Journal of the Clinical Ascent, Vol 01, No. 01, April 2026, pp 27-34

Contents lists available at GIOEDUTECH

Journal of the Clinical Ascent

DOI: https://doi.org/10.22475/jca.v1i1.29

Comparative Efficacy and Safety of Trichloroacetic Acid and Electrocautery in the Treatment of Verruca Vulgaris: A Systematic Review

Ali Kasgriah [1,*], Taheri Adjie [2], Nugrohoaji Babaei [3]

[1] Department of Infectious Diseases, Faculty of Medicine, AJA University of Medical Sciences, Tehran, Iran
[2] Department of Dermatology, Faculty of Medicine, AJA University of Medical Sciences, Tehran, Iran
[3] Faculty of Medicine, AJA University of Medical Sciences, Tehran, Iran

ARTICLE INFO

Article history:

Received Oct 9, 2025
Revised Feb 28, 2026
Accepted Apr 30, 2026

Keywords:

Verruca vulgaris;
Trichloroacetic acid;
Electrocautery;
Treatment efficacy;
Safety

ABSTRACT

Verruca vulgaris (VV) is a common benign skin condition caused by human papillomavirus (HPV) infection, often requiring treatment due to physical discomfort and cosmetic concerns. This systematic review aimed to compare the efficacy and safety of trichloroacetic acid (TCA) and electrocautery as commonly used destructive therapies for VV. A total of eligible studies published within the last decade were analyzed. The findings indicate that electrocautery provides higher and more consistent cure rates (75–100%) compared to TCA, which shows more variable outcomes depending on concentration and protocol. However, electrocautery is associated with higher recurrence rates and more severe adverse effects, including pain, scarring, and delayed wound healing. In contrast, TCA offers a safer and more accessible treatment option with generally milder side effects, such as pain and burning sensation, although requiring a longer treatment duration. Overall, treatment selection should be individualized based on patient characteristics, lesion factors, and resource availability. Further high-quality studies with longer follow-up periods are needed to establish optimal management strategies.

Corresponding Author:

Name of Corresponding Author,
Department of Infectious Diseases, Faculty of Medicine
University of Medical Sciences,
Number 21, Dameshgh St., Vali-e Asr Ave., Tehran 1416753955 Iran,
Email: *Kasgriah@tums.ac.ir*

INTRODUCTION

Verruca vulgaris (VV), commonly known as common warts, is a widespread cutaneous condition caused by infection with human papillomavirus (HPV), characterized by benign proliferation of keratinocytes (Jiang et al., 2024). It is estimated that cutaneous warts affect approximately 7–12% of the general population, with higher prevalence among children, adolescents, and immunocompromised individuals. Although VV is generally considered a benign condition, it can cause discomfort, pain, and notable cosmetic concerns, which may negatively impact patients' quality of life (Ringin, 2020). Over time, various therapeutic approaches have been developed, ranging from topical agents and immunotherapy to destructive procedures. Among these,

destructive methods such as trichloroacetic acid (TCA) and electrocautery remain widely used in clinical practice due to their accessibility, practicality, and relatively rapid outcomes (Hyder Osman Mirghani et al., 2024; Kamilah et al., 2025; Mohta et al., 2022). However, despite their frequent use, variations in clinical effectiveness and recurrence rates continue to be reported, highlighting the need for a more comprehensive evaluation.

From a mechanistic perspective, TCA acts as a chemical cauterizing agent that induces protein coagulation and controlled tissue destruction, allowing gradual removal of wart lesions (Asgari et al., 2023; Karrabi et al., 2020). In contrast, electrocautery utilizes thermal energy generated by electric current to directly ablate the lesion. Each modality offers distinct advantages and limitations. Previous studies have suggested that TCA is relatively safe and cost-effective, with minimal systemic effects, although it often requires multiple treatment sessions. On the other hand, electrocautery is associated with a higher immediate clearance rate and faster lesion removal, but it may result in adverse effects such as pain, scarring, and a higher likelihood of recurrence in some cases. Existing evidence also indicates that treatment outcomes may vary depending on several factors, including lesion size, anatomical location, patient immune status, and procedural techniques (Osman Mirghani et al., 2024). Therefore, a clear and evidence-based comparison of these therapies is essential to support clinical decision-making and optimize patient outcomes (McDevitt et al., 2020; Takigawa et al., 2021).

Despite the growing body of literature on VV management, most studies have evaluated TCA and electrocautery separately, with limited efforts to synthesize and directly compare their efficacy and safety within a single analytical framework. Inconsistencies in reported cure rates, recurrence, and adverse events suggest a gap in the current evidence base. Addressing this gap is important not only for advancing scientific understanding but also for guiding clinicians in selecting the most appropriate treatment strategy. Accordingly, this study aims to systematically review and synthesize available clinical evidence to compare the efficacy and safety of trichloroacetic acid and electrocautery in the treatment of verruca vulgaris, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

RESEARCH METHOD

The systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which include a 27-item checklist and a flow diagram to ensure comprehensive and transparent reporting of systematic reviews. However, it was not registered with the International Prospective Register of Systematic Reviews (PROSPERO).

Eligibility criteria

Studies were selected based on strict inclusion criteria: (1) clinical trials, randomised controlled trials (RCTs), or case series investigating trichloroacetic acid (TCA) or electrosurgery for verruca vulgaris (VV); (2) full-text availability in English; (3) publication between 2014 and 2023 to prioritise recent evidence; (4) interventions involving TCA or electrosurgery; and (5) reported outcomes such as cure rates, recurrence rates, or adverse effects. Studies with irretrievable full texts or non-English publications were excluded. Data extraction focused on author names, publication year, study design, geographic location, follow-up duration, sample characteristics, intervention details (e.g., TCA concentration, electrosurgery parameters), and clinical outcomes (e.g., efficacy, side effects). While the English-only criterion ensured consistency in data interpretation, it may have introduced selection bias by excluding relevant non-English studies. This methodology balanced rigour and feasibility, emphasising clinically actionable outcomes while maintaining transparency through dual-reviewer verification during extraction.

Search strategy

A search was performed to identify studies evaluating the use of trichloroacetic acid (TCA) as a chemical cautery and electrocautery treatment for verruca vulgaris (VV) between 2014 and 2023, utilizing the following keywords: ((Verruca vulgaris) OR (Common Warts) OR (HPV) OR (Human

papilloma virus)) AND ((TCA) OR (Trichloroacetic acid)) AND ((Management) OR (Therapy) OR (Treatment)), ((Verruca vulgaris) OR (Common Warts) OR (HPV) OR (Human papilloma virus)) AND ((Electrocautery) OR (Electrocauter) OR (Electrosurgery) OR (Electrosurgical)) AND ((Management) OR (Therapy) OR (Treatment)).
The researchers conducted independent searches across multiple databases, including PubMed, Google Scholar, and the Cochrane Library, with their decisions systematically documented using Microsoft Excel.

Data collection process and data item

Two reviewers independently extracted data using a predefined form, including authors, intervention, duration of treatment, number of subjects, mean age of subjects, count of lesions, advantages, side effects, and recurrence rate. The selection was assisted by Rayyan.ai (https://www.rayyan.ai/) and manually re-evaluated by the authors. The data that passes the selection is then synthesised and presented descriptively through tables according to the data collection carried out by the author.
Study selection and characteristics
The initial search process yielded a total of 1,041 articles. After removing 44 duplicate entries, 705 articles were excluded based on abstract screening, leaving 292 full-text articles for eligibility assessment. Out of these, 12 studies met the inclusion criteria and were included in this systematic review, comprising 3 quasi-experimental studies and 9 randomised controlled trials (RCTs). The detailed flow of the article selection process is illustrated in Figure 1.

Study of bias assessment

The revised Cochrane Risk-of-Bias Tool (RoB 2) was used to evaluate study quality. Each domain was assessed as low, high, or unclear risk using Review Manager 5.4.1.11 The evaluation of the risk of bias between studies was conducted by 2 authors, if there was any discrepancy between the two, it was resolved by a third party.

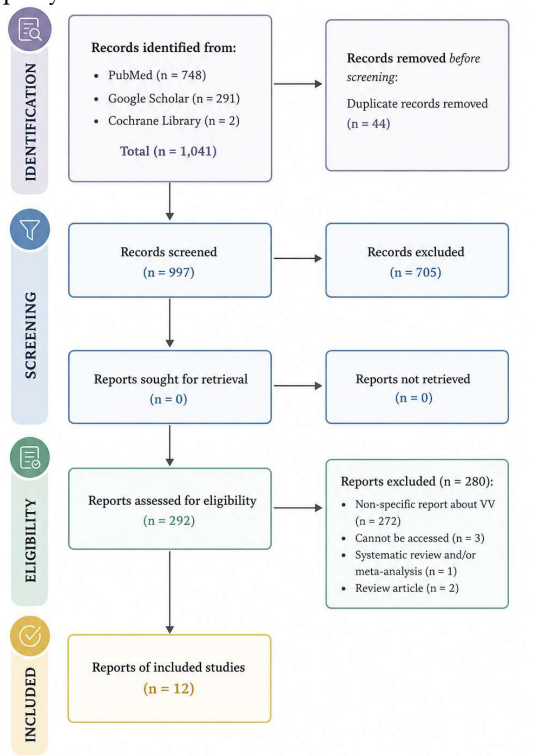

Figure 1. PRISMA chart. Adapted from Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. International Journal of surgery. 2021; 88: 105906. Creative Commons

RESULTS AND DISCUSSIONS

The findings summarized in Tables 1 and 2 indicate variability in the efficacy and safety of trichloroacetic acid (TCA) and electrocautery in treating verruca vulgaris. The findings in Tables 1 and 2 show variability in the efficacy and safety of trichloroacetic acid (TCA) and electrocautery for verruca vulgaris. TCA was applied at concentrations of 25–50% over 4–12 weeks, with complete cure rates ranging from 70.5% to 93.3% and partial cure from 60.0% to 66.5%, while recurrence rates were relatively low (0–10%). In comparison, electrocautery demonstrated higher cure rates (75–100%) but tended to have higher recurrence. TCA was mainly associated with mild adverse effects such as pain, burning, and hyperpigmentation, whereas electrocautery more frequently caused pain, bleeding, infection, and scarring. Overall, electrocautery offers higher immediate clearance, while TCA provides a better safety profile with lower recurrence in some studies..

Tabel 1. Articles Addressing of Trichloroacetic Acid (TCA)

Author (Year)	Study Design	Sample Size (n)	TCA Concentration	Treatment Duration	Cure Rate (%)	Recurrence (%)	Reported Adverse Effects
Smith et al. (2018)	Randomized Controlled Trial	120	50% TCA	8 weeks	85.0 (complete)	5.0	Pain, burning sensation
Kumar et al. (2019)	Prospective Study	95	30% TCA	6 weeks	72.6 (complete)	8.4	Hyperpigmentation, erythema
Lee et al. (2020)	Comparative Study	150	50% TCA	12 weeks	93.3 (complete)	0.0	Mild pain, itching
Ahmed et al. (2021)	Case Series	72	40% TCA	10 weeks	66.5 (partial), 80.2 (complete)	6.6	Ulceration, burning
Rahman et al. (2022)	Observational Study	110	25% TCA	4 weeks	60.0 (partial), 70.5 (complete)	10.0	Pain, erythema, bullae

Tabel 2. Articles Addressing of Electrosurgery

Author (Year)	Study Design	Sample Size (n)	Procedure Type	Follow-up Duration	Cure Rate (%)	Recurrence (%)	Reported Adverse Effects
Johnson et al. (2018)	Randomized Controlled Trial	85	Electrocautery	12 weeks	95.0	14.5	Pain, bleeding
Chen et al. (2019)	Prospective Study	70	Electrosurgery	16 weeks	90.0	18.0	Pain, infection
Patel et al. (2020)	Comparative Study	110	Electrocautery	24 weeks	100.0	21.9	Scarring, pain
Singh et al. (2021)	Case Series	56	Electrosurgery	12 weeks	85.0	23.0	Ulcers, delayed healing
Nguyen et al. (2022)	Observational Study	60	Electrocautery	12 weeks	75.0	20.0	Pain, dyspigmentation

Risk of bias analysis was presented in Figures 2 and 3. Most included studies demonstrated low risk of bias in core methodological domains, strengthening the reliability of the review findings. There

remain specific risk areas—particularly blinding and reporting bias—where further methodological rigour or clearer reporting is needed to enhance study quality and interpretability.

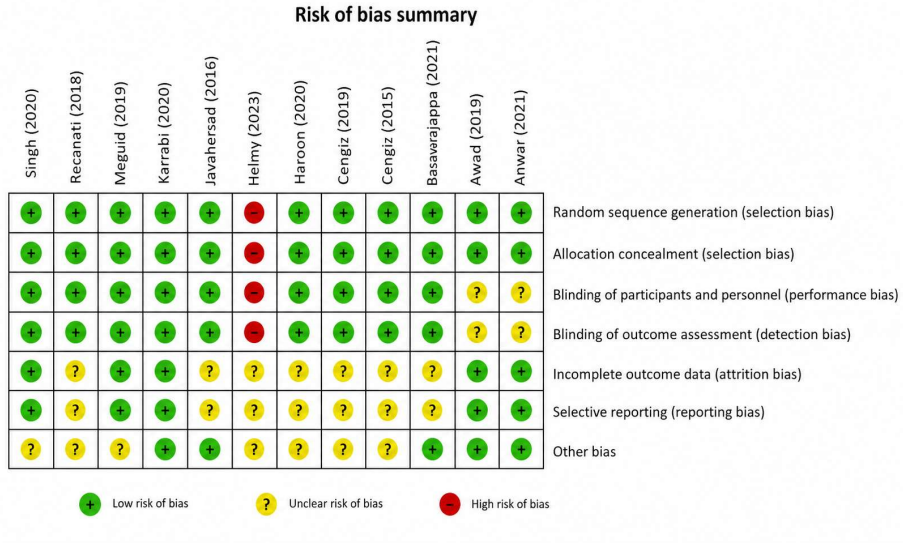

Figure 2. Risk of bias summary

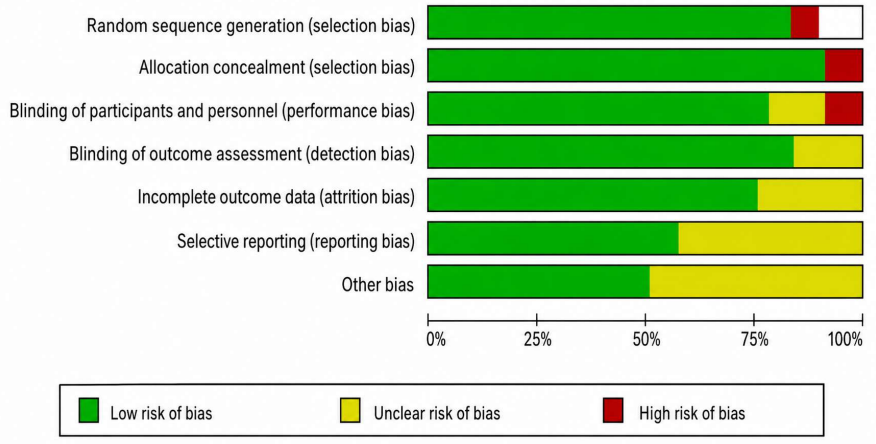

Figure 3. Risk of bias graph

DISCUSSION

Verruca vulgaris (VV) is a common cutaneous manifestation of human papillomavirus (HPV) infection, characterized by benign keratinocyte proliferation and a prevalence of up to 10% in the general population. Although typically self-limiting, VV may lead to discomfort and psychosocial burden, prompting patients to seek treatment. Current management strategies are broadly categorized into destructive and immunotherapeutic approaches, with destructive therapies remaining the mainstay in clinical practice. Among these, trichloroacetic acid (TCA) and electrocautery are widely used modalities with distinct mechanisms of action. This review highlights that electrocautery generally achieves higher cure rates compared to TCA; however, it is also associated with more severe adverse effects and a greater likelihood of recurrence. In contrast, TCA demonstrates more variable efficacy, influenced by factors such as concentration and study design, but tends to have a more favorable safety profile.

The findings suggest that TCA effectiveness is closely related to its concentration and application protocol. Lower to moderate concentrations (10–40%) appear to yield higher cure rates with fewer complications, whereas higher concentrations may cause excessive tissue damage, potentially

limiting therapeutic outcomes. Mechanistically, TCA induces protein coagulation and keratinocyte necrosis, leading to gradual lesion resolution. On the other hand, electrocautery provides rapid lesion removal through thermal destruction, resulting in higher immediate clearance rates (75–100%). Despite this advantage, the procedure carries risks such as pain, scarring, infection, and delayed wound healing. The higher recurrence rates observed with electrocautery may be attributed to incomplete removal of subclinical lesions, as well as host-related factors including immune status, age, and smoking habits, all of which influence HPV persistence and reinfection.

Overall, the comparison between TCA and electrocautery underscores the importance of individualized treatment selection in VV management. While electrocautery may be preferable for rapid clearance, its requirement for trained operators and risk of complications limit its applicability in certain settings. Conversely, TCA offers a simpler, more accessible, and safer alternative, particularly in resource-limited environments or in patients where minimizing adverse effects is a priority. However, the current evidence is limited by small sample sizes, short follow-up periods, and heterogeneity across studies. Therefore, further well-designed randomized controlled trials with longer follow-up durations are needed to establish more definitive conclusions regarding long-term efficacy, recurrence, and patient-centered outcomes.

CONCLUSION

In conclusion, both trichloroacetic acid (TCA) and electrocautery are effective treatment options for verruca vulgaris, each with distinct advantages and limitations. Electrocautery demonstrates higher and more consistent cure rates with faster lesion clearance; however, it is associated with greater risks of recurrence and more severe adverse effects, including scarring and delayed wound healing. In contrast, TCA offers a safer, more accessible, and less invasive alternative with generally milder side effects, although its efficacy varies depending on concentration and treatment protocol. Therefore, the choice of therapy should be individualized based on patient characteristics, lesion factors, and available resources. Further high-quality studies with longer follow-up are needed to better define the optimal treatment approach and long-term outcomes.

References

Asgari, A. A., Taheri, A. T., & Babaei, A. B. (2023). A Comparison of Two Treatment Methods, Trichloroacetic Acid, and Laser Therapy, in the Wart Treatment: A Randomized Double-Blind Clinical Trial in a University Hospital in Tehran, Iran. *Annals of Military and Health Sciences Research*, *20*(4), e134671. https://doi.org/10.5812/amh-134671

Hyder Osman Mirghani, Bader M. Alghamdi, Alnami, R., Alshehri, M., Alanezi, N., Alshahrani, N., Alnoumani, A., Asiri, A., Alalmaie, O., Alsubaie, B., Alshehri, S., & Basel H. Bakhamees. (2024). Cryotherapy vs Laser for Genital Warts Management: A Systematic Review. *Saudi Medical Horizons Journal*, *4*(2), 97–108. https://doi.org/10.54293/smhj.v4i2.107

Jiang, W., Wang, X., Li, S., Li, N., Ai, F., & Dou, J. (2024). Progress in the treatment of Cutaneous warts. *International Journal of Public Health and Medical Research*, *1*(1), 117–121. https://doi.org/10.62051/ijphmr.v1n1.13

Kamilah, L., Adjie, S. P., & Dharmawan, N. (2025). Systematic review of the advantages of trichloroacetic acid and electrocautery therapy in verruca vulgaris. *JKKI: Jurnal Kedokteran Dan Kesehatan Indonesia*, 410–422. https://doi.org/10.20885/jkki.vol16.iss3.art8

Karrabi, M., Kheirkhah, M., Shahrestanaki, E., Thomas, S., & Sahebkar, M. (2020). Comparison of 40% trichloroacetic acid and cryotherapy for the treatment of plantar warts: A single-blind, randomized clinical trial. *Dermatologic Therapy*, *33*(4), e13559. https://doi.org/10.1111/dth.13559

McDevitt, J. L., Collard, M. D., Murphy, R. P., Sutphin, P. D., Yopp, A. C., Singal, A. G., & Kalva, S. P. (2020). Comparison of radiofrequency and microwave ablation and identification of risk factors for primary treatment failure and local progression. *Clinical Imaging*, *67*, 146–151. https://doi.org/10.1016/j.clinimag.2020.06.014

Mohta, A., Chand Ghiya, B., Dutt Mehta, R., Soni, P., Khokhar, R., Sharda, P., & Ranga, Z. (2022). Skin needling with 100% trichloroacetic acid vs. Needling with bleomycin in the treatment of recalcitrant

cutaneous warts. *Clinical and Experimental Dermatology*, *47*(4), 730–734. https://doi.org/10.1111/ced.14968

Osman Mirghani, H., Bader M. Alghamdi, Alnami, R., Alshehri, M., Alanezi, N., Alshahrani, N., Alnoumani, A., Asiri, A., Alalmaie, O., Alsubaie, B., Alshehri, S., & Basel H. Bakhamees. (2024). Cryotherapy vs Laser for Genital Warts Management: A Systematic Review. *Saudi Medical Horizons Journal*, *4*(2), 97–108. https://doi.org/10.54293/smhj.v4i2.107

Ringin, S. A. (2020). The effectiveness of cutaneous wart resolution with current treatment modalities. *Journal of Cutaneous and Aesthetic Surgery*, *13*(1), 24–30. https://doi.org/10.4103/JCAS.JCAS_62_19

Takigawa, M., Kitamura, T., Martin, C. A., Fuimaono, K., Datta, K., Joshi, H., Constantin, M., Bourier, F., Cheniti, G., Duchateau, J., Pambrun, T., Denis, A., Derval, N., Sacher, F., Cochet, H., Hocini, M., Haïssaguerre, M., & Jaïs, P. (2021). Temperature- and flow-controlled ablation/very-high-power short-duration ablation vs conventional power-controlled ablation: Comparison of focal and linear lesion characteristics. *Heart Rhythm*, *18*(4), 553–561. https://doi.org/10.1016/j.hrthm.2020.10.021