

What Is in a Name?—Demystifying “SKINTED”—A Review of Literature from Dermatological Perspective

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Abstract

Surgery of the knee, injury to the infrapatellar branch of the saphenous nerve, traumatic eczematous dermatitis (SKINTED) is a regional dermatitis specific to total knee arthroplasty, occurring postsurgically. It is characterized by an eczematous eruption localized to the knee, mostly the anteroinferior aspect, presenting as pruritic, dry, erythematous, scaly, or at times papulovesicular lesions. Having been known over the past decade by various nomenclatures, the basic pathogenesis has now been agreed upon as a locoregional immune dysfunction because of damage to lymphatics occurring postsurgically. We have described three case reports of typical eczematous lesions occurring after total knee replacement surgery and reviewed the literature for similar cases described across the literature. A PubMed and Google Scholar search pertaining to the articles published with the keywords “SKINTED” and “autonomic denervation dermatitis” was conducted. A total of 10 results were obtained after exclusion of duplicated and irrelevant search results. This yielded one review article, one original article, seven case reports, and two correspondence articles. Based on the review, the authors agree with the concept of Rucco’s immunocompromised district, being the most logical explanation for the occurrence of SKINTED. SKINTED should be differentiated from implant eczema occurring because of hypersensitivity to metal implants, which presents as systematized contact dermatitis and has a predefined set of diagnostic criteria.

Keywords: Autonomic denervation dermatitis, immunocompromised district, injury to the infrapatellar branch of the saphenous nerve, surgery of the knee, traumatic eczematous dermatitis (SKINTED)

INTRODUCTION

Surgery of the knee, injury to the infrapatellar branch of the saphenous nerve (IPBSN), traumatic eczematous dermatitis (SKINTED) is a regional dermatitis specific to total knee arthroplasty (TKA), occurring postsurgically. It is characterized by an eczematous eruption localized to the anteroinferior aspect of the knee, presenting as pruritic, dry, erythematous, scaly, or at times papulovesicular lesions. This term was first conceived in 2009^[1] and, over the years, has been referred to by different nomenclatures, such as autonomic denervation dermatitis, trophoneurosis, neuropathic dermatitis,^[2] and posttraumatic eczema. These terms have sometimes been used synonymously and sometimes as different entities. The most recent concept that tries to unify these entities is explained by the theory of

“immunocompromised district” (ICD).^[3] Surgical incision of the TKA leads to the damage to the locoregional sensory nerves—saphenous nerve being the most important nerve, as well as to the interruption of lymphatic drainage. These factors contribute to a barrier dysfunction as well as immune dysregulation, which in turn predisposes the healed surgical site to develop eczema or even other dermatoses. In the present article, we describe three cases, with similar eczematous eruption post-TKA, and a review of literature for this entity “SKINTED.” Our aim of conducting this review is to clarify the etiopathogenesis of this entity and to “declutter” the somewhat confusing

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conundrum of various nomenclatures. Another objective is to differentiate it from a rare, but possible diagnosis of implant eczema.

SKINTED: REPORT OF THREE CASES

Case 1

A 68-year-old woman, presented with itchy, exfoliating skin lesions over the right knee, which appeared 4 months after a TKA (cobalt chromium knee implant), indicated for right knee osteoarthritis. There was no history of oozing, pustules, ulcers, or edema over the area or any pain or difficulty during the joint movement. The patient did not have a history of preexisting atopic dermatitis. Cutaneous examination revealed a well-demarcated, erythematous, scaly plaque, over the surgical incision and extending medially. Orthopedic examination did not reveal any restriction of joint mobility, pain, or deformity. X-ray of the knee (anteroposterior and lateral view) was completely normal without any signs of implant loosening. Patch testing was negative for the metals in the implant. Based on the typical clinical morphology and topography of the lesion, a diagnosis of SKINTED was put forward. X-ray of the knee (anteroposterior and lateral view) was completely normal without any signs of implant loosening. Patch testing by Indian standard battery of contact allergens was found to be negative. Rest of the cutaneous examination was normal. Based on the typical clinical morphology and topography of the lesion, a diagnosis of SKINTED was put forward. Topical emollients and moderate potency topical steroid cream (mometasone furoate 0.1%) were given, following which the patient showed clinical improvement in terms of regression of itching, erythema, and scaling. However, during the period of follow-up of 6 months, the patient continued to develop relapses and remission over the same site.

Case 2

A 52-year-old woman presented with itchy plaques, associated with oozing, over the left knee [Figure 1]. She had undergone TKA (cobalt chromium), for osteoarthritis, 5 months before the skin lesions appeared. The lesions initially started as itchy, reddish, slightly edematous plaques, with overlying erosions and papulovesicular eruptions, associated with oozing. They were present over both the medial and lateral aspects of the knee with a central, healed scar.

The patient had recurrent episodes of such lesions over the operated knee, which would resolve partially with treatment, but did not show complete resolution during the course of a 6-month follow-up period. There was a history of postoperative wound infection and postoperative wound gaping, which resolved with antibiotics. X-ray of the operated knee showed a healthy implant, without any signs of loosening. Patch test



Figure 1: Erythematous, indurated coalescent plaques with oozing present over the left knee, with a central, hypopigmented scar

was negative. There was no pain on joint movement or postoperative deformity of the knee joint. The patient was treated with a combination of topical steroid and antibiotic cream, with a relapsing and remitting course of the skin lesions.

Case 3

A 53-year-old male underwent TKA of the left knee, with a cobalt-chromium knee implant. After 3 months of an uneventful postoperative course, the patient began developing reddish scaly plaques over the operated knee, associated with severe itching. The patient was atopic and had a past history of chronic eczema over the ankles, which also aggravated simultaneously. The patient was prescribed a topical corticosteroid and emollient, following which the lesions subsequently improved, but with frequent relapses, even on treatment, over the subsequent course of follow-up. Rest of the local and systemic examination, x-ray of the operated knee, and patch testing did not show any abnormal or positive findings.

DISCUSSION AND REVIEW OF LITERATURE

A PubMed and Google Scholar database search pertaining to the articles published with the keywords “SKINTED” and “autonomic denervation dermatitis” was conducted. A total of 10 results were obtained after the exclusion of duplicated and irrelevant search results. This yielded one review article, one original article, seven case reports, and two correspondence articles. These articles were thoroughly reviewed, and information was collected and condensed, regarding the pathomechanisms and clinical course of SKINTED [Table 1].

Table 1: Literature summary of SKINTED

Type of publication	Results/summary	Remarks/consensus
Brief report/ correspondence ¹	Total number of patients: 55 Clinical presentation: See footnote* Preceded by anesthesia or hypoesthesia Timeline: 3 weeks to 4 months after surgery Distribution of lesions: Exclusively lateral: 75% 25% had involvement of the skin on both sides of incision	The term SKINTED was coined in this correspondence and gained slow popularity The pathogenesis was considered obscure and attributed to barrier dysfunction occurring postsurgery
Case report and literature review ²	Number of cases: 10 Consisting of various surgical procedures on their lower extremities Clinical presentation: Typical* Timeline: 6 months to 3 years postsurgery Patch test: No significant positive results Hypoesthesia and decreased sweating (demonstrated by starch iodine testing) at the lesional sites	The authors in this study coined the term “autonomic denervation dermatitis” The entity of SKINTED was considered as a subset under the umbrella of autonomic denervation dermatitis
Review article ³	Total studies reviewed: 8 (one cohort and other case reports and series) 69 reported cases of dermatitis occurring post-TKA Distribution: Lateral to the incision in 30/34 operated knees. Bilateral lesions : six patients No functional limitation	The review focuses on skin lesions occurring in the local area, after knee arthroplasty Since the article has been published in an orthopedic journal, a dermatological viewpoint cannot be derived accurately; however it seems that a majority of cases are SKINTED
Original article ⁴	Total number of cases: 203 Estimated incidence of 4.4% Mean duration: 4 months (range: 3–6 months) Clinical presentation: See footnote* Presence of perilesional and marginal hypoesthesia in all patients Complete response, without recurrence in all patients at the end of 6 months	In this article also, SKINTED has been considered as a subset of autonomic denervation dermatitis
Case report ⁵	68-year-old patient with eczematous lesions along the lateral margin of incision on both the knees, 9 months postbilateral arthroplasty Managed with topical mid-potent corticosteroid and emollient	SKINTED considered as a subset of autonomic denervation dermatitis
Case report ⁶	60-year-old woman B/L total knee replacement Presented with scaly, erythematous to hyperpigmented pruritic plaques 9 months after TKR on the right knee and oozy, erythematous plaques over the left knee, 3 months post-TKR	SKINTED considered as a part of “autonomic denervation dermatitis”
Case report ⁷	Two cases Case 1: 70-year-old, arthroplasty—1.5 years back Case 2: 49-year-old woman Localized itchy red lesions with watery discharge over both lower limbs adjacent to surgical scar	SKINTED considered as “autonomic denervation dermatitis”
Correspondence ⁸		SKINTED is considered to be a subset of the ICDs of the skin
Case report ⁹	Two cases relevant to the present review—one patient developed surgical scars on both the knees after bilateral knee transplant Other patient developed eczema at the site of surgical scar for an operated humerus	SKINTED is considered as a manifestation or a type of Rucco’s ICD of the skin

TKR = total knee replacement; *Clinical presentation: xerotic eczematous, discrete to confluent papules and plaques with associated xerosis and scaling, occasionally associated with oozing and fissuring

Table 1: References

¹Verma SB, Mody BS. Explaining a hitherto nameless condition: “SKINTED.” Clin Exp Dermatol 2009;34:e465-6

²Madke B, Mhatre M, Kumar P, Singh AL, Patki A. Autonomic denervation dermatitis: A new type of eczematous dermatitis. Clin Dermatol Rev 2017;1:61-4

³Dhillon MS, Jindal K, Shetty VD, Kumar P, Rajnish RK. Autonomic denervation dermatitis: A relatively undocumented “ADD”itional complication of total knee replacements and other surgeries around the knee. Indian J Orthop 2021;55:1068-75

⁴Nazeer M, Ravindran R, Katragadda BC, Muhammed EN, Rema DTJ, Muhammed MN. SKINTED: A rare complication after total knee arthroplasty. Arthroplast Today 2020;6:1028-32

⁵Rana A, Mehta P. SKINTED: A new type of eczematous dermatitis. J Med Sci Clin Res 2021;9:74-6

⁶Pathania YS, Singh S. SKINTED: An autonomic denervation dermatitis. Int J Dermatol 2020;59:613-4

⁷Mathur D, Sharda S. Autonomic denervation dermatitis in two patients. JDA Indian J Clin Dermatol 2019;2:96-7

⁸Verma SB. Adding “SKINTED” to the list of immunocompromised districts. Clin Exp Dermatol 2020;45:346-7

⁹Bharti R. SKINTED-4 cases of locus minoris resistentiae. Our Dermatol Online 2021;12:e7. Available from: <http://www.odermatol.com/odermatology/2021e/E318.SKINTED-BhartiR.pdf>.

Primary concepts of etiopathogenesis of SKINTED

- Sensory denervation and subsequent barrier dysfunction:** The pure sensory IPBSN is most commonly resected during TKA.^[4] The subsequent hypoesthesia alters the local epidermal barrier function, increases transepidermal water loss, and leads to subsequent xerosis.^[1] However, this cannot convincingly explain how sensory loss could trigger eczematous eruptions at the surgical site.
- Posttraumatic eczema:** Inflammatory response occurring posttrauma has been postulated as a likely trigger for eczema and is likely to occur within 2–4 weeks after any type of mechanical, chemical, or thermal trauma.
- Autonomic denervation dermatitis:** In 2017, the entity of autonomic denervation dermatitis^[5,6] was suggested to include all cases of eczematous eruptions occurring at the site of healed surgical scars. Resection of dermal autonomic nerves following surgical trauma alters the vasomotor and sudomotor responses as well as the cutaneous microcirculation and ultimately disrupts the physiological skin barrier, aided and abetted by resected C-type nerve fibers and an imbalance of various neuropeptides and acetylcholine.
- The unifying concept of “ICD”:** A coordinated crosstalk between the keratinocytes, appendages, Langerhans cells, lymphocytes, mast cells, macrophages, and Merkel cells is necessary for maintaining the homeostasis of skin, which is also a dynamic immune organ. This sectorial impairment of immunological homeostasis of skin, following trauma or any other “stressor” event has been described by the term Ruocco’s ICDs. It unites different phenomena such as isomorphic (Koebner) and isotopic (Wolf) responses of skin^[7] and is central to understanding SKINTED and many similar types of dermatoses. In surgical scars and their vicinity, the regional lymphatic drainage is hampered, which adversely affects the

immune cell trafficking in the surgical site. Also, the transection of autonomic and sensory nerves in the area leads to an altered neurotransmitter signaling. Other similar examples of the ICDs include skin grafts, herpes zoster scars, striae, insect bites, injection sites, sites of radiotherapy, tattoos, sites exposed to chronic friction, and sites of epilation. All these ICDs are vulnerable because they show predilection to develop infections, inflammatory dermatosis, and even tumors.^[7]

We agree with the viewpoint that SKINTED is indeed a subset of the ICD. In the three cases that we have reported, the timeline for the development of eczematous lesions was variable, ranging from 2 months to 5 months. In the variable case reports of non-SKINTED ICDs, the onset of second dermatoses ranges from as early as 2 days (the development of new onset lesions of cutaneous B cell lymphoma in a healed herpes zoster lesions, within 5 days) to more than 40 years (the development of basal cell carcinomas in previously irradiated sites with signs of chronic radiation dermatitis).^[7]

An important differential diagnosis of SKINTED is implant eczema, which occurs secondary to cobalt-chromium metal implants, and is a common concern prevailing among the orthopedic surgeons. The most important presenting symptoms of implant eczema are painful persistent synovitis and synovial effusion and unexplained implant failure. Cutaneous presentation is variable, ranging from therapy resistant local eczema to a systematized contact dermatitis reminiscent of symmetrical drug-related intertriginous and flexural exanthema. A majority of the reported cases are presumed metal allergy, many of them ultimately being misrepresentations of SKINTED itself.^[8] However, there is still a lack of evidence regarding correlation between metal hypersensitivity and implant-related complications.^[9] The criteria for metal hypersensitivity to implants are tabulated in Table 2.

Table 2: Diagnostic criteria for metal implant hypersensitivity by American contact dermatitis society¹

Major criteria	Minor criteria
Eruption overlying the metal implant	Unexplained pain and/or failure of the offending implant
Positive patch test to the metal used in the implant	Dermatitis reaction is resistant to therapy
Complete resolution after the removal of the implant	Morphology consistent with dermatitis (erythema, induration, papules, vesicles)
Chronic dermatitis beginning weeks to months after implantation	Systemic allergic dermatitis reaction
	Histology consistent with allergic contact dermatitis
	Positive <i>in vitro</i> test to metals (e.g., lymphocytes transformation test)

Noncriteria features: Radiographic images can show osteolytic lesions in the proximity of the femoral and tibial components, which form as a result of the inflammatory response and can lead to aseptic loosening of the implant, loss of tibial posterior slope, and setting of the tibial base plate into varus, as compared to the previous images taken after surgery

Table 2: Reference

¹Schalock PC, Crawford G, Nedorost S, Scheinman PL, Atwater AR, Mowad C *et al.* Patch testing for evaluation of hypersensitivity to implanted metal devices: A perspective from the American Contact Dermatitis Society. *Dermatitis* 2016;27:241-7.

Role of predisposing factors in the occurrence of SKINTED: Can it be predicted?

Cicek *et al.*^[10] studied the role of autonomic dysfunction in atopic dermatitis and concluded that sudomotor activity controlled by the sympathetic nervous system, as well as unmyelinated fibers that play a role in this activity is affected in patients with atopic dermatitis. The same findings may be extrapolated at the sites of surgical scars, as pointed out by Madke *et al.* This dysautonomia, along with cutaneous dysimmunity, may synergistically play a role in triggering eczematous lesions at the surgical sites. Moreover, an ICD is more liable to be affected by regional recurrence of preexistent dermatoses.^[11] It can only be hypothesized that the incidence of SKINTED may be increased in atopic individuals; however, further studies of this entity are required to find out the association.

SUMMARY AND CONCLUSION

Based on the review of available data, the authors conclude that SKINTED represents locus minoris resistentiae or ICD of the skin. Autonomic denervation seems to be an adjunctive factor in the etiopathogenesis by contributing in creating the ICD. The knowledge of this entity alleviates unnecessary stress among the orthopedic surgeons as well as the knee arthroplasty patients. The patients can also be counseled regarding the relapsing and remitting nature of the entity, thus improving overall patient care.

Limitations of this review

Because of limited data availability, a systematic meta-analysis cannot be conducted reliably. Furthermore, we have not been able to shed light on the rate of relapses and recurrence of SKINTED, as well as any predisposing factors that play a role in the occurrence of this entity. A systematic study should be conducted with a reasonable sample size for further insight into the predisposing factors of SKINTED as well as its course and prognosis.

Ethics statement

Informed consent was taken from the patient prior to using data and photograph.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the

patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

Data availability statement

Data sharing was not applicable to this article as no datasets were generated or analyzed during the current study.

REFERENCES

1. Verma SB, Mody BS. Explaining a hitherto nameless condition: "SKINTED". *Clin Exp Dermatol* 2009;34:e465-6.
2. Sharquie KE, Noami AA, Alaboudi AS. Neuropathy dermatitis following surgical nerve injury. *Case Rep Dermatol Med* 2011;2011:234185.
3. Verma SB. Adding "SKINTED" to the list of immunocompromised districts. *Clin Exp Dermatol* 2020;45:346-7.
4. Ebraheim NA, Mekhail AO. The infrapatellar branch of the saphenous nerve: An anatomic study. *J Orthop Trauma* 1997;11:195-9.
5. Madke B, Mhatre M, Kumar P, Singh AL, Patki A. Autonomic denervation dermatitis: A new type of eczematous dermatitis. *Clin Dermatol Rev* 2017;1:61-4.
6. Pathania YS, Singh S. SKINTED: An autonomic denervation dermatitis. *Int J Dermatol* 2020;59:613-4.
7. Vojvodic A, Tirant M, Nardo VD, Lotti T, Wollina U. Immunocompromised districts of skin: A case series and a literature review. *Open Access Maced J Med Sci* 2019;7:2969-75.
8. Wu PY, Muo CH, Tsai CH. Increased risk of eczema after joint replacement: A population-based retrospective cohort study. *Medicine (Baltimore)* 2019;98:e17914.
9. Saccomanno MF, Sircana G, Masci G, Cazzato G, Florio M, Capasso L, *et al.* Allergy in total knee replacement surgery: Is it a real problem? *World J Orthop* 2019;10:63-70.
10. Cicek D, Kandi B, Berilgen MS, Bulut S, Tekatas A, Dertlioglu SB, *et al.* Does autonomic dysfunction play a role in atopic dermatitis? *Br J Dermatol* 2008;159:834-8.
11. Wollina U, Schönlebe J. Disseminated specific cutaneous infiltrates of B-cell chronic lymphocytic leukemia—Wolf's isotopic response following herpes zoster infection. *J Dtsch Dermatol Ges* 2016;14:179-81.