



Original Article

Treatment of Genital Warts by 30% Salicylic Acid Peel and Cautery Vs 5% Imiquimod Cream and Cautery in Shahid Jabar Dermatology and Venereology Center

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Abstract

Background: Genital warts are the epidermal manifestation of human papillomavirus infection, associated with physical discomfort and psychosocial distress. Our study aimed to compare the efficacy and safety between two combinations: Group A: 30% salicylic acid peel with cautery (SA peel + CA) Group B: 5% Imiquimod cream with cautery (IMQ+CA).

Methods: 70 patients were recruited in a single-center, open label, and parallel-group randomized clinical trial. Participants were randomly assigned to one of the treatment arm, assessments conducted at baseline and every two weeks for 12 weeks.

Results: 30% (SA + CA) obtained significantly and more rapid and consistent clearance rate. The clearance rate was markedly higher in the SA peel arm across all time points, reaching 94.3% by week 10, while the IMQ cream arm only reached 54.3% by week 12. Additionally, recurrence rates were significantly lower in the SA peel group (8.6%) than in the IMQ cream group (48.6%) ($P < 0.001$). In terms of side effects, the SA peel group reported milder and less frequent adverse events (25.7%), whereas the IMQ cream group experienced moderate to severe side effects in 77.1% of cases ($p < 0.001$).

Conclusion: Both treatments were effective, but 30% (SA peel +CA) demonstrated higher efficacy, faster clearance, lower recurrence rate, fewer and milder side effects, higher patient satisfaction, and greater quality of life improvement; therefore, this combination represents a promising, effective, and well-tolerated treatment option for genital warts.

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Introduction

Genital warts (GWs) are benign epidermal proliferations caused by infection with human papillomavirus (HPV) and constitute one of the most prevalent sexually transmitted infections worldwide, affecting both men and women [1]. More than 200 identified HPV subtypes; types 6 and 11 are

responsible for the majority of GWs cases [2]. GWs presented clinically, as (soft, fleshy papules or plaques in the anogenital region), which mostly associated with pruritus, bleeding, and considerable psychological burden due to their sexual transmission and social stigma, leading to impaired quality of life (QOL) of the

patients [3]. Treatment modalities for management of GWs are broadly divided into ablative and topical modalities [4]. Ablative modalities such as electrocautery (CA), cryotherapy, and laser therapy, these destructive modalities cause immediate physical removal of visible lesions [5]. These methods have notable limitations such as pain, risk of scarring, and high recurrence rates), nevertheless, they often require adjunctive treatments to improve long term clearance [3]. Topical agents, such as (IMQ), Podophyllotoxin, and Sinecatechins, these agents work by either stimulate local immune response or inducing cytotoxicity to the wart tissues [6]. 5% IMQ cream is an immunomodulator that works by acting like a toll like receptor 7 (TLR7) agonist, activating innate and adaptive immune response to target HPV infected cells [7]. Despite its effectiveness, IMQ is commonly associated with local adverse effects such as (erythema, itching, and ulceration), that may impair patient compliance and satisfaction [8]. SA, a beta-hydroxy acid, it's a potent keratolytic agent, result in exfoliation of hyperkeratotic layers of the epidermis and is widely used in the treatment of many dermatological conditions [9]. Despite its efficacy and favorable safety profile in non-genital settings, its application in (GWs), particularly at higher concentrations and in combination regimens, remains underexplored. Despite available treatment options for the management of GWs, there are several challenges, particularly the high recurrence rate [10]. While CA provides rapid physical removal of visible lesions, but doesn't address the underline viral infection, limiting its efficacy as monotherapy and increasing the risk of recurrence and scarring [11]. To the best of our knowledge, this is the first study to evaluate the use of 30% SA peel plus CA for the treatment of GWs, this is a significant gap in the current

literature that need to be addressed. Our aim is to address the efficacy and safety, recurrence rate and side effect profile of both combinations. Additionally, patient-reported outcomes (PRO) in terms of patient satisfaction, adherence, and impact on quality of life were assessed in both combinations.

Materials and Methods

1. Study Design and Setting

This study was conducted as a single-center, open-label, parallel-group, randomized clinical trial. Our research was conducted at Shahid Jabar Dermatology and Venereology Teaching Center in Sulaymaniyah City, Kurdistan Regional Government, Iraq, spanning from December 2024 to June 2025. The total study duration was 24 weeks, comprising a 12-week active treatment period followed by a 12-week post-treatment follow-up phase.

2. Participants and Randomization

A total of 70 patients diagnosed with GWs were enrolled and randomly assigned to one of two treatment groups ($n=35$ per group) using a computer-generated block randomization method with a block size of 4. Complete blinding of participants and clinicians was not feasible due to the distinct nature of the treatments.

3. Inclusion and Exclusion Criteria

Inclusion criteria: male and female patients with clinically diagnosed GWs were included, no prior treatment for GWs within the last three months, and willingness to provide informed consent and comply with study protocols.

Exclusion criteria: pregnancy or lactation, allergies to study medications, contraindications for cautery, any immunodeficiency conditions (e.g., HIV,

hepatitis B/C, diabetes, malignancy), and coexisting sexually transmitted infections.

4. Ethical Considerations

The research protocol has been registered in the Department of Clinical Science, Sulaymaniyah University under the reference number (146) on (14/10/2024). Ethical approval was obtained from the College of Medicine Review Committee / Sulaymaniyah University with approval number: 358 on (23/10/2024). Written informed consent was obtained from all participants before enrollment and participants were fully informed about the study procedures, potential risks and benefits, and their right to withdraw at any time. We anonymized patient data to ensure confidentiality and compliance with data protection regulations.

5. Baseline Assessment and Outcome Measures

Baseline assessment was performed for all participants such as medical history, physical examination, and assessment of GWs characteristics in term of (wart number, in which discrete warts were counted individually; coalesced plaques were counted as one lesion). Wart size (we measured the longest diameter of the lesion) and GWs location. All lesions were photographed by the same investigator at each visit. Viral screening and (VDRL) for syphilis were performed for all participants. The primary outcome was complete clearance of warts defined as total disappearance of visible lesions confirmed by clinical examination [12]. Recurrence was defined as lesion reappearance at or within 2 cm of the original site within three months post-treatment [12]. Secondary outcomes included safety, side effects, compliance, treatment satisfaction, and quality of life (QoL) which assessed by

using the Dermatology Life Quality Index (DLQI) [13] at baseline and at 12 week. Treatment satisfaction was evaluated using a patient satisfaction questionnaire at the end of the treatment period [14].

6. Safety and Tolerability

Treatment-emergent adverse events (AEs) such as pruritus, burning, erythema, edema, erosions, and ulcerations were recorded at each visit. Local reactions were graded as none, mild, moderate, or severe.

7. Intervention Protocols

Group A: 30% SA Peel + CA, participants in Group A received 30% SA peel + CA, prior to application, the treatment area was cleansed, the SA peel was applied topically to whole area using a sterile cotton applicator until the onset of visible epidermal whitening (pseudofrost), after which it was thoroughly rinsed with water. Immediately following the peel, radiofrequency CA was performed in the same session, local anesthesia (1% lidocaine) injected to visible lesions, and CA was delivered via a fine-tipped electrode using the electrofulguration technique at low power. A topical antibiotic ointment was applied post-procedure, and patients were advised to keep the area clean and dry. We applied SA peel + CA regimen every two weeks, follow up visits was scheduled two weekly, and for total of six sessions, with treatment adjustments according to participant's clinical response and tolerability.

Group B: 5% IMQ+CA, in this arm we instructed participants to clean the area and apply thin layer of IMQ cream to the wart lesions at bedtime. The application site was rinsed off (6-10) hours post application. IMQ was applied three times per week (e.g., Monday, Wednesday, and Friday), for 12 weeks. We scheduled for CA every two

weeks for total of six sessions, and CA protocol was similar to that of SA group. We scheduled two weekly follow up visits throughout the treatment period to assess therapeutic response, document side effects, and adjust management as clinically indicated.

8. Statistical Analysis

Data analysis was performed using IBM SPSS Statistics (v27.0). Distribution of continuous variables was assessed by Shapiro–Wilk tests and Kolmogorov–Smirnov that revealed non-normal distributions of our variables. Therefore, continuous variables were reported as medians with Interquartile Range (IQR), and categorical variables as frequencies and percentages with 95% confidence intervals (CIs) reported for key proportions. We conducted between-group comparisons of baseline characteristics and time to final response by using the Mann–Whitney U test. Categorical outcomes, including demographics, adverse effects, recurrence rates, patient satisfaction, and gender-based subgroup analyses, were evaluated using the Chi-square test. Within-group changes in wart size and number across time points were analyzed by using the Friedman test, and pairwise comparisons using the Wilcoxon Signed-Rank test. Statistical significance was defined as $p < 0.05$.

Results

1. Baseline Characteristics

Our baseline characteristics analysis, which detailed in Table 1, demonstrated that the both treatment groups were well-balanced at baseline regarding demographic and clinical characteristics. Median age was similar (SA: 32 years, IMQ: 33 years, $p=0.99$). Gender distribution was comparable (17 males and 18 females in each group, $p=0.594$). The median duration of warts was not

statistically significant between groups (SA: 6 months, IMQ: 7 months, $p=0.164$). Baseline wart size and number of warts at baseline also showed no statistically significant differences ($p=0.156$ and $p=0.56$, respectively), although a greater proportion in the SA group initially had >10 warts (42.9%) compared to the IMQ group (17.1%). Other factors such as smoking status, marital status, medical history, and residency were evenly distributed.

2. Efficacy Outcomes (Primary, Secondary, and Over Time)

The results in Table 2 demonstrate that at 12 weeks, the SA peel +CA group achieved significantly higher complete clearance of genital warts (94.3%, 33/35) compared to the IMQ+CA group (54.3%, 19/35), corresponding to a risk difference (RD) of 0.40 (95% CI: 0.20–0.57) and a risk ratio (RR) of 1.74 (95% CI: 1.27–2.38; $p < 0.001$). The median time to final response was substantially shorter in the SA peel +CA group (6 weeks, IQR = 2) than in the IMQ+CA group (12 weeks, IQR = 2; $p < 0.001$). Over the treatment period, clearance in the SA peel + CA group progressed rapidly, reaching 62.9% by week 6, 91.4% by week 8, and reaching 94.3% by week 10, whereas the IMQ + CA group showed minimal early response (0% at weeks 2 and 4), (22.9% clearance by week 8) and only reached 54.3% by week 12. Recurrence during the 3-month post-treatment follow-up was markedly lower in the SA peel +CA group (8.6%) than in the IMQ+5CA group (48.6%; RD = -0.40 , 95% CI: -0.57 to -0.19 ; RR = 0.18, 95% CI: 0.06–0.55; $p < 0.001$). In our gender analyses, (SA peel + CA) demonstrated significantly superior efficacy in females (100% vs. 50.0%; $p = 0.002$), while the difference in males did not reach statistical significance (88.2% vs. 64.7%; $p = 0.234$).

3. Safety, Tolerability, and Patient-Reported Outcomes (PROs)

Our data in Table 3 presents the safety, tolerability, and PROs between the two treatment arms. Adverse events (AEs) were reported less frequently in the SA peel + CA group (25.7%, 9/35) compared to the IMQ cream + CA group (77.1%, 27/35), resulted in a risk difference (RD) of -0.51 (95% CI: -0.67 to -0.28) and a risk ratio (RR) of 0.33 (95% CI: 0.18 – 0.60 ; $p < 0.001$). Regarding severity of AEs in the SA peel + CA arm were mild (25.7%), no moderate or severe AEs have been reported. In contrast, IMQ cream + CA group reported higher moderate (25.7%) and severe (20.0%) AEs ($p < 0.001$). Particularly, among IMQ cream + CA recipients, smokers demonstrated a significantly higher risk of developing moderate to severe side effects compared with nonsmokers ($p = 0.004$), indicating a potential interaction between treatment and current smoking status. Regarding patient satisfaction our analysis revealed significantly higher patient satisfaction in the SA+CA arm: among males, 88.2% (15/17) reported satisfaction versus only 11.8% (2/17) in the IMQ cream + CA group ($p < 0.001$); similarly, 77.8% (14/18) of females in the SA peel + CA group were satisfied, compared to only 11.1% (2/18) in the IMQ+CA group ($p < 0.001$). QOL was assessed by using the Dermatology Life Quality Index (DLQI). The analysis showed considerable improvement in both groups from baseline to week 12 (SA peel + CA: 14.5 ± 4.2 to 4.1 ± 2.3 ; IMQ cream + CA: 15.1 ± 4.8 to 9.7 ± 3.9), however, the mean improvement was significantly greater in the SA peel + CA group ($\Delta = -10.4$ vs. -5.4 ; $p < 0.001$), highlighting its superior impact on improving the QOL of the participants.

Table 1. Participants Demographics and Wart Characteristics

		SA+CA	IMQ+CA	P value
Age(y) , median(Interquartile Range)		32.00(10)	33.00(8)	0.99
Gender	Male ,No.	17	17	0.594
	Female, No.	18	18	
Duration of warts (months), median(Interquartile Range)		6.00(5)	7(7)	0.164
Size of the warts at baseline, No.(%within treatment group)	<1cm	7(20%)	13(37.1%)	0.156
	1-3 cm	11(31.4%)	14 (40.0%)	
	>3 cm	5(14.3%)	5(14.3%)	
	multiple sizes	12(34.3%)	3(8.6%)	
No. of the warts at baseline cm, No.(%within treatment group)	one lesion(plaque)	0 (0.0%)	2(5.7%)	0.56
	2-5 warts	8(22.9%)	14 (40.0%)	
	6-10 warts	12(34.3%)	13(37.1%)	
	> 10 warts	15(42.9%)	6(17.1%)	
Smoking, No. (%)		14 (40%)	16 (45.7%)	0.629
Marital status	Married, No. (%)	29(82.9%)	26(74.3%)	0.382
	Unmarried No. (%)	6(17.1%)	9(25.7%)	
Medical history	Previous genital wart, No.	17	14	0.470
	Negative, No.	18	21	
	Chronic illness	0	0	
	Allergy to the drugs	0	0	
	Current medication	0	0	
Residency	Inside Sulaimani, No. (%)	30(85.7%)	23(65.7%)	0.093
	Outside Sulaimani, No. (%)	5(14.3%)	12(34.3%)	

Table 2. Efficacy Outcomes (Primary, Secondary, and Over Time)

Outcome	SA+CA	IMQ+CA	Effect size (95% CI)	p-value
Final clearance at 12 weeks, n/N (%)	33/35 (94.3%)	19/35 (54.3%)	RD = 0.40 (0.20–0.57); RR = 1.74 (1.27–2.38)	<0.001*
Time to final response, median weeks (IQR)	6 (2)	12 (2)	—	<0.001‡
Recurrence during follow-up, n/N (%)	3/35 (8.6%)	17/35 (48.6%)	RD = –0.40 (–0.57 to –0.19); RR = 0.18 (0.06–0.55)	<0.001*
Clearance over time, n/N (%)	• 2 w: 0/35 (0%) • 4 w: 1/35 (2.9%) • 6 w: 22/35 (62.9%) • 8 w: 32/35 (91.4%) • 10 w: 33/35 (94.3%) • 12 w: 33/35 (94.3%)	• 2 w: 0/35 (0%) • 4 w: 0/35 (0%) • 6 w: 2/35 (5.7%) • 8 w: 8/35 (22.9%) • 10 w: 15/35 (42.9%) • 12 w: 19/35 (54.3%)	—	—
Final clearance by gender, n/N (%)	Male: 15/17 (88.2%) Female: 18/18 (100%)	Male: 11/17 (64.7%) Female: 9/18 (50.0%)	RR (male) = 1.36 (0.92–2.02); RR (female) = 1.95 (1.23–3.07)	0.234 (M) 0.002 (F)§

* χ^2 test for proportions. Effect sizes (RD, RR) shown with 95% CIs.

‡Mann Whitney U

§ Chi-Square Tests

RD: risk difference; RR: risk ratio; IQR: interquartile range

Table 3. Safety, Tolerability, and Patient Reported Outcomes (PROs)

Measure	SA+CA	IMQ+CA	Effect size (95% CI)	p-value
Any AE, n/N (%)	9/35 (25.7%)	27/35 (77.1%)	RD = −0.51 (−0.67 to −0.28); RR = 0.33 (0.18–0.60)	<0.001*
AE severity, n/N (%)	• None: 26 (74.3) • Mild: 9 (25.7) • Moderate: 0 (0) • Severe: 0 (0)	• None: 6 (17.1) • Mild: 13 (37.1) • Moderate: 9 (25.7) • Severe: 7 (20.0)	Severe AE RD = −0.20 (−0.36 to −0.06); RR † ≈ 0.07 (0.00–1.12)	<0.001*
AE severity by smoking (IMQ arm), n	—	Smokers: • Mild 1 • Moderate 5 • Severe 5 • None 5 Nonsmokers: • Mild 12 • Moderate 4 • Severe 2 • None 1	—	0.004*
Patient satisfaction — Male, n	• Satisfied 15 • Neutral 2 • Unsatisfied 0	• Satisfied 2 • Neutral 9 • Unsatisfied 6	—	<0.001*
Patient satisfaction — Female, n	• Satisfied 14 • Neutral 4 • Unsatisfied 0	• Satisfied 2 • Neutral 6 • Unsatisfied 10	—	<0.001*
DLQI (mean ± SD)	Baseline 14.5 ± 4.2 → Week 12 4.1 ± 2.3; Δ −10.4	Baseline 15.1 ± 4.8 → Week 12 9.7 ± 3.9; Δ −5.4	—	Baseline p=0.78; Week-12 p<0.001; Δ p<0.001

* χ^2 test

†Haldane Anscombe correction used because SA had zero severe AEs

AE: adverse event; DLQI: Dermatology Life Quality Index; Δ: change

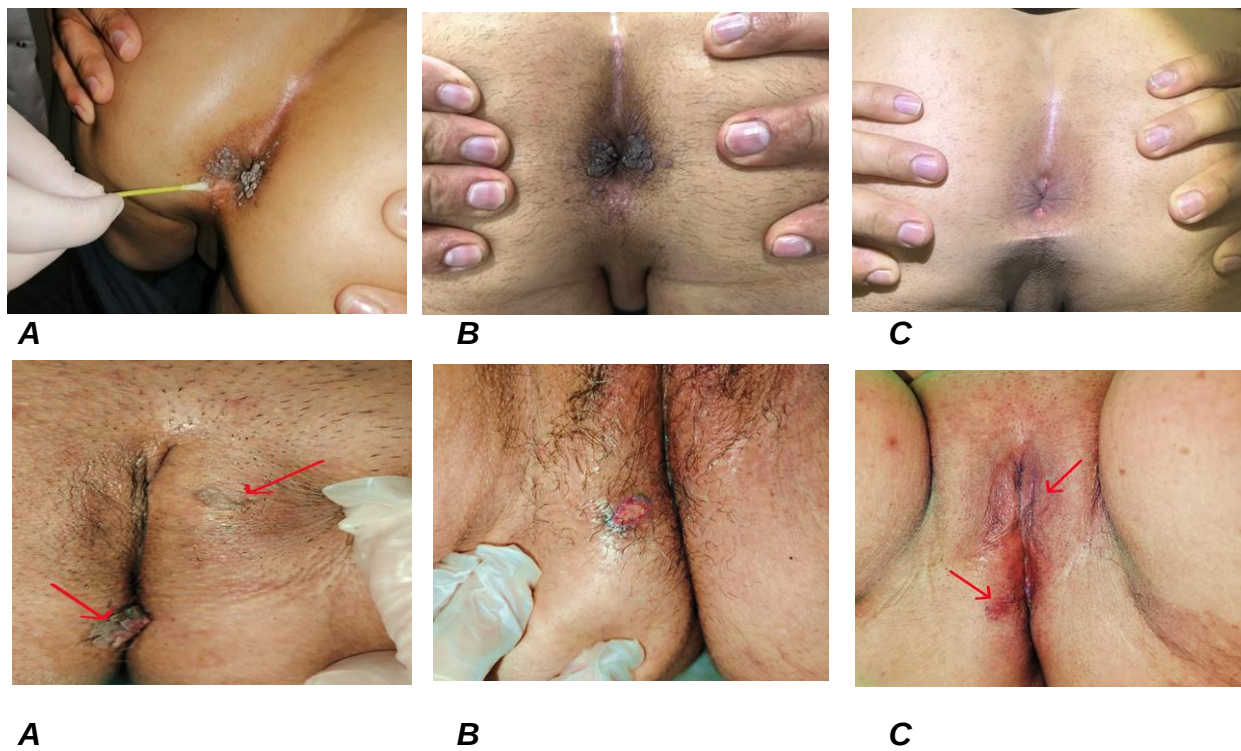


Figure 1: Clinical photography of male and female patients diagnosed with GWs treated with SA peel + CA at (A) baseline, (B) 2 weeks (C) 6 weeks

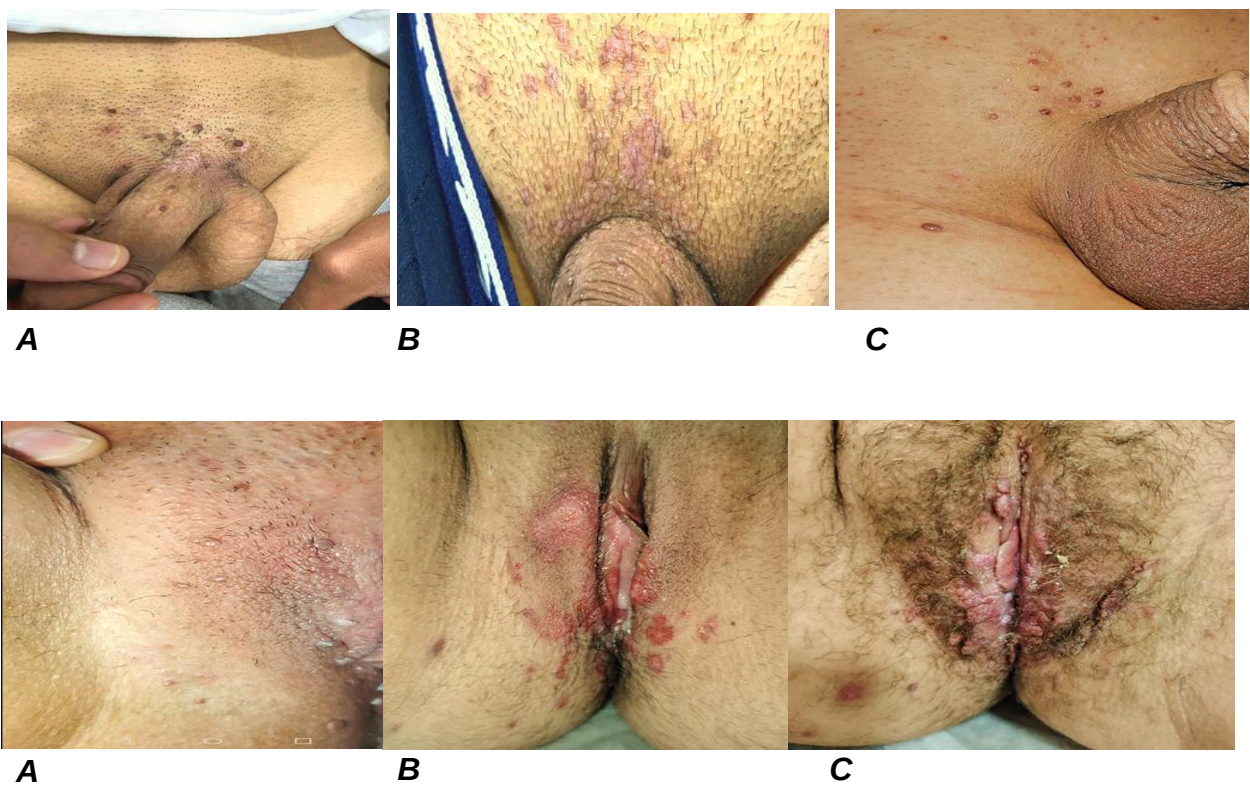


Figure 2: Clinical photography of male and female patients diagnosed with GWs treated with IMQ cream +CA at (A) baseline, (B) 6 weeks, (C) 12 weeks

Discussion

Our study systematically evaluated efficacy, safety of two distinct combinations: 30% SA peel +CA vs. IMQ cream + CA in management of GWs. To the best of our knowledge, no prior study evaluated SA peel + CA in GWs, this addresses a significant gap in the literature.

Primary Efficacy and Comparative Context:

One of the most significant findings of our study is the superior efficacy of the SA peel + CA combination, which reached a complete clearance rate of (94.3%) by the end of the active treatment period, compared to (54.3%) clearance rate observed in the IMQ + CA group. Moreover, the SA group achieved faster and more significant reduction in the wart size and number, suggesting synergistic effect of this combination. The greater clearance rate observed with the SA peel + CA is comparable with documented efficacy of SA as a potent exfoliating agent in the treatment of cutaneous warts. Two prior studies have included SA into multimodal regimens, particularly using lower concentration (10% SA) in combination with (5 fluorouracil) for the management of GWs. Our findings align with the results of these studies [15, 16], both studies revealed significant improvements in clearance rates, thus supporting the therapeutic potential of SA based combinations in clinical practice. Our results support the hypothesis of the synergistic effect of high concentration of SA peel, which enhance the removal of hyperkeratotic wart tissue combined with the immediate destructive effect of CA, therefore provides a highly effective treatment strategy [17]. Our observed clearance rate is consistent with another research which used combination of intralesional (measles-mumps-rubella) vaccine with topical 20% SA solution in cutaneous wart,

and achieved 96% clearance rate [18]. Whereas, our observed clearance rate of IMQ + CA group was 54.3% clearance, this aligns with the documented efficacy of IMQ's monotherapy in GWs treatment, which has been reported to be approximately 50% in randomized controlled trials [19, 20]. Our results regarding IMQ, are consistent with a previous study revealing that IMQ provides limited therapeutic efficacy compared to placebo, with reported complete regression rates of approximately ~ 4% [21]. Nevertheless, it is essential to highlight contrasting findings in the literature, such as one study that found a significantly higher efficacy of IMQ, with 95.6% of patients achieving complete clearance from GWs [22]. This discrepancy emphasizes the importance of additional high quality randomized clinical trials to clarify the actual effect of IMQ in combination therapy.

Recurrence and Long Term Durability: Our observed recurrence analysis demonstrated a significantly lower recurrence rate in the SA peel + CA group in comparison with IMQ + CA group, suggesting enhanced long term clearance of GWs. Additionally, SA peeling effectively acts on the subclinical lesions, consequently, reducing the latent viral reservoir and lowering GWs recurrence rates. This aligns with previous studies that observed minimal recurrence when SA was combined with other destructive agents [23, 24]. In contrast, the higher recurrence rate in the IMQ group is consistent with literature, suggesting that IMQ monotherapy is correlate with relatively high recurrence rates between 19% to 23% at 3 to 6 months post treatment [19]. Multiple randomized controlled trials have similarly reported that 5% IMQ monotherapy may be insufficient to maintain long-term clearance [25]. Our data expand this

finding by demonstrating that even when combined with CA, IMQ is associated with a higher recurrence rate.

Patient Reported Outcomes and Safety Profile:

A critical finding was the significant difference in (PROs) and the side effect profile. The SA peel + CA group demonstrated a significantly greater improvement in the Dermatology Life Quality Index (DLQI), nearly two-fold compared to the IMQ group, and reported significantly higher overall patient satisfaction. Our results are consistent with previous studies, showing that combination therapies containing SA may result insignificant improvements in QOL [18, 26]. The improved PROs are likely caused by more favorable safety profile of the SA peel + CA. Approximately one quarter of SA peel patients reported mild AEs, in contrast, over three quarters of IMQ cream patients exhibited moderate to severe side effects following treatment use. This local AEs of IMQ is well documented in literature [27, 28].

Secondary findings and additional observations:

Data analysis revealed notable findings based on gender and smoking status. The results showed significant gender specific variation in treatment response. In IMQ + CA arm females reported significantly lower complete response rates compared to males, and this difference was statistically significant [29, 30]. Conversely, both male and female participants in the SA peel + CA group demonstrated high complete response rates; particularly the rate was more pronounced among females and reached significant level, this aligns with previous studies that confirm gender variation in treatment response [30]. Moreover, a statistically significant association was observed between current smoking status

and higher recurrence rates, particularly in the IMQ group. This could be explained by the known immunosuppressive effects of smoking and its role in the persistence and recurrence of HPV-related conditions [31, 32]. One of interesting secondary finding was the strong association between smoking status and severity of AEs. Smoking was a significant variable in IMQ group, but not the SA group. Although this has not been directly investigated in the literature, it may explained by that smoking promotes systemic inflammation by increasing production of proinflammatory cytokines, which could enhance the local inflammatory response induced by IMQ. Our finding supports the recent published British guidelines that recommend incorporating smoking cessation programs into GWs management [12].

Recommendations: The combination of SA peel +CA demonstrates superiority across multiple clinical and PROs (response rate, clearance time, recurrence, side effects, patient satisfaction, and quality of life), providing evidence for its use as a first line treatment for GWs. Its enhanced efficacy in female patients underscore the value of gender tailored approaches. Patient specific factors, including gender and smoking status, significantly influence outcomes, recommending personalized treatment strategies. The significant psychosocial improvement, highlight the importance of addressing QOL impacts alongside clinical resolution.

Limitations: We acknowledge several limitations in our study; the 12-week follow-up may be insufficient to capture long-term recurrence, which can occur beyond one year. Although the sample size was sufficient to detect significant differences, larger multicenter trials are needed to improve generalizability.

The lack of HPV genotyping, a potential modifier of treatment response and recurrence represents another limitation. Lastly, the open label design may have introduced bias in subjective outcomes.

Conclusion

- SA peel + CA is superior to IMQ + CA in treating GWs, with better efficacy, faster clearance, lower recurrence, fewer AEs, higher satisfaction, and greater QOL improvements.
- The benefits are especially notable in female patients, supporting gender specific treatment decisions.
- This combination represents a promising, well tolerated first line therapy for GWs across diverse populations.

Conflict of interest

The authors declare no conflict of interest.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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References

- Bertolotti A, Ferdynus C, Milpied B, Dupin N, Huiart L, Derancourt C. Local management of anogenital warts in non-immunocompromised adults: a network meta-analysis of randomized controlled trials. *Dermatol Ther*. 2020;10(2):249–62. <https://doi.org/10.1007/s13555-020-00357-z>
- van Eer K. The human papillomavirus: Dynamics between vaccination, viral properties and surveillance. 2025. 176 p. [doi: 10.5463/thesis.988](https://doi.org/10.5463/thesis.988)
- Workowski KA, Bachmann LH, Chan PA, Johnston CM, Muzny CA, Park I, Reno H, Zenilman JM, Bolan GA. Sexually Transmitted Infections Treatment Guidelines, 2021. *MMWR Recomm Rep*. 2021 Jul 23;70(4):1-187. [doi: 10.15585/mmwr.r7004a1](https://doi.org/10.15585/mmwr.r7004a1). PMID: 34292926; PMCID: PMC8344968.
- Mawardi P, Kamilah L, Fauziyyah Heryadi F, Arrosyid A. The effectiveness of chemical cautery and electrosurgery on anogenital wart: systematic review. *Clinical, Cosmetic and Investigational Dermatology*. 2023 Dec 31:2773-80. [DOI: 10.2147/CCID.S426851](https://doi.org/10.2147/CCID.S426851)
- Kore VB, Anjankar A. A comprehensive review of treatment approaches for cutaneous and genital warts. *Cureus*. 2023 Oct 25; 15(10). [DOI: 10.7759/cureus.47685](https://doi.org/10.7759/cureus.47685)
- Mirghani HO, Alghamdi BM, Alnami R, Alshehri M, Alanezi N, Alshahrani N, Alnoumani A, Asiri A, Alalmaie O, Alsubaie B, Alshehri S. Cryotherapy vs laser for genital warts management: a systematic review. *Saudi Medical Horizons Journal*. 2024 Apr 27;4(2):97-108. [DOI:10.54293/smhj.v4i2.107](https://doi.org/10.54293/smhj.v4i2.107)
- van den Noort JA, Assil S, Ronner MN, Osse M, Pot I, Yavuz Y, Damman J, Lubberts E, Rissmann R, der Kolk TN, Tomljanovic I. Extending the IMQ Model: Deep Characterization of the Human TLR7 Response for Early Drug Development. *Inflammation*. 2024 Aug 26:1-2. [DOI: 10.1007/s10753-024-02127-x](https://doi.org/10.1007/s10753-024-02127-x)
- Lagacé-Thomassin F, Nateghi A, Kechichian E, Veilleux M. Topical imiquimod adverse event: Beyond the local skin reaction—A case report. *SAGE Open Medical Case Reports*. 2024 Aug;12:2050313X241274916. [DOI: 10.1177/2050313X241274916](https://doi.org/10.1177/2050313X241274916)
- Amo-Navarrete J, García-Oreja S, León-Herce D, Navarro-Pérez D, Lázaro-Martínez JL, Álvaro-Afonso FJ. Cantharidin (1%), podophyllin (5%), and salicylic acid (30%) formulation in recalcitrant plantar warts: Analysis of 48 patients. *Journal of Medical Virology*. 2024 Sep; 96(9):e29925. [doi:10.1002/jmv.29925](https://doi.org/10.1002/jmv.29925)
- Herzum A, Ciccarese G, Occella C, Gariazzo L, Pastorino C, Trave I, Viglizzo G. Treatment of pediatric anogenital warts in the era of HPV-vaccine: a literature review. *Journal of Clinical Medicine*. 2023 Jun 23; 12(13):4230. [DOI: 10.3390/jcm12134230](https://doi.org/10.3390/jcm12134230)
- Barton S, Wakefield V, O'Mahony C, Edwards S. Effectiveness of topical and ablative therapies in treatment of anogenital warts: a systematic review and network meta-analysis. *BMJ Open*. 2019;9(10):e027765. <https://doi.org/10.1136/bmjopen-2018-027765>
- Nugent D, Apoola A, Coleman H, Gilmour C, Lawton MD, Nori A, DC Ross J, Whitlock G, Yeend-Curd-Trimble H. British association for sexual health and HIV national guideline for the management of anogenital warts in adults (2024). *International journal of STD & AIDS*. 2024 Jun;35(7):498-509. [DOI: 10.1177/09564624241233338](https://doi.org/10.1177/09564624241233338)
- Qurrotaa'yun S, Hidayati AN, Djuari L, Murtiastutik D. Dermatology Life Quality Index (DLQI) of Condyloma Acuminata Patients at Dr. Soetomo General Regional Hospital in 2024. *Age*;15(24):25-44. [DOI: 10.51542/ijscia.v5i6.84](https://doi.org/10.51542/ijscia.v5i6.84)
- Lang BM, Zielbauer S, Stege H, Grabbe S, Staubach P. If patients had a choice—Treatment satisfaction and patients' preference in therapy of actinic keratoses. *JDDG: Journal der Deutschen Dermatologischen Gesellschaft*. 2024 Oct;22(10):1362-8. [DOI: 10.1111/ddg.15457](https://doi.org/10.1111/ddg.15457)
- Işık S, Koca R, Sarici G, Altinyazar HC. A comparison of a 5% potassium hydroxide solution with a 5-fluorouracil and salicylic acid combination in the treatment of patients with

- anogenital warts: a randomized, open-label clinical trial. *International Journal of Dermatology*. 2014 Sep;53(9):1145-50. DOI: [10.1111/ijd.12505](https://doi.org/10.1111/ijd.12505)
16. Ciccarese G, Parodi A, Drago F. 5-Fluorouracil 0.5%/salicylic acid 10% solution in the treatment of ano-genital warts. *Dermatologic Therapy*. 2022 May; 35(5):e15370. DOI: [10.1111/dth.15370](https://doi.org/10.1111/dth.15370)
 17. Kausdikar RN, Kondawar MS, Jadhav PH, Jaiswal NM, Mali RD. A Study on the Treatment of Hyperkeratotic and Scaling Disorders Using Salicylic Acid Film Forming Gel with It's Development and Characterization. <https://doi.org/10.9734/bpi/acpr/v1/6329B>
 18. Noori BM, Elethawi AM. The efficacy of 20% salicylic acid solution versus intralesional MMR vaccine combination with 20% salicylic acid solution in treatment of plane wart. *AMJ (Advanced Medical Journal)*. 2024 Sep 9; 9(3):82-8. DOI: [10.56056/amj.2024.280](https://doi.org/10.56056/amj.2024.280)
 19. Diamantis ML, Bartlett BL, Tyring SK. Safety, efficacy & recurrence rates of imiquimod cream 5% for treatment of anogenital warts. *Skin Therapy Lett*. 2009 Jun;14(5):1–3, 5. PMID: 19609471.
 20. Puri N. A study on the use of imiquimod for the treatment of genital molluscum contagiosum and genital warts in female patients. *Indian Journal of Sexually Transmitted Diseases and AIDS*. 2009 Jul 1;30(2):84-8. doi: [10.4103/2589-0557.62763](https://doi.org/10.4103/2589-0557.62763)
 21. Grillo-Ardila CF, Angel-Müller E, Salazar-Díaz LC, Gaitán HG, Ruiz-Parra AI, Lethaby A. Imiquimod for anogenital warts in non-immunocompromised adults. *Cochrane Database of Systematic Reviews*. 2014(11). DOI: [10.1002/14651858.CD010389.pub2](https://doi.org/10.1002/14651858.CD010389.pub2)
 22. Rakhmatulina MR, Kubanov AA, Samtsov AV, Sukharev AV, Bondar OI, Semenenko AV. Clinical efficacy, safety and tolerance of the Kerawort (imiquimod) cream used for treatment of anogenital warts. *Vestnik dermatologii i venerologii*. 2015 Feb 24;91(1):129-34. DOI: <https://doi.org/10.25208/0042-4609-2015-91-1-129-134>
 23. Han SH, Kim SH, Jo DI. Recurrent subungual viral warts. *Journal of Wound Management and Research*. 2020 Oct 31;16(3):193-7. DOI: [10.22467/jwmr.2020.01200](https://doi.org/10.22467/jwmr.2020.01200)
 24. Nguyen AL, Quint KD, Bouwes Bavinck JN, Erceg A, de Kort WJ, Körver JE. Real-life treatment of cutaneous warts with cantharidin podophyllin salicylic acid solution. *Dermatologic Therapy*. 2019 Nov; 32(6):e13143. DOI: [10.1111/dth.13143](https://doi.org/10.1111/dth.13143)
 25. Smith DA. Is 5% Imiquimod Cream More Efficacious at Sustained Clearance of Genital Warts at 3 Months Compared to 1% Imiquimod, Ablation Therapy, and a Placebo Vehicle Cream? [Master's thesis, Physician Assistant Studies]. Philadelphia College of Osteopathic Medicine; 2011. (PCOM Physician Assistant Studies Student Scholarship; 8). Available from: https://digitalcommons.pcom.edu/pa_systematic_reviews/8
 26. Zhang L, Cheng S, Chen C, Fang L, Cui C. Application of cantharidin, retinoic acid cream and salicylic acid in multiple palmoplantar warts. *Skin Res Technol*. 2024 Feb;30(2):e13586. doi: [10.1111/srt.13586](https://doi.org/10.1111/srt.13586)
 27. Hammerl V, Parlar B, Navarini A, Gantenbein L, Väh H, Mueller SM. Mucosal side effects in patients treated with topical imiquimod—a scoping review of the literature. *Dermatol Ther*. 2021 Jan;34(1):e14355. doi: [10.1111/dth.14355](https://doi.org/10.1111/dth.14355)
 28. Zhang X, Xie Y, Wang L. Rare cutaneous side effects of imiquimod: A review on its mechanisms, diagnosis, and management. *Dermatology and Therapy*. 2023 Sep; 13(9):1909-34. doi: [10.1007/s13555-023-00978-0](https://doi.org/10.1007/s13555-023-00978-0)
 29. He SJ, Zuo JP, Lin ZM. Androgen-type 2 innate lymphoid cells-dendritic cell axis modulates sex-associated differences in skin immune responses. *MedComm*. 2024 Sep 15;5(10):e732. doi: [10.1002/mco2.732](https://doi.org/10.1002/mco2.732)
 30. ÇİFCİ N, KAYA ÖZDEN H. Evaluation of Factors That May Affect Success of Cryotherapy in the Treatment of Warts: A Retrospective Cross-Sectional Study. *Türkiye Klinikleri Journal of Dermatology*. 2022 Jan 1;32(1). DOI: [10.5336/dermato.2021-86125](https://doi.org/10.5336/dermato.2021-86125)
 31. Hansen BT, Hagerup-Jenssen M, Kjær SK, Munk C, Tryggvadottir L, Sparén P, et al. Association between smoking and genital warts: longitudinal analysis. *Sex Transm Infect*. 2013;89(1):78–83. doi: [10.1136/sextrans-2012-050621](https://doi.org/10.1136/sextrans-2012-050621)
 32. Bencini PL, Guida S, Cazzaniga S, Pellacani G, Galimberti MG, Bencini M, et al. Risk factors for recurrence after successful treatment of warts: the role of smoking habits. *J Eur Acad Dermatol Venereol*. 2017 Apr;31(4):712–6. doi: [10.1111/jdv.14086](https://doi.org/10.1111/jdv.14086)
 33. Kotlyarov SN, Uryas' yev OM, Yakusheva EN, Shchulkin AV, Kotlyarova AA. Analysis of Influence of Cigarette Smoke on Signaling Pathways of Innate Immune System in Monocytes of Peripheral Blood. *IP Pavlov Russian Medical Biological Herald*. 2023 Oct 12;31(3):391-404. <https://doi.org/10.17816/PAVLOVJ306495>
 34. Jiménez-Gómez N, López-Suárez A, Haro S, Fernández-González P, Monserrat J, Eraña-Tomás I, et al. Immunomodulation with AM3 and antioxidants creates an adequate framework for skin repair and decreases the monocyte proinflammatory stage in smoker women. *Biomed Pharmacother*. 2024 Jan; 170:115929. doi: [10.1016/j.biopha.2023.115929](https://doi.org/10.1016/j.biopha.2023.115929)