Original Article
DOI: https://doi.org/10.70749/ijbr.v2i02.267

INDUS JOURNAL OF BIOSCIENCES RESEARCH
https://induspublisher.com/IJBR
ISSN: 2960-2793/ 2960-2807

Safety and Efficacy of Microneedling Procedure in Treating Warts: Retrospective Analysis

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ARTICLE INFO

Keywords

Human Papilloma Virus, Warts, Warts Treatment, Micro Needling.

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Declaration

Author's Contributions: All authors contributed to the study and approved the final manuscript.
Conflict of Interest: The authors declare no conflict of interest.
Funding: No funding received.

Article History

Received: 06-10-2024
Revised: 15-11-2024
Accepted: 24-11-2024

ABSTRACT

Introduction: Warts are one of the most prevalent viral disorders that affect epidermal keratinocytes and are cutaneous signs of human papilloma virus infection. Warts are usually slow-growing and self-limiting, but treatment is required because of the possibility of transmission, aesthetic effect of the warts, psychological impact, excruciating pain, and disfiguring effects. **Methodology:** This was a retrospective analysis of 130 patients with warts to determine the effectiveness and safety of the needling procedure and the factors that could affect the outcomes. **Results:** In total, 130 patients were included in this study. Females made the major section (70.8%) of the study population, and the mean age of the study sample was 24.14 ± 5.9 years. The number of lesions ranged from single to 75. Time for the warts being symptomatic to present to clinic was 1 to 15 weeks, and 16.9% patients had pain when they presented to clinic. The sole (33.8%) and toes (17.7%) of feet were the most common sites of warts. The duration for which the patient had been symptomatic and the symptom of pain at presentation were significant factors for healing ($p < 0.05$). **Conclusion:** Needling procedures are still effective method for treating warts; in our study, 64.62% participants out of 130 showed improvement at certain level. Person perception and patient satisfaction were subjective.

INTRODUCTION

Warts are one of the most prevalent viral disorders that affect epidermal keratinocytes and are cutaneous signs of human papilloma virus infection. Clinical characteristics and family history are usually sufficient to confirm the diagnosis (1). Slow growing, benign, and usually self-limiting warts can measure from a few millimetres to several centimetres in size (2). Depending on their location or appearance, warts can be divided into three types: genital, plantar, and common warts (3). Epithelial lesions or warts caused by human papilloma virus (HPV), a two-stranded DNA virus, can range from benign to malignant (2) and can occur at any age (4). HPV can be contracted by indirect contact with infected individuals or environmental exposure (3).

These viruses cause slow-growing lesions that can persist for a long time despite the absence of immediate indications or symptoms (1). Neoplastic transformation can occur after inability to eradicate HPV. Neutrophils, CD8 + T cells, type 1 T-helper cells, and chemokines that function through CXCR 4 receptors are immune to HPV (5). HPV is incredibly tenacious and resistant to various

therapeutic medications because it lacks an envelope. Currently, there is a comprehensive classification of HPV genotypes that cause both cutaneous and genital warts. The most common sites where they appear are trauma sites, such as the hands and feet (2). Cutaneous warts frequently express HPV types 1, 2, 27 and 57 (5). Immunosuppressed individuals are more prone to acquire and retain warts (2). Refractory warts in immunocompetent males have been reported in the literature, along with a few cases of HPV vaccine response. Refractory warts can be predisposed to both inherited immune defects (such as WHIM syndrome and epidermodysplasia verruciformis / EV) and acquired immunity (HIV infection, cancer, chemotherapy etc.) (5).

While many warts heal on their own, several patients seek treatment because warts can be unpleasant, and in the case of many cutaneous warts, may have psychological consequences (6). Wart treatment is required because of the possibility of transmission, aesthetic effect, psychological impact, excruciating pain, and disfiguring effects (7). The location of warts and any possible side effects are crucial factors to consider when treating patients with warts. Adopting hygiene practices, in addition to treatment, is necessary to reduce transmission (8).

It is still unclear how severe and resistant viral warts (verrucae vulgaris, palmar warts, and plantar warts) should be treated (5). Many invasive, non-invasive, destructive, and immunotherapeutic techniques have been used to treat common warts. Destructive therapies include carbon dioxide (CO_2) laser ablation, electrocautery, surgical excision, and cryosurgery. Additionally, medical substances, such as formaldehyde, 5-fluorouracil, salicylic acid, and trichloroacetic acid, can be used alone or in combination (3). Immunotherapy seems to be a good treatment course in warts. Immunotherapeutic techniques that are effective in treating both injected and non-injected warts have the advantage of not leaving scars from damaging procedures (2). Transdermal drug therapy (TDD) through micro-needling has advantages, as it bypasses gastrointestinal stimuli and degradation. Patients are usually compliant, and the drug is saved from first-pass elimination from the gut and remains effective for more time (9). Micro-needling has good transdermal efficacy. Solid, hollow, dissolving, and coated are types of micro-needles. Hollow micro-needles were used in the cohort of patients we observed.

METHODOLOGY

This was a retrospective analysis of 130 patients with warts to determine the effectiveness and safety of needling. The patients' records were obtained from a tertiary care hospital where they received micro-needling therapy for wart treatment from January 2022 to September 2023. All treatment records from the dermatology department of the hospital were searched to segregate patients using microneedling therapy. Permission for searching data was obtained from the Ethical Review Board Committee of the hospital, and the patients' consent was skipped as the data included patients for whom the therapy was already completed, the follow-up was done, and hospital records were used with permission from the hospital IRB committee. Therefore, patients were not contacted. Data were included if one or more warts were diagnosed by an experienced health care professional. The micro-needling treatment was not administered to pregnant women, breastfeeding mothers, or children under five years of age. To reduce the risk of infection, cross-contamination was controlled using a separate needle for each session for all patients. Details regarding the type of warts, location, duration, and demographic details were obtained. We used an outcome variable to measure patient perception. This was calculated from the percentage of healing reported by the patients. A ten-point scale was used at each appointment to record the pain reported by the patients on arrival. The first follow-up was conducted at a week gap and for the next follow-ups, each appointment was four weeks apart, until the lesion was resolved. The final follow-up was called on the 12^{th} week after needling was performed, and the response to treatment was recorded in terms of "resolved" and "not resolved." The response to treatment was considered successful if the lesion was no longer visible and the skin returned to its normal form. Photographic evidence is used to support this assessment. If the patient had an unresolved lesion at the 12^{th} week, they continued or discontinued treatment on their own.

All data collected from the clinical records were extracted into Excel worksheets and transferred to SPSS 25.0. The data included patient demographics, relevant medical history, and details of the microneedling procedure. Continuous variables were age, lesion duration, and number of warts. The distribution of these variables can be seen in the histogram, which indicates the normality of the data. A mean plot was constructed for prognosis. For the variables of sex, marital status, type of warts, presence of a comorbidity such as hepatitis and HIV, location of warts, follow-up, and prognosis, frequency and percentages were calculated using SPSS. The association of continuous variables was determined by one-way analysis of variance (ANOVA), and for categorical variables, a chi-square test was applied. Statistical significance was set at $P < 0.05$.

RESULTS

In total, 130 patients were included in this study. Females made the major section (70.8%) of the study population (Table 1), and the mean age of the study sample was 24.14 ± 5.9 years. The number of lesions ranged from single to 75. The time for the warts to present to the clinic was 1–15 weeks and was very important as it could determine the course of the disease (Table 2).

16.9% patients had pain when they presented to clinic. Among the locations of warts, the sole (33.8%) and toes (17.7%) of feet were the most common sites. index finger and dorsum of the foot made the second highest occurrence site, with 8.5% and 9.2% of the cases.

After needling, improvement at the first week follow-up was seen in only six patients, while other patients took time to heal; 10 patients healed in one month, 6 in 2 months and two patients healed in 3 months.

Table 1

Basic statistics including demographic and clinical characteristics of patients

Variables		Frequency	Percentage
Gender	Male	38	29.2
	Female	92	70.8
Marital status	Unmarried	77	59.2
	Married	53	40.8
Wart type	Filiform warts	46	35.4
	Planter warts	84	64.6
Painful at Presentation	No	108	83.1
	Yes	22	16.9
Follow-up	No	49	37.7
	Yes	81	62.3
Prognosis	No follow-up available	24	18.5
	No improvement and patient do not want to follow-up further	22	16.9
	Improving first week follow-up	6	4.6
	Improving 1 month lesion size not reduced	21	16.2
	Improving at 1 month lesion size reduced and no pain	24	18.5
	Healed at 1 month	10	7.7
	Healed at 2 months	6	4.6
	Healed at 3 months	2	1.5
	70-80% subjective improvement in 3 weeks	5	3.8
	60-70% subjective improvement in 3 weeks	3	2.3
	40-50% subjective improvement in 45 days	7	5.4
Location	Arch of Left Foot	6	4.6
	Both Feet	3	2.3
	Foot Sole	44	33.8
	Foot Toe	23	17.7
	Heel Single Lesion	4	3.1
	Index Finger	11	8.5
	Instep of Right foot	2	1.5
	Middle Finger	2	1.5
	On top of right foot	12	9.2
	Palm of hand	7	5.4
	Right side of foot	4	3.1
	Ring Finger	4	3.1
	Side of heel	1	0.8
	Side of the Foot	3	2.3
	Side of the Palm	1	0.8
	Thumb of Right Hand	3	2.3

Subjective feelings were also important. The feeling of complete healed completely was not observed; the maximum healing index was 70-80% feeling of healing in five patients after 3 weeks of treatment (Table 1).

Table 2

Continuous variables withs means and standard deviation

	Minimum	Maximum	Mean	Median
Age	6	39	24.14±5.9	24.00
Number of Kids	0	5	0.39±0.87	0.00
Time in weeks since the lesion was noticed or became painful	1	15	5.2±2.3	5.00

Number of Lesions	1	75	3.76±8.4	2.00
INR	0.6	1.1	0.97±0.16	1.000
APTT (time in seconds)	23	37	28.8±3.3	27.00

The factors associated with healing are important. The duration for which the patient had been symptomatic and the symptom of pain at presentation were significant factors for healing ($p < 0.05$) (Table 3) (Figure 1).

Table 3

One-way ANOVA and Chi-square test for association

One-way-ANOVA test	F statistics	p-value
Age	0.276	0.985
Time in weeks since the warts was noticed or became painful	18.255	0.000
INR	1.196	0.301
Time in seconds	0.371	0.957
Chi-square test	Pearson Chi-Square	p-value
Gender	7.108	0.715
Location	167.354	0.158
Wart type	10.316	0.413
Painful at Presentation	130.0	0.000

Figure 1

The prognosis of the patients across the mean of time in weeks since the warts was noticed or was painful

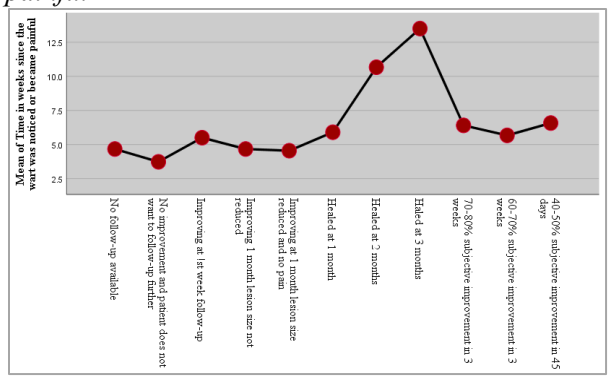
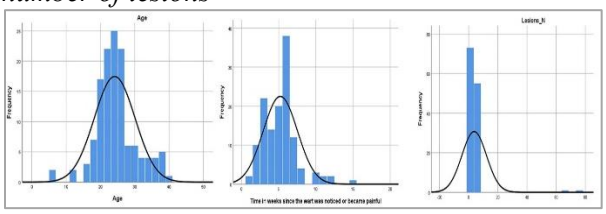


Figure 2

The distribution of age, duration of the warts and number of lesions



DISCUSSION

With an estimated prevalence of 10–20%, warts are common and largely benign occurrence in individuals worldwide. There are several methods to treat warts, as no single treatment approach has a satisfactory rate of success or recurrence. Despite a low level of success, these methods are still reliable for treating warts. Treatments such as aminolaevulinic acid photodynamic therapy and pulsed dye lasers have encouraging success rates. For severe and treatment-resistant warts, surgical removal remains the preferred course of action (10). Forty% of people are thought to have HPV infection, and 7% to 12% of people get warts, with yearly incidence of plantar warts to be 14%. Increased HPV exposure, a higher chance of epidermal barrier penetration, and improper immune responses are the main risk factors. Age, sex, race (European), and state of health all affect the occurrence of plantar warts. Variable rates of plantar wart incidence are also linked to behavioral, seasonal (winter), regional (12.9% of Russians; the estimated prevalence of plantar warts in Americans is only 0.84%), and socioeconomic factors. HPV, which can infect other locations in the plantar region or be transmitted to other persons, is excreted by plantar warts (11).

Over 40% of children get the infection during their second decade of life, when it is most common. Six main categories can be used to categorize therapies for pediatric warts: NO release, vascular destruction, immune boosting, immunological regulation, normalization of epithelial development, and destruction. As a rule, destructive therapies are used; immune-stimulating and vascular damaging therapies are avoided for more serious, long-lasting, or treatment-resistant infections (12). According to evidence, the major treatments for plantar warts continue to be keratolytic drugs and destructive procedures, specifically salicylic acid, and cryotherapy. The lowest recurrence rate was observed with pulsed dye laser treatment. According to the literature, the hands, upper limbs, feet, lower limbs, face, head, neck, and trunk. Patients who worked in shops, housewives, office workers, and students made up most of the patient population. The most prevalent morphological subgroups are common warts and palmoplantar warts (13).

For the safe treatment of common warts, topical imiquimod 5% cream and salicylic acid 30% cream are both appropriate. Although topical salicylic acid cream with 30% may be more

effective, there is also a higher chance of discomfort (1). For the treatment of plantar warts, topical salicylic or lactic acid produces marginally greater clinical cure, while both placebo and cryotherapy have a 25% cure rate; salicylic acid and cryotherapy together do not increase cure rates. Other treatments include dithranol, photodynamic therapy, formaldehyde, glutaraldehyde, lasers, topical 5-fluorouracil, topical immunotherapy, and podophyllotoxin (14). Topical salicylic acid treatment has been linked to an increased incidence of adverse events, treatment failure, and recurrence following successful treatment. Surgical ablation, on the other hand, was linked to lower recurrence rates and higher success rates during therapy (15). Earlier age was linked to a better prognosis, whereas a history of laser treatment was linked to a worse outcome. Negligible, fleeting, and localized adverse events were observed. No systemic adverse effects were observed. Recalcitrant cutaneous warts may be treated with intralesional 9-valent HPV vaccination (16).

Cryotherapy is one of the most popular and successful treatment options for common warts. When administered in large quantities, trichloroacetic acid (TCA) has therapeutic applications. When treating common warts, Cryotherapy is 90% more successful than TCA. Compared with cryotherapy, TCA 90% has less adverse effects (17). Nano-pulse stimulation (NPS) technology causes highly localized, controlled cell death in the targeted zone's cellular structures, while having very little impact on nearby non-cellular components. NPS is a safe and efficient method (18). A 2017 pilot study revealed that 75.9% of cutaneous warts were cleared with microwave therapy compared to 23–33% with cryotherapy or salicylic acid. These results suggest that microwaves may be a potentially effective treatment for cutaneous warts (19).

To help stubborn plantar warts absorb and transport bleomycin into the lesion, microneedling-aided topical bleomycin spraying appears to be a promising, successful, and non-invasive therapeutic approach (20). Intralesional (IL) bleomycin has shown promising benefits in warts. Following the initial intervention with IL bleomycin, 38.84% of patients had complete wart clearance, 26.31% had it almost complete, 26.31% had it considerable, and 10.53% had it moderate. Very serious systemic and local side effects were not observed in any patient. IL bleomycin may be a preferable option for the treatment of challenging and resistant controlled (21). In patients with resistant cutaneous warts, safety, and effectiveness of topical 100% trichloroacetic acid (TCA) versus bleomycin for the same type of skin needling was tested. Overall, all warts were completely cleared in 33 (63.5%) of the TCA group and 35 (81.4%) of the bleomycin group; however, this difference was not statistically significant. Temporary procedure site pain was the most frequent adverse event (AE) in both the groups. Compared to needling plus bleomycin, needling plus TCA results in a quicker resolution of warts while maintaining a similar safety profile. However, owing to their low risk of adverse events and recurrence, needling with either bleomycin or TCA has great and equivalent efficacy. Therefore, both treatments should be employed for the management of numerous or resistant warts (22).

An innovative treatment option for warts is antiviral acyclovir (AV2), which is effective against DNA viruses. Intralesional acyclovir is not a better treatment option for remote warts; however, it can be a useful tool for isolated cutaneous warts. For patients looking for a prompt reaction, it may be a useful technique (6), as it can deactivate HPV. However, because it cannot destroy the affected cells already present there, salicylic acid (SA), an extra ablative treatment, is required. By activating HPV on the one hand by AV2-Salicylic acid (AV2-SA) combination therapy and eliminating the lesion on the other through SA treatment, permanent lesion removal can be guaranteed (23).

Lesions can cause pain, bleeding, and deformity, and can be large even though they are benign. However, immunological responses in children and lower pain thresholds can complicate treatment. Salicylic acid in combination with cryotherapy may reduce these adverse effects. Other treatment approaches, including cantharidin, immunotherapy, and other mechanical therapies such as carbon dioxide lasers, may also be considered, especially for lesions that are resistant to treatment, despite the paucity of data (24). Topical cantharidin showed mild effectiveness in pediatric molluscum contagiosum with high tolerability and safety and cleared warts, especially

when combined with podophyllotoxin and salicylic acid (25).

Ionic contrast viral therapy (ICVT) using digoxin and furosemide may be a novel treatment for cutaneous warts. When comparing the HPV burden of all treated warts between the digoxin + furosemide and placebo groups, there was a statistically significant decrease. Both partial and whole responsive warts lose their histologically and immunohistochemically determined viral features as the size of the wart shrinks (26). Participants in one study comprised treatment group that used soaking cotton in an 85% formic acid solution and applied it to the warts for three seconds once a week; 10.8% participants reported experiencing a burning sensation, which manifested itself after six treatments. Formic acid is a cost-effective and safe therapy that works well for treating warts and has few side effects (27).

To cure a single wart and create immunity against virally infected cells, two minimally invasive methods are available: auto-implantation and Falkon needling. In the treatment of warts, both modalities demonstrated an outstanding response, with Grade 4 improvement in 85% of the patients, in the needling group, 5% of the patients showed improvement in grades 2 and 3. Both autologous therapeutic techniques are inexpensive, straightforward, safe, and effective in treating cutaneous warts (7). Micro needling for immunotherapy using Falknor's needling method is one of the most cost-effective, efficient, and easy procedures for the treatment of warts. This method has high lesion resolution (28). In our study, microneedling showed good outcomes.

Limitations: The retrospective design of the study and the small sample size pose limitations, and we cannot state that micro-needling is a standard approach. Therefore, the generalizability of this study was very low.

CONCLUSION

The microneedling procedure was successful in our cohort of patients. Needling procedures are still effective method for treating warts; in our study, 64.62% participants out of 130 showed improvement at certain level. Person perception and satisfaction of patients are very subjective and not controlled by dermatologists. There should be more studies with larger cohorts of patients, in which clinical trials should be conducted to confirm the efficacy of this treatment.

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