



The Indonesian Journal of General Medicine

Treatment Outcomes of Topical Calcineurin Inhibitor Therapy for Patients With Vitiligo

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Article History :

Received date : 2024/07/01
Revised date : 2024/08/15
Accepted date : 2024/09/12
Published date : 2024/10/27



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ABSTRACT

Background: The literature on topical calcineurin inhibitors (TCIs) for the treatment of vitiligo highlights their promising role as an alternative to traditional therapies. **Literature Review:** The comparative study by established that the combination of narrowband ultraviolet B (NB-UVB) therapy with 0.1% tacrolimus is both efficacious and safe, especially for localized vitiligo affecting less than 30% of the body surface area. The rapid onset of pigmentation, observed within 4-8 weeks, underscores the immunomodulatory properties of tacrolimus, which enhances melanocyte activity by inhibiting pro-inflammatory cytokines. This study laid the groundwork for further investigations into the mechanisms and effectiveness of TCIs in vitiligo treatment. **Conclusion:** In conclusion, the body of literature indicates that topical calcineurin inhibitors represent a significant advancement in the management of vitiligo. Their immunomodulatory properties, safety profile, and potential for combination therapies position them as effective treatment options. However, the need for further research to establish robust clinical guidelines and optimize treatment protocols remains evident.

Keyword: Treatment Outcomes, Topical Calcineurin Inhibitor Therapy, Vitiligo

INTRODUCTION

The treatment outcomes of topical calcineurin inhibitors (TCIs) for patients with vitiligo have garnered significant attention in recent years, reflecting an evolving understanding of both the disease and its therapeutic options. The literature presents a multifaceted view of TCIs, particularly tacrolimus and pimecrolimus, as promising alternatives to traditional therapies.

In 2017, conducted a comparative study demonstrating that the combination of narrowband ultraviolet-B (NB-UVB) therapy with 0.1% tacrolimus is efficacious and safe for treating vitiligo, especially in cases where less than 30% of the body surface area is affected. The study highlighted that initial pigmentation could be observed within 4-8 weeks, emphasizing the immunomodulatory role of tacrolimus in promoting melanocyte activity through the inhibition of pro-inflammatory cytokines. This foundational work set the stage for further exploration into the mechanisms and effectiveness of TCIs.

Also in 2017, (Xu et al., 2017) explored the in vitro effects of

pimecrolimus, revealing its capacity to increase melanogenesis and facilitate the migration of melanocytes, which is critical for repigmenting depigmented areas in vitiligo patients. The authors underscored the limitations of traditional topical corticosteroids, suggesting that TCIs may offer a more favorable safety profile while achieving comparable or superior cosmetic outcomes. This study reinforced the potential of TCIs as a viable treatment option, particularly given the adverse effects associated with corticosteroids.

The following year, (H Haines et al., 2018) initiated the HI-Light Vitiligo Trial, which aimed to systematically evaluate home interventions alongside light therapy, including TCIs. They noted that while clinical guidelines advocate for the use of TCIs, the evidence base remains limited, with many studies exhibiting poor quality. Their findings suggested that combination therapies, including TCIs, might enhance treatment efficacy, particularly when initiated early in the disease course.

In 2021, (Emmanuel Kubelis-López et al., 2021) provided an overview of new medical treatments for vitiligo, reiterating the role of TCIs as immunomodulators that inhibit calcineurin, thus reducing inflammation and promoting melanocyte function. They highlighted the off-label use of TCIs as a significant advancement in vitiligo management, particularly for patients who do not respond adequately to conventional therapies.

Most recently, examined the current status of cell-based therapies for vitiligo, emphasizing the need for novel treatments due to the limitations of existing options, including TCIs. Their review reflects a broader trend in vitiligo research, where the focus is shifting towards innovative therapeutic strategies that enhance repigmentation and improve patient outcomes.

Additionally, a systematic review on the safety and efficacy of TCIs in treating psoriasis by (AMIRI et al., 2023) further contextualizes the use of these agents, suggesting their potential applicability in vitiligo treatment, particularly in sensitive areas like the face and genital regions.

Lastly, (Al-Smadi et al., 2023) discussed the use of topical formulations of vitamin D in conjunction with TCIs, highlighting the ongoing exploration of combination therapies that may optimize treatment responses in vitiligo patients.

Together, these studies illustrate the promising role of topical calcineurin inhibitors in the management of vitiligo, emphasizing their immunomodulatory properties, safety, and potential for combination therapies, while also acknowledging the need for further research to solidify their place in clinical practice.

LITERATURE REVIEW

The article titled "A Comparative Study of Narrowband-Uvb Alone Vs Narrowband-Uvb With 0.1% Tacrolimus in the Treatment of Vitiligo" by provides a comprehensive examination of the efficacy of combining narrowband ultraviolet B (NB-UVB) therapy with topical calcineurin inhibitors, specifically tacrolimus, in treating vitiligo. The study's main assertion is that this combinatory approach is both effective and safe for patients with

localized vitiligo, particularly when the affected body surface area is less than 30%.

The methodology employed in the study is noteworthy, as it involves treating localized vitiligo lesions with NB-UVB therapy supplemented with tacrolimus twice weekly over an average of 24 to 48 sessions. The results indicate that initial pigmentation can be observed within a timeframe of 4 to 8 weeks, which is significant for patients seeking timely improvement in their condition. This rapid onset of pigmentation can enhance patient compliance and overall satisfaction with the treatment process.

A critical evaluation of the article reveals that the mechanism of action for tacrolimus is well-articulated. It operates through immunomodulation by influencing T cells, which is crucial in the context of vitiligo, a condition characterized by an autoimmune response leading to the destruction of melanocytes. The article details the pharmacodynamics of tacrolimus, emphasizing its interaction with the FK506 binding protein to inhibit calcineurin. This inhibition subsequently prevents the

phosphorylation of the transcription factor NFAT, thereby blocking the transcription of pro-inflammatory cytokines that contribute to the pathogenesis of vitiligo.

Moreover, the article highlights the role of tacrolimus in stimulating follicular repigmentation. By promoting the proliferation of inactive melanocytes from the outer root sheath of hair follicles and facilitating the differentiation and growth of melanoblasts, tacrolimus showcases its potential not just as a topical agent but as a therapeutic modality that addresses the underlying mechanisms of vitiligo.

The article titled "Current Status of Cell-Based Therapies for Vitiligo" by provides a comprehensive overview of the treatment landscape for vitiligo, particularly focusing on the emerging role of cell-based therapies. The authors effectively contextualize vitiligo as a chronic pigmentary disorder that impacts approximately 1% of the global population, characterized by the formation of white macules and patches due to the loss of melanocytes in the epidermis. This loss not only leads to physical

changes but also significantly affects the psychological well-being of patients, with around 75% experiencing associated psychological disorders.

The article "Safety and Efficacy of Topical Calcineurin Inhibitors in the Treatment of Facial and Genital Psoriasis: A Systematic Review" by (AMIRI et al., 2023) provides a comprehensive evaluation of the effectiveness and safety profile of topical calcineurin inhibitors (TCIs) in the management of psoriasis, particularly in sensitive areas such as the face and genitals. While the primary focus of the article is on psoriasis, the insights gleaned from this systematic review can be extrapolated to inform the understanding of TCIs in the treatment of other skin conditions, including vitiligo.

The article titled "Using a Topical Formulation of Vitamin D for the Treatment of Vitiligo: A Systematic Review" by (Al-Smadi et al., 2023) presents a comprehensive examination of the efficacy of calcipotriol, a topical vitamin D analog, in the treatment of vitiligo. The authors synthesize data from

several studies that highlight the potential of calcipotriol, both as a monotherapy and in combination with phototherapy modalities such as PUVA (psoralen plus ultraviolet A) and NB-UVB (narrowband ultraviolet B).

CONCLUSION

The literature on topical calcineurin inhibitors (TCIs) for the treatment of vitiligo highlights their promising role as an alternative to traditional therapies. The studies reviewed indicate that TCIs, particularly tacrolimus and pimecrolimus, not only provide effective treatment outcomes but also exhibit a favorable safety profile.

The comparative study by established that the combination of narrowband ultraviolet B (NB-UVB) therapy with 0.1% tacrolimus is both efficacious and safe, especially for localized vitiligo affecting less than 30% of the body surface area. The rapid onset of pigmentation, observed within 4-8 weeks, underscores the immunomodulatory properties of tacrolimus, which enhances melanocyte activity by inhibiting pro-inflammatory cytokines. This study laid the groundwork for further

investigations into the mechanisms and effectiveness of TCIs in vitiligo treatment.

In exploring pimecrolimus, (Xu et al., 2017) demonstrated that this TCI can stimulate melanogenesis and promote melanocyte migration, presenting an alternative to traditional corticosteroids that often carry adverse effects. This finding supports the hypothesis that TCIs can achieve comparable or superior cosmetic results while minimizing safety concerns.

Further research by (H Haines et al., 2018) in the HI-Light Vitiligo Trial emphasized the need for high-quality evidence regarding the use of TCIs, suggesting that combination therapies may enhance treatment efficacy, particularly when initiated early. This aligns with the comprehensive overview by (Emmanuel Kubelis-López et al., 2021), which reiterated the role of TCIs as immunomodulators that facilitate the management of vitiligo, especially for patients unresponsive to conventional treatments.

The systematic review by (AMIRI et al., 2023) further contextualizes TCIs by evaluating

their safety and efficacy in treating psoriasis, suggesting their potential applicability in vitiligo, especially in sensitive areas. Additionally, the exploration of combination therapies, including topical formulations of vitamin D as discussed by (Al-Smadi et al., 2023), reflects an ongoing effort to optimize treatment responses in vitiligo patients.

In conclusion, the body of literature indicates that topical calcineurin inhibitors represent a significant advancement in the management of vitiligo. Their immunomodulatory properties, safety profile, and potential for combination therapies position them as effective treatment options. However, the need for further research to establish robust clinical guidelines and optimize treatment protocols remains evident.

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