The isomorphic phenomenon of Koebner

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The Koebner (isomorphic) phenomenon (response) is probably one of the most well known phenomena in dermatology and is named after the man who was the first to describe it.¹ The isomorphic phenomenon is now well documented in a number of skin diseases.

DEFINITION

The Koebner phenomenon is the development of isomorphic pathologic lesions in the traumatized uninvolved skin of patients who have cutaneous diseases.² It refers to the fact that in persons with certain skin diseases, especially psoriasis, trauma is followed by new lesions in the traumatized but otherwise normal skin, and these new lesions are clinically and histopathologically identical to those in the diseased skin.³

HISTORICAL BACKGROUND

Heinrich Koebner (1838-1904), one of the outstanding dermatologists of the 19th century, is not only well known as the person who first described the Koebner phenomenon in psoriasis, but also as a founder of the university dermatology clinic and pioneer of dermatology in Breslau.¹,² His initial observations and studies resulted from having seen patients who had developed psoriasis at sites of excoriations, horse bites, and tattoos. In 1872, at a meeting of the Silesian Society for National Culture, he presented the phenomenon that bears his name,⁴ and 4 years later published a paper describing his original patient. The mechanism of experimentally producing such a reaction was known as the Koebner experiment.² Since the time of Koebner, this phenomenon has been the subject of research by several authors.

TYPES OF KOEBNER PHENOMENON

Boyd and Neldner have classified all reported cases of Koebner phenomenon into four different groups:⁴

1. True isomorphic phenomenon: There appear to be three disease processes that display the true isomorphic response of Koebner: psoriasis, lichen planus and vitiligo;

2. Pseudoisomorphic phenomenon: The Koebner phenomenon seen in infectious diseases, e.g. warts, molluscum contagiosum and Behcet’s disease and pyoderma gangrenosum;

3. Occasionally occurring isomorphic phenomenon: In this category, diseases occasionally localize to sites of trauma, e.g. cancer (gastric, testicular or mammary), Darier’s disease, erythema multiforme, Hailey-Hailey disease, Kaposi’s sarcoma, Kyrlé’s disease, lichen sclerosus et atrophicus, pellagra, perforating folliculitis, reactive perforating collagenosis, and

4. Questionable isomorphic phenomenon: There are

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many conditions that have been associated with the Koebner phenomenon, many of which are single case reports. This includes: anaphylactoid purpura, bullous pemphigoid, dermatitis herpetiformis, discoid lupus erythematous, eczema, erythrokeratoderma variabilis, keratoacanthoma, lichen amyloidosis, lichen nitidus, multicentric reticulohistiocytosis, nevocytic nevi, pityriasis rubra pilaris, porokeratosis of Mibelli, urticaria pigmentosa, urticarial eruption of Still’s disease, telangiectasia macularis eruptive perstans, transient acantholytic dermatosis, vasculitis, and xanthoma eruptivum. Recently, isomorphic response has been noted in morphea, necrobiosis lipoidica diabeticorum, Kaposi’s sarcoma, pemphigus vulgaris, aspergillosis, scleromyxoedema, granuloma annulare, and PLEVA. In several cases of lupus erythematosus, the Koebner phenomenon has been seen in the apparently normal skin of patients following trauma, excoriation, operation scars, contact dermatitis, pressure from sock tops, application of liquid nitrogen, exposure to strong sun light, etc.

CAUSES OF THE KOEBNER RESPONSE

Koebner response may follow: (1) mechanical or thermal trauma (due to animal bites, burns, electrodesiccation, excoriation, freezing, friction, gunshot wounds, insect bites, lacerations, nail manicuring, poor fitting shoes, pressure, shaving, surgical grafts, surgical incision, tape stripping, thumb sucking), (2) dermatoses (such as carbuncles/furuncles, dermatitis, dermatitis herpetiformis, dermatophytosis, diaper dermatitis secondary to Candida infection, eczema, epidermal inclusion cyst, folliculitis, herpes simplex, herpes zoster, lichen planus, lymphangitis, measles, miliaria, perianal Corynebacterium minutissimum infection, perianal neurodermatitis, pityriasis rosea, psoriasis, scabies, seborrheic dermatitis, varicella, vitiligo), (3) allergic or irritant reactions (following BCG vaccination, hair spray, hair tints, influenza vaccination, photosensitivity, positive patch testing, scratch skin test, tattoos, tuberculin skin test, urticaria), and (4) therapy (such as Grenz ray therapy, roentgen therapy, iodine application, ultraviolet light).

PATHOGENESIS OF KOEBNER RESPONSE

The pathogenesis of Koebner phenomenon is not known. There have been few experimental studies outside the field of psoriasis. Speculative pathogenetic factors involved are immunologic, vascular, dermal, enzymatic, inhibitory, neural, growth, genetic and hormonal factors. There is growing evidence that immunologic factors are involved in the pathogenesis of psoriasis and consequent Koebner response to trauma. According to some investigators, capillary changes in the dermis precede all other morphologic changes.

Koebner response in psoriasis

The reported incidence of Koebner response in psoriasis varies from 11-75%. The latent period between injury to uninvolved skin and appearance of disease is usually 10-14 days, but it may range from 3 days to several years. The Koebner response is more likely to occur when psoriasis is unstable or flaring and less likely with quiescent or resolving psoriasis. More severe injury may result in more extensive skin lesions. The involuting central portion of a psoriatic plaque is refractory to the experimental induction of psoriasis and has been called the “zone of immunite locale”. The Koebner response appears to have no anatomic site preferences. It occurs more frequently in the winter than in the summer. Medications may provoke an allergic, irritant, or photosensitive type reaction in a patient, any of which may be considered a potential, albeit nonspecific, precipitator of the Koebner response.

In vitiligo, Koebner phenomenon has been recorded in 5% of cases in an Indian study.

All or none phenomenon in isomorphic response

Pedace et al found that if a patient reacted to one experimental stimulus, he would react to all. Conversely, lack of a positive response to a known Koebner inducing stimulus predicted failure of other stimuli in the series. They termed this positive and
negative reactivity, the all or none phenomenon.\textsuperscript{15}

The “reverse” Koebner response
The reverse Koebner reaction is seen when an area of psoriasis clears following injury.\textsuperscript{4} It has followed electrodesiccation, sandpaper abrasion, following infections (rubeola, colds, and acute tonsillitis) and surgery. Spontaneous repigmentation of vitiligo patches distant from the autologous skin graft sites has been termed as a “remote reverse Koebner phenomenon”.\textsuperscript{16}

**CLINICAL SIGNIFICANCE OF KOEBNER PHENOMENON**

Apart from its importance in clinical diagnosis, the Koebner phenomenon signifies activity of the disease.\textsuperscript{4} It guides the clinician to avoid physical/chemical irritants, surgical procedures and to treat underlying or concurrent diseases in order to better manage their cases. Koebner phenomenon can occur in distant wounds of patients with pre-existing cutaneous diseases.\textsuperscript{17} Thus, surgeons should be aware of this entity and should warn their patients about its possible occurrence.

**REFERENCES**