes of work-related skin injuries in the United States. By convention, traumatic injuries from chemicals (burns) result from single (usually brief) episodes of cutaneous exposure and have a relatively rapid onset following exposure; they are arbitrarily distinguished from irritant cutaneous reactions (irritant contact dermatitis), which require multiple (usually prolonged) skin exposures and have a relatively delayed onset.

Complications of occupationally acquired skin injuries have important medicolegal aspects. These complications include persistent pain or itching, disfiguring scar formation, infections, and contact dermatitis from topical agents used to disinfect wounds or promote healing. The intent of this article is to acquaint readers with another, poorly understood, complication of skin injuries, namely the occurrence of dermatitis at the site of prior cutaneous trauma unrelated to infection or topical treatment. I shall refer to this phenomenon as "post-traumatic eczema" and illustrate it with representative case histories.

## CLINICAL CLASSIFICATION

Table 2 provides a brief clinical classification of post-traumatic eczema. Dermatitis following

cutaneous trauma may occur either in association with an underlying endogenous eczema (isomorphic reaction) or as an isolated phenomenon (idiopathic reaction).

## Isomorphic Reaction

An isomorphic (Koebner) reaction is the development of a cutaneous lesion(s) within areas of traumatized but otherwise normal skin identical in appearance to cutaneous disease elsewhere on the skin surface. Isomorphic reactions are commonly seen in the traumatized skin of patients with vitiligo, psoriasis, and lichen planus<sup>4</sup> but may occur in other skin disorders such as discoid lupus erythematosus and Darier's disease as well. Some dermatology textbooks<sup>3, 4, 9</sup> mention isomorphic reactions in patients with eczema during its active phases, although secondary references are not cited. An isomorphic reaction may be the primary (first) cutaneous manifestation of an endogenous skin disorder (that is, it precedes onset of the endogenous condition) but most frequently occurs as a secondary lesion following trauma (that is, it follows the onset of the endogenous condition) in patients with active disease elsewhere on the skin surface. The following four case histories illustrate primary and secondary isomorphic reactions in post-traumatic eczema.

**Case 1 (Primary Isomorphic Reaction).** A 55-year-old painter slipped on a ladder, sustaining a superficial abrasion of his medial right ankle, which never completely healed. He had no history of dermatitis. One month later, the patient presented with dermatitis over the right

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Table 1. *Leading Causes of Occupational Skin Injuries, United States*

INJURY TYPE	PER CENT TOTAL SKIN INJURIES*	
	SDS, 1983†	NEISS, 1985‡
Lacerative, punctures	82.3	86.2
Burns, nonchemical	11.9	8.3
Foreign bodies§	—	3.5
Abrasions§	3.4	—
Burns, chemical	2.2	1.9
Cold§	0.2	—
Radiation (mostly sunburn)	0.04	0.1

\*Percentages determined after excluding injuries to eyes or other body parts, then dividing cases in each type category by total of all injury types and multiplying by 100.

†Based on workers' compensation claims reported to the Supplementary Data System (SDS) of the Bureau of Labor Statistics from 29 participating states.

‡Based on projected estimates from cases reported to the National Electronic Injury Surveillance System (NEISS) by selected hospital emergency rooms.

§Complete data by injury type not available for both surveillance systems.

medial malleolus confined to the area of previous cutaneous trauma (Fig. 1A). Bilateral venous varicosities were noted, without other cutaneous changes of venous stasis. Despite treatment with a topical steroid ointment, he developed two new nummular patches of dermatitis on the anterolateral aspect of his right ankle 2 months later (Fig. 1B). Within 6 months of the initial injury, the patient had typical nummular lesions of stasis dermatitis over both lower legs and ankles.

**Case 2 (Primary Isomorphic Reaction).** A 27-year-old man cut his left middle finger on a broken piece of glass at home. Although this laceration healed within two weeks without medical attention, persistent mild dermatitis developed at the site of trauma approximately 4 weeks after the injury. Two months after beginning new employment as a blender at a winery (approximately 8 months after the finger injury), he developed new patches of dermatitis on his arms and hands, in addition to the persistent dermatitis on his left middle finger, which he attributed to irritation from a dilute bleach solution used to hose down the tops of blending tanks but which did not resolve despite the patient's switching to dry work. On examination 2 months later, the patient had nummular patches of dermatitis on the antecubital fossae and palms; a nummular, vesicular area of dermatitis was also present over the dorsal left middle finger, where the laceration had been sustained 10 months earlier. The

patient had a personal history of allergic rhinitis but no history of any dermatitis preceding his finger injury. On the basis of the pattern and appearance of flexural involvement, a diagnosis of probable atopic dermatitis preceded by an episode of post-traumatic eczema (finger) and possible irritant contact dermatitis (arms) was made. He was given a topical steroid cream. He did not return for follow-up examination.

**Case 3 (Secondary Isomorphic Reaction).** A 20-year-old college student with typical flexural atopic dermatitis and mild dyshidrotic eczema of the hands sustained a blistering sunburn on both heels after taking a nap outside on a warm spring day. He had removed his shoes and socks but had otherwise remain fully clothed as he slept prone. The acute sunburn reaction did not resolve, and he presented 2 weeks later with persistent rash and itching of both heels. Along with typical atopic flexural eczema and mild dyshidrosis of the hands, he had dyshidrosiform dermatitis confined to the sites of sunburn on both heels (Fig. 2). He was given topical steroid cream. He did not return for follow-up.

**Case 4 (Secondary Isomorphic Reaction).** A 45-year-old machinist developed mild irritant dermatitis of the dorsal part of his hands from exposure to cutting fluids for which he intermittently applied a topical ointment containing benzocaine. One month later, he punctured his dorsal left middle finger on the teeth of a nonrotating band saw; this injury never healed. He had a personal history of allergic rhinitis and asthma as a child but no history of dermatitis. On examination 1 month after the injury to his finger, he had a small patch of subacute dermatitis over the dorsal aspect of his left third finger confined to the site of prior trauma. A few faint nummular patches of dermatitis, less severe than the middle finger lesion, were also present over the dorsal left hand. A potassium hydroxide (KOH) examination and patch testing for possible secondary contact allergy were negative. After 1 month of topical steroid therapy, mild dermatitis persisted on the left middle finger, but other patches of dermatitis on his hands had resolved.

Table 2. *Clinical Classification of Post-Traumatic Eczema*

Isomorphic reaction
1. Primary (precedes endogenous eczema)
2. Secondary (follows endogenous eczema)
Idiopathic reaction (endogenous eczema absent)



**Figure 1.** A, Primary isomorphic reaction, post-traumatic eczema (see Case 1). Dermatitis initially occurred over the medial ankle, where skin had been abraded during a fall off a ladder. B, New lesions of nummular dermatitis over



the anterolateral ankle 2 months after abrasion to the medial ankle. Typical nummular lesions of stasis dermatitis appeared on the opposite ankle and lower legs 6 months after the initial injury.



**Figure 2.** Secondary isomorphic reaction, post-traumatic eczema (see Case 3). Dermatitis appeared on the heels of a patient with flexural atopic dermatitis and hand eczema 2 weeks after acute sunburn to the heels.



**Figure 3.** Idiopathic reaction post-traumatic eczema (see Case 8). Dermatitis appeared over a healed laceration on the thumb within 3 weeks of acute injury.



**Figure 4.** Idiopathic reaction post-traumatic eczema (see Case 13). Dermatitis developed within 3 weeks after acute laceration on the thigh with a chain saw.

### Idiopathic Reaction

If cutaneous lesions on nontraumatized skin do not precede post-traumatic eczema, an idiopathic reaction can be reliably distinguished from a primary isomorphic reaction only after months of careful follow-up. If no new cutaneous lesions develop on nontraumatized skin within 1 year to confirm the existence of an underlying endogenous skin disorder, then the reaction may be classified as idiopathic. This functional criterion of 1 year is an admittedly arbitrary one, based as much on practical considerations as on personal experience. Case histories 5 through 13 are representative of the idiopathic reaction of post-traumatic eczema and demonstrate that it may be quite persistent.

**Case 5.** A 47-year-old farmer suffered thermal burns to both calves when a gasoline tank on his tractor exploded. The burns never completely healed, and persistent inflammation developed at the burn sites, requiring intermittent treatment with topical steroids. There was no personal history of atopy or dermatitis preceding his injury. On examination 7 years after the accident, nummular eczematous patches each approximately  $4 \times 4$  cm in diameter were present on both calves where he had been burned. He was moderately obese but had no venous varicosities or changes of stasis dermatitis. A biopsy showed only nonspecific changes of subacute dermatitis. One year later, his condition was unchanged.

**Case 6.** A 52-year-old truck mechanic slipped from the cab of a truck and abraded the skin over his right shin. The abrasion never healed, and he developed persistent inflammation at the site. He had no personal history of atopy or antecedent skin disorder. On examination 4 years after his accident, an annular patch of subacute dermatitis approximately 5 cm in diameter was present over the right shin without varicosities or other stasis changes. No other cutaneous lesions were noted. Dermatitis was controlled with intermittent use of topical steroid creams and steroid-impregnated tape. Four years later, he still had dermatitis confined to the site of the trauma.

**Case 7.** A 33-year-old man employed as a painter's helper by a manufacturer of light fixtures abraded the knuckle skin overlying the proximal interphalangeal joint of his right ring finger while scraping paint residue off a work surface. The abrasion did not heal, even after oral antibiotic therapy given by another physician for persistent inflammation at the site of trauma. There was no history of atopy or hand dermatitis. One month after the initial injury,

he presented with a small indurated plaque of vesicular dermatitis confined to the site of prior trauma. Bacterial culture and KOH examination were negative. The patient continued to have intermittent mild recurrences of vesicles at the site of trauma, despite topical therapy with a high-potency steroid. One year later, he had another severe flare requiring medical treatment.

**Case 8.** A 33-year-old electrical parts assembler sustained a laceration to the base of his right thumb from a knife at work, requiring three sutures. At the time of suture removal 1 week later, no dermatitis was present; no topical therapy was prescribed. Several days later, he noted onset of vesicles around the site of the laceration. There was no personal history of atopy, but the patient had been intermittently treated over the past 5 years for chronic fungal infection of both soles and the left palm; the right hand had never been involved. On examination approximately 3 weeks after the injury, he had a  $2 \times 2$ -cm area of acute vesicular dermatitis over the area of the healed laceration on his right thumb (Fig. 3). The soles and left palm showed typical dry, keratotic changes of chronic tinea pedis and manum without vesiculation. A KOH examination and culture from the acute lesion on the right thumb were both negative for fungus. The eczematous lesion at the site of the laceration resolved on topical steroid therapy within 2 weeks and had not recurred at follow-up 1 month later.

**Case 9.** A 28-year-old machine assembler sustained a deep scratch to the base of his left thumb while assembling a collator. The scratch never healed, and he developed persistent inflammation at the site. The patient had a personal history of seasonal rhinitis and asthma. Although he had also had infantile eczema, there was no history of acute dermatitis since early childhood. On examination 1 month after the injury, there was an annular area of crusted, vesicular dermatitis where he had scratched his thumb. A KOH examination and bacterial culture were negative. Despite topical steroid therapy, the patient continued to experience dermatitis at the site of trauma for 3 months, at which time he was lost to follow-up.

**Case 10.** A 30-year-old apprentice butcher sustained a superficial laceration to his left lower leg from a hook on a meat basket. Within 3 days, he had developed some purulent drainage at the injury site, which was diagnosed as an infection and treated in a local hospital emergency room with oral antibiotics. For the next 8 months, the site never completely healed despite multiple courses of topical steroids and

oral antibiotics for persistent inflammation. There was no personal history of atopy or prior dermatitis. On examination, he had an approximately 10 × 10-cm plaque of crusted, vesicular eczema over the anteromedial left lower leg. No venous varicosities or other signs of stasis were present. An initial bacterial culture grew *Staphylococcus aureus*, but bacterial and fungal cultures of this lesion were negative on two separate occasions. A biopsy showed only subacute dermatitis. Patch testing for possible secondary allergic contact dermatitis was negative. The lesion responded to topical steroid therapy but continued to recur over the next 16 months. At last follow-up 2 years after the initial injury, the patient still required intermittent topical steroid therapy to control his condition.

**Case 11.** A 44-year-old maintenance mechanic slipped while working and punctured his left palm with the tip of a screwdriver. The puncture never completely healed, and small blisters began to occur around the site. He had no personal history of atopy or prior dermatitis. On examination 3 months after his accident, he had a patch of vesicular dermatitis confined to the center of his left palm. No vesicular lesions or other inflammatory changes were noted on the right hand or the feet. A KOH examination, x-ray for metal fragments, and patch tests (including nickel, chromate, and cobalt) were negative. For the next 3 years, he continued to have intermittent episodes of vesicular dermatitis of the left palm only, controlled with topical steroids. Approximately 3 years after initial injury, the dermatitis completely resolved and had not recurred within the year preceding his last follow-up.

**Case 12.** A 58-year-old machine operator employed by a wire coating and manufacturing company burned the dorsal part of his right hand when some molten metal accidentally splashed on it. The burn apparently healed without further incident except for residual hyperpigmentation and dryness at the injury site. Approximately 3 months after this injury, the patient noted onset of inflammation over his dorsal right hand. The patient had a history of infantile eczema but had not experienced dermatitis since childhood. On examination 6 months after injury, he had a 6 × 6-cm patch of subacute dermatitis with mild lichenification confined to the site of the previous thermal burn. No cutaneous lesions were present on the opposite hand or other areas of the body. After 1 month of treatment with topical steroids, he continued to have mild residual eczema. He did not return for further follow-up.

**Case 13.** A 24-year-old gardener lacerated his anterior right thigh on a chain saw and required more than 20 stitches. No dermatitis was apparent at the time of suture removal, but the patient noted a rash in the area of the laceration approximately 3 weeks after injury. There was no personal history of atopy or dermatitis. On examination approximately 6 weeks after the injury, he had nummular patches of crusted, vesicular eczema confined to the skin surrounding the laceration (Fig. 4). Bacterial cultures were negative. Although dermatitis was controlled with topical steroid therapy, he still had residual dermatitis at the site of previous trauma at his last follow-up 2 months later.

## DIFFERENTIAL DIAGNOSIS

Post-traumatic eczema must be differentiated from other noneczematous disorders that may be associated with an isomorphic response (such as psoriasis), foreign-body reactions, and recurrent herpes simplex precipitated by trauma.<sup>6</sup> Although the role of microorganisms in the perpetuation of eczema remains controversial,<sup>10</sup> secondary bacterial or fungal infections should be excluded by appropriate cultures and smears of scrapings or exudates. Superimposed allergic contact dermatitis must also be excluded, particularly since physicians or injured patients tend to treat wounds with a variety of topical preparations. In my experience, the most frequent causes of secondary allergic contact dermatitis following injury in the workplace are neomycin, benzocaine, and thimerosal, which are found in many industrial first aid preparations. Occasionally, an adhesive plaster used to cover a wound causes allergic contact dermatitis.

## DISCUSSION

The subject of dermatitis occurring after cutaneous trauma has received little attention in the dermatological literature. Only a few textbooks mention it, and they provide no detail.<sup>3, 4, 9</sup> Occasional case reports in journals have documented its occurrence following mild repetitive frictional trauma.<sup>1, 5, 12</sup> Wilkinson has described a patient who developed a nummular pattern of dermatitis at the site of an acute burn from caustic soda, which occurred within 10 days of initial injury and was followed by even-

tual development of new nummular lesions at other cutaneous sites.<sup>13</sup>

Zuehlke and associates have described the preferential occurrence of irritant contact dermatitis and asteatotic eczema in surgical or burn scar tissue in 13 patients.<sup>14</sup> They speculated that injured tissue is a site of diminished resistance for subsequent eczematous eruptions and coined the phrase "dermatitis in loco minoris resistentiae" to refer to this phenomenon. Although 11 of their patients had sustained their cutaneous injuries 7 months to 25 years prior to the onset of eczema, two of the patients had developed dermatitis within 3 months of acute injury. Although my series of post-traumatic eczema cases emphasizes the occurrence of dermatitis at the site of recent injury, it seems likely that the cases of "dermatitis in loco minoris resistentiae" reported by Zuehlke and associates represent part of a continuous spectrum of eczema that may follow cutaneous trauma.

Table 3 summarizes the essential features of post-traumatic eczema in the present series of case reports. The usual onset of dermatitis within weeks of cutaneous injury, frequently associated with the subjective perception that the skin never completely healed at the injury site, suggests a primary, stimulatory role of trauma in the precipitation of eczema rather than a passive innocent-bystander role, as suggested by Zuehlke and coworkers. Onset within weeks after trauma is consistent with temporal observations of experimental induction of isomorphic reactions in psoriasis.<sup>8</sup> A dynamic relationship between trauma and subsequent eczema has important medicolegal implications when the injury occurs as a result of a job-related accident, since direct complications of work-related injuries may be covered under state workers' compensation statutes. In Sweden, this dynamic concept that trauma may cause eczema has already been accepted by the workers' compensation bureau and insurance companies for more than 30 years (Sigfrid Fregert, Department of Occupational Dermatology, University Hospital, Lund, Sweden; personal communication).

Although atopics have increased susceptibility to contact dermatitis following exposure to environmental irritants, no increased susceptibility to post-traumatic eczema could be clearly established in the present small case series. Of the four total isomorphic reactions, clinically typical atopic dermatitis was the underlying endogenous skin disorder, that preceded one of the two secondary isomorphic reactions and

followed one of the two primary reactions. A history of atopy was present in the other isomorphic reaction preceded by irritant contact dermatitis. However, a history of atopy occurred in only two of nine cases classified as idiopathic reactions. Stasis dermatitis was the underlying condition that followed the other primary isomorphic reaction, and venous stasis secondary to obesity was a possible predisposing factor in one idiopathic reaction.

Exacerbation of both atopic dermatitis and stasis dermatitis may occur following cutaneous injury from sunlight exposure<sup>7</sup> and mechanical trauma,<sup>11</sup> respectively. Two idiopathic reactions were associated with fungal and bacterial infections, but any contributory role of these microorganisms remains purely speculative; the fungal infection was noninflammatory, was not clinically evident in the same anatomic area, and could not be identified in scrapings or culture from the post-traumatic eczematous skin in one case. Bacteria could not be isolated in repeated cultures or identified in biopsy tissue in the other case, nor could bacterial lesions be found elsewhere on the skin. Nonetheless, since eczematous lesions may appear spontaneously on previously uninvolved skin of patients with these associated disorders (autoeczematization, "id" reactions), the possibility remains that disorders prone to autoeczematization may predispose to post-traumatic eczema.

The type of cutaneous trauma that precipitated eczema in this series (which includes two cases where trauma was incurred outside the work environment) roughly corresponds to the distribution of trauma type for skin injuries in general (Table 1), and no gross trends can be observed. The exclusive occurrence of post-traumatic eczema on the extremities in males probably reflects the greater likelihood of injuries to the extremities and employment of men in jobs with higher risks of trauma rather than an anatomic site or sex predilection. In all cases, the trauma was sufficient to cause obvious tissue damage followed by an inflammatory or regenerative response. No definitive conclusions can be drawn regarding long-term prognosis, given the small numbers of cases and the relatively short follow-up in this series, but two idiopathic cases persisted for at least 8 years.

## SUMMARY

Thirteen cases of eczema that followed acute cutaneous trauma were observed. On the basis

Table 3. *Clinical Summary of Cases with Post-Traumatic Eczema*

TYPE AND CASE NO.	TIME FROM INJURY TO ONSET (WEEKS)	AGE AT ONSET	OCCUPATION	PERSONAL HISTORY OF ATOPY	ASSOCIATED SKIN CONDITION	INJURY		TIME FROM ONSET TO LAST FOLLOW-UP	CONDITION AT LAST FOLLOW-UP
						Type	Site		
Primary Isomorphic Reaction									
1	3	55	Painter	No	Stasis dermatitis	Abrasion	Ankle	6 mo	Active
2	4	27	Wine blender	Yes	Atopic dermatitis	Laceration	Finger	10 mo	Active
Secondary Isomorphic Reaction									
3	3	20	Student	Yes	Atopic dermatitis	Sunburn	Heels	2 wk	Active
4	3	45	Machinist	Yes	Irritant dermatitis	Puncture	Finger	6 wk	Active
Idiopathic Reaction									
5	3	40	Farmer	No	Obesity	Thermal burn	Both calves	8 yr	Active
6	3	48	Truck mechanic	No	None	Abrasion	Shin	8 yr	Active
7	3	33	Painter	No	None	Abrasion	Finger	1 yr	Active
8	3	33	Electrical assembler	No	Fungal infection on soles, oppo- site palm	Laceration	Thumb	2 mo*	Inactive
9	3	28	Machine assembler	Yes	None	Laceration	Thumb	3 mo*	Active
10	3	30	Butcher	No	Bacterial infection	Laceration	Shin, calf	2 yr	Active
11	3	44	Maintenance mechanic	No	None	Puncture	Palm	3 yr	Inactive
12	3	58	Machine operator	Yes	None	Thermal burn	Dorsal hand	7 mo*	Active
13	3	24	Gardener	No	None	Laceration	Thigh	3 mo*	Active

\*Since cases were followed for less than 1 year, primary isomorphic reactions cannot be absolutely excluded.

of the present case series, the following conclusions may be drawn:

1. Cutaneous trauma may precipitate eczema.
2. The trauma is sufficient to cause obvious tissue damage accompanied by an inflammatory or regenerative response.
3. Eczema usually begins within a few weeks of acute injury at the site of the cutaneous trauma.
4. Eczema may occur as an isolated idiopathic reaction or as an isomorphic reaction either preceding or following the appearance of an endogenous eczematous condition in nontraumatized skin.
5. Individual lesions of post-traumatic eczema may persist or recur for long periods of time.
6. The occurrence of post-traumatic eczema following occupational injury has important medicolegal implications.

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