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Original Research Article

Effect of Vitamin C Supplementation on Clinical Outcomes in Patients with Moderate to Severe Burns: A Prospective Study from a Tertiary Care Hospital in Bihar

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Abstract

Background: Burn injuries remain a major cause of morbidity and mortality worldwide, particularly in developing countries. Severe burn injury triggers oxidative stress, systemic inflammatory response, and increased capillary permeability, resulting in large fluid shifts and tissue oedema. Vitamin C (ascorbic acid) is a potent antioxidant that may help reduce oxidative damage and improve outcomes in burn patients.

Aim: To evaluate the clinical outcomes of vitamin C supplementation in burn patients admitted to a tertiary care hospital in Bihar.

Methods: A prospective comparative study was conducted in the Department of Plastic Surgery at Patna Medical College and Hospital, Bihar, over 8 months. A total of 60 patients with burns involving ≥15% total body surface area (TBSA) was included. Patients were divided into two groups:

- Group A (Vitamin C group): Standard burn management + Tablet vitamin C supplementation
- Group B (Control group): Standard burn management only

Primary outcomes included wound healing time and hospital stay. Secondary outcomes included infection rate and mortality.

Results: Wound healing time was significantly less in the vitamin C group (18.4 ± 4.2 days) compared with controls (23.1 ± 5.6 days, $p < 0.001$). Hospital stay was also reduced in the vitamin C group (20.6 ± 5.3 days vs 26.4 ± 6.1 days, $p < 0.001$). Infection and mortality rates were lower in the vitamin C group.

Conclusion: Vitamin C supplementation significantly improves clinical outcomes in burn patients by accelerating wound healing and decreasing complications. Incorporating vitamin C into burn management protocols may improve patient outcomes.

Keywords: Burn injury, Vitamin C, Antioxidant therapy, wound healing, Burn resuscitation.
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Introduction

Burn injuries represent a significant global health burden and are associated with substantial morbidity, mortality, and long-term disability. According to the World Health Organisation, burns account for nearly 180,000 deaths annually worldwide, with the majority occurring in low- and middle-income countries [1].

Severe burn injury leads to a complex physiological response characterised by systemic inflammation, oxidative stress, and increased capillary permeability. This results in massive fluid shifts, tissue oedema, and hypovolemia, requiring aggressive fluid resuscitation during the early phase of burn management [2]. Reactive oxygen species generated following burn injury contribute significantly to tissue damage and endothelial dysfunction. Excessive oxidative stress disrupts cellular membranes, impairs microcirculation, and exacerbates inflammatory responses [3].

Vitamin C (ascorbic acid) is a powerful antioxidant that neutralises reactive oxygen species and stabilises endothelial cell membranes. It also plays an essential role in collagen synthesis, immune function, and wound healing [4]. Following severe

burns, plasma vitamin C levels decline rapidly due to increased metabolic demand and oxidative stress. Supplementation of vitamin C has therefore been proposed as an adjunct therapy in burn management [5].

Some studies have supported the findings, suggesting that vitamin C reduces capillary leakage and tissue oedema [6]. In addition, antioxidant therapy has been associated with improved wound healing and reduced incidence of infections in burn patients [7].

Some studies have also reported decreased mortality rates among patients receiving vitamin C supplementation [8]. Despite promising evidence, the routine use of vitamin C in burn resuscitation remains controversial due to limited clinical studies and concerns regarding optimal dosing strategies [9].

In India, burn injuries are common due to domestic accidents, industrial exposure, and unsafe cooking practices. However, limited research has evaluated the effectiveness of vitamin C supplementation in burn patients in this region.

Therefore, the present study was conducted to evaluate the clinical outcomes of vitamin C supplementation in burn patients admitted to a tertiary care hospital in Bihar.

Materials and Methods

Study Design: A prospective comparative study was conducted to evaluate the effect of Oral vitamin C supplementation on clinical outcomes in burn patients.

Study Setting: The study was carried out in the Department of Plastic Surgery at Patna Medical College and Hospital in Bihar.

Study Duration: The study was conducted over a period of 8 months from July 2025 to February 2026.

Sample Size

$$n = \frac{Z^2 \cdot p \cdot q}{d^2}$$

Based on previously published studies evaluating outcomes in burn patients receiving antioxidant therapy, the calculated minimum sample size was approximately 55 patients. To increase the study's reliability and account for potential dropouts, 60 patients who met the inclusion criteria were enrolled.

Study Groups: The patients were divided into two groups:

- Group A (Vitamin C group): Patients received standard burn care along with 500 mg oral vitamin C supplementation twice a day for 28 days.
- Group B (Control group): Patients received standard burn care without vitamin C supplementation.

Inclusion Criteria

Patients fulfilling the following criteria were included in the study:

- Age 18–65 years
- Burns involving ≥15% total body surface area (TBSA)
- Patients admitted within 24 hours of injury

Exclusion Criteria

Patients with the following conditions were excluded from the study:

- Chronic kidney disease
- Known allergy to vitamin C

Vitamin C Protocol

Patients in the vitamin C group received Oral vitamin C supplementation in addition to standard burn care.

- Dose: 500mg Oral vitamin C
- Frequency: Every 12 hours
- Duration: 28 days

Standard Burn Care

All patients in both groups received standard burn management, including:

- Fluid resuscitation according to the Parkland formula
- Regular wound dressing and burn wound care
- Antibiotic therapy when indicated
- Nutritional support
- Surgical intervention when required

Outcome Measures

Primary Outcomes

The following primary outcomes were evaluated:

- Wound healing was assessed clinically over a period of 28 days

Secondary Outcomes

Secondary outcomes included:

- Infection rate
- Development of sepsis
- Mortality

Statistical Analysis: Data were entered into Microsoft Excel and analysed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation (SD). Categorical variables were expressed as frequencies and percentages.

Student's t-test for comparison of continuous variables. Chi-square test for comparison of categorical variables. A p-value < 0.05 was considered statistically significant.

Results

A total of 60 patients with burn injuries were included in the present study and were divided equally into two groups, with 30 patients in the vitamin C group and 30 patients in the control group. All patients were followed up and assessed for wound-healing outcomes over 28 days. The baseline demographic characteristics of the patients in both groups were comparable. The mean age of patients in the vitamin C group was 36.2 ± 12.5 years, while in the control group it was 35.8 ± 11.9 years. There was no statistically significant difference between the groups in terms of age, gender distribution, or total body surface area burned (p > 0.05) (Table 1).

Table 1: Baseline Demographic Characteristics

Variable	Vitamin C Group (n=30)	Control Group (n=30)	p value
Age (years)	36.2 ± 12.5	35.8 ± 11.9	0.85
Male	17	16	0.79
Female	13	14	
Mean TBSA (%)	32.5 ± 6.4	31.8 ± 6.1	0.53

The mean wound healing time was significantly shorter in the vitamin C group compared to the control group (18.4 ± 4.2 days vs 23.1 ± 5.6 days, p < 0.001) (Table 2). The average duration of hospital stay was also reduced among patients receiving vitamin C supplementation (20.6 ± 5.3 days) compared with the control group (26.4 ± 6.1 days), and the difference was statistically significant (p < 0.001) (Table 2; Figure 1).

Table 2: Clinical Outcomes

Outcome	Vitamin C Group (n=30)	Control Group (n=30)	p value
Healing time (days)	18.4 ± 4.2	23.1 ± 5.6	<0.001
Hospital stays (days)	20.6 ± 5.3	26.4 ± 6.1	<0.001

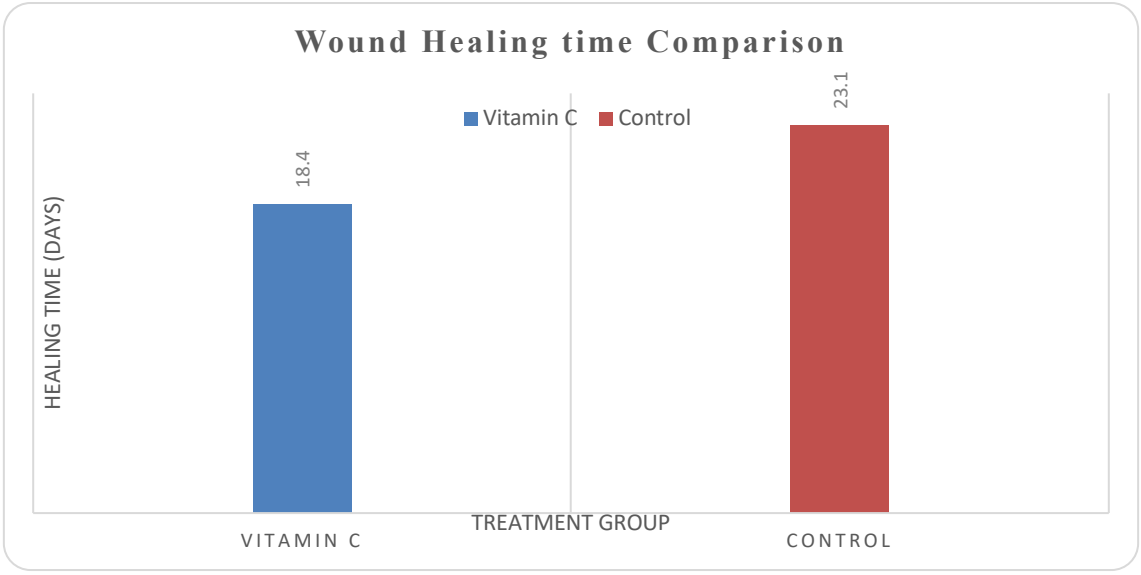

Figure 1: Comparison of wound healing time between study groups

Healthy granulation tissue appeared at around 14 days in the vitamin C group, whereas it appeared significantly later in the control group at around 24 days, and the difference was statistically significant (p < 0.001) (Table 3; Figure 2).

Table 3: Granulation Tissue Formation in Study Groups

Parameter	Vitamin C Group (n=30)	Control Group (n=30)	p value
Mean time to appearance of healthy granulation tissue (days)	14.0 ± 1.5 days	24.0 ± 3.0	<0.001

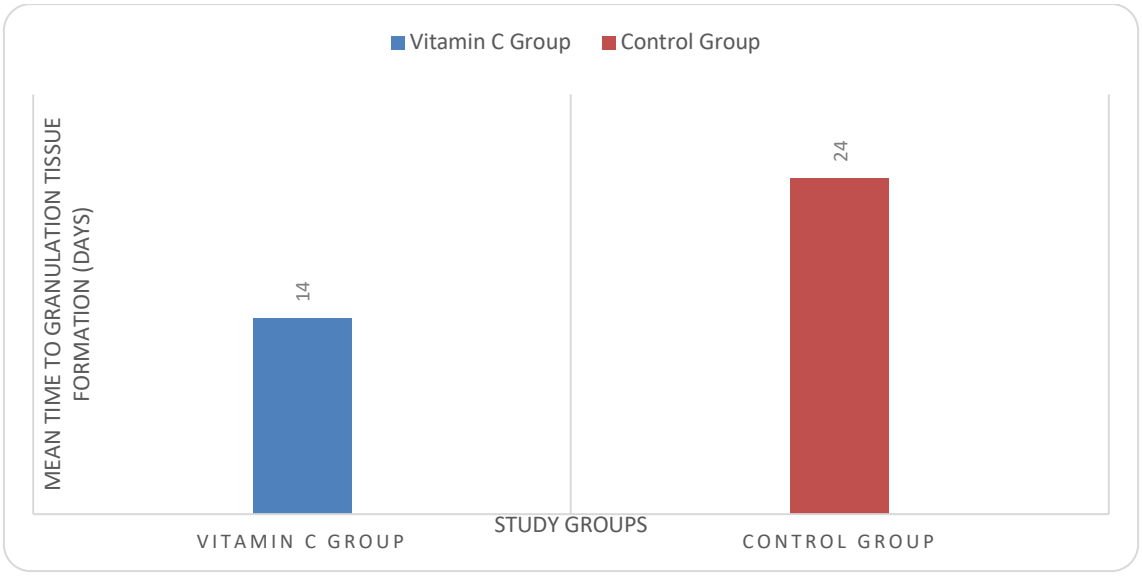

Figure 2: Comparison of Granulation Tissue Formation between Study Groups

The incidence of wound infection was lower in the vitamin C group (16.7%) compared to the control group (36.7%). Similarly, the occurrence of sepsis was reduced in the vitamin C group (6.7% vs 16.7%). Mortality was also lower among patients receiving vitamin C supplementation compared with controls (Table 3).

Table 3: Complications

Complication	Vitamin C Group (n=30)	Control Group (n=30)
Infection	5 (16.7%)	11 (36.7%)
Sepsis	2 (6.7%)	5 (16.7%)
Mortality	3 (10.0%)	5 (16.7%)

The incidence of complications was lower in the vitamin C group compared with controls.

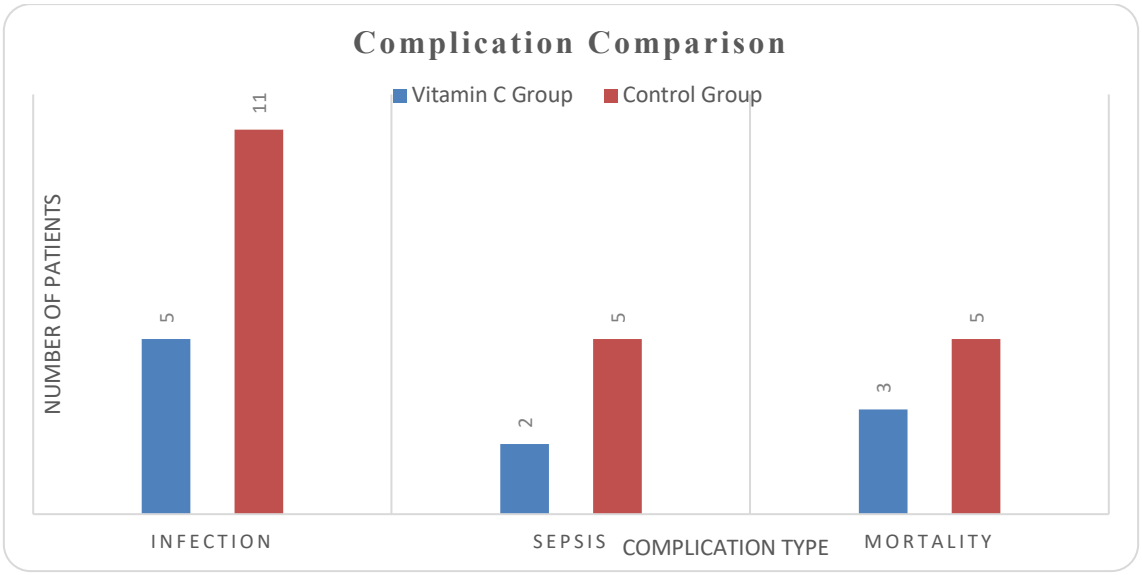

Figure 3: Complication rates among study groups

Overall, patients treated with vitamin C supplementation demonstrated better clinical outcomes, including faster wound healing, shorter hospital stay, and lower complication rates.

Discussion

Burn injuries produce extensive oxidative stress that contributes to tissue damage and systemic inflammatory response [10]. Antioxidant therapy has therefore been investigated as a potential strategy to improve burn outcomes.

The present study also demonstrated significantly shorter wound healing time in patients receiving vitamin C supplementation. Vitamin C plays a crucial role in collagen synthesis and tissue repair,

which likely contributes to improve wound healing [11]. An additional observation in the present study was the earlier development of healthy granulation tissue among patients receiving vitamin C supplementation. Granulation tissue appeared significantly earlier in the vitamin C group compared with the control group.

Vitamin C plays an important role in collagen synthesis, fibroblast proliferation, and angiogenesis, all of which are essential for the formation of healthy granulation tissue during the proliferative phase of wound healing. Improved granulation tissue formation likely contributed to faster epithelialization and shorter wound healing time observed in the vitamin C group. Similar findings have been reported in previous studies were antioxidant supplementation enhanced tissue repair and wound healing in burn patients [13].

Another important finding was the reduced hospital stay in the vitamin C group. Faster healing and lower complication rates likely contributed to earlier discharge. Infection rates were also lower in the vitamin C group. Vitamin C enhances immune function by improving neutrophil activity and reducing oxidative damage to immune cells [12]. Although mortality was lower in the vitamin C group, the difference was not statistically significant. Similar findings have been reported in previous studies evaluating antioxidant therapy in burn patients [13]. Overall, the findings of this study support the role of vitamin C as a beneficial adjunct therapy in burn management.

Limitations

- Single-centre study
- Moderate sample size
- Short follow-up duration

Future multicenter randomised trials are required to confirm these findings.

Conclusion

Vitamin C supplementation significantly improves clinical outcomes in burn patients by accelerating wound healing, shortening the duration of hospital stay, and decreasing complication rates. Therefore, vitamin C may be considered a useful adjunct therapy in the management of burn patients.

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