

THE EFFICACY OF VITAMIN C IN PREVENTING CRPS IN DISTAL END RADIUS FRACTURES-A RANDOMIZED CONTROLLED STUDY

Orthopaedics

Dr. Alan Mohan C Junior Resident, Sri Siddhartha Medical College and Hospital, BH Road, Tumkur, Karnataka

Dr. Veeranna H. D Professor, Sri Siddhartha Medical College and Hospital, BH Road, Tumkur, Karnataka

ABSTRACT

Background: Complex Regional Pain Syndrome (CRPS) is a severe and debilitating condition that can occur following fractures, particularly of the distal radius. The prophylactic use of vitamin C has gained attention for its potential to prevent CRPS in such patients due to its antioxidant, anti-inflammatory, and collagen-synthesis properties. **Objective:** To assess the efficacy of vitamin C supplementation in preventing CRPS following distal radius fractures. **Methods:** A prospective, randomized controlled study was conducted over 24 months, enrolling 120 patients with acute distal radius fractures. Participants were randomized into two groups: Group A received 500 mg of vitamin C daily for 50 days along with standard care, while Group B received standard care alone. The primary outcome was the incidence of CRPS at 12 weeks, with secondary outcomes including pain scores, wrist motion, grip strength, functional status, and adverse effects. **Results:** The CRPS incidence was significantly lower in the vitamin C group (8.3%) compared to the control group (21.6%) ($p=0.03$). Group A also reported significantly lower pain scores (2.1 vs. 3.4), improved wrist flexion (55.3° vs. 47.6°), and higher grip strength (78.2% vs. 67.5%). The DASH score was significantly lower in the vitamin C group (15.6 vs. 24.3). No serious adverse effects were reported, with mild gastric upset observed in 3 patients in Group A. **Conclusion:** Vitamin C supplementation significantly reduced the incidence of CRPS and improved functional recovery in patients with distal radius fractures. Its use is safe and effective, suggesting it should be considered as a routine prophylactic treatment.

KEYWORDS

Complex Regional Pain Syndrome, Vitamin C, Distal Radius Fractures, Prophylaxis, Functional Recovery

INTRODUCTION

Complex Regional Pain Syndrome (CRPS) is a severe, often debilitating complication following trauma, particularly fractures of the distal radius. It is characterized by disproportionate pain, swelling, and limited mobility. Despite its clinical significance and high incidence in certain patient populations, CRPS is poorly understood and challenging to treat, highlighting the critical importance of effective prevention. The pathophysiology is believed to involve a complex interplay of neural, vascular, and inflammatory processes, with a key role attributed to oxidative stress.

Given this understanding, vitamin C (ascorbic acid), a powerful antioxidant, has emerged as a promising prophylactic agent. Its proposed mechanism involves neutralizing free radicals generated during tissue injury and healing, thereby reducing local inflammation and protecting nerve tissue from damage. Furthermore, vitamin C is a vital cofactor in collagen synthesis, a process integral to bone and soft-tissue repair.

A number of clinical studies have investigated the effectiveness of vitamin C in this context, with the literature presenting a mix of promising and inconclusive results. Early work by Zollinger et al. demonstrated that daily supplementation of 500 mg of vitamin C significantly reduced the incidence of CRPS after wrist fractures, a finding that influenced major orthopedic guidelines.

Given the existing body of literature, this study aims to provide further clarity on the role of vitamin C prophylaxis. The primary aim is to evaluate the efficacy of oral vitamin C supplementation in preventing the development of CRPS following distal end radius fractures. We also seek to compare secondary clinical outcomes, including pain intensity, wrist range of motion, grip strength, and overall functional recovery, between patients receiving vitamin C and those managed with standard care alone.

MATERIALS AND METHODS

This was a prospective, randomized controlled trial conducted over 24 months (August 2022 to July 2024) at the Department of Orthopaedics at Sri Siddhartha Medical College and Hospital. The study enrolled 120 patients aged 18 or older with acute distal radius fractures. Patients were randomized into two groups: Group A ($n=60$) received 500 mg of oral vitamin C daily for 50 days, while Group B ($n=60$) received standard care alone. The primary outcome was the incidence of Complex Regional Pain Syndrome (CRPS) at 12 weeks, diagnosed using the Budapest criteria. Secondary outcomes included pain scores, wrist range of motion, grip strength, and functional status (DASH score). Data were collected at 2, 4, 6, and 12 weeks, and analyzed using SPSS 25.0, with statistical significance set at $p<0.05$. Ethical clearance

was obtained, and written informed consent was secured from all participants.

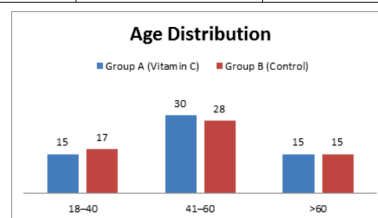
RESULTS

1. Age Distribution

Most participants were aged between 41–60 years in both groups, showing no significant age difference ($p=0.74$). This indicates comparable age distribution across study arms (Table 1).

Table 1: Age Distribution

Age Group (Years)	Group A (Vitamin C)	Group B (Control)	Total
18–40	15	17	32
41–60	30	28	58
>60	15	15	30
Total	60	60	120



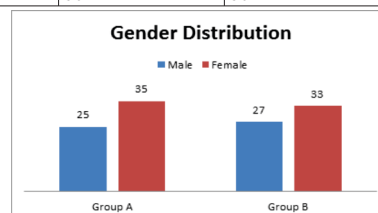
Graph 1: Age Distribution

2. Gender Distribution

Both groups had a slightly higher number of female participants, with no significant gender difference ($p=0.63$). Gender distribution was well-matched between groups (Table 2).

Table 2: Gender Distribution

Gender	Group A	Group B	Total
Male	25	27	52
Female	35	33	68
Total	60	60	120



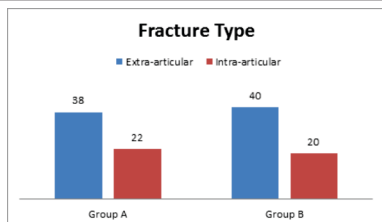
Graph 2: Gender Distribution

3. Fracture Type

Extra-articular fractures were most common in both groups. There was no significant difference in fracture type distribution ($p=0.88$) (Table 3).

Table 3: Fracture Type

Fracture Type	Group A	Group B	Total
Extra-articular	38	40	78
Intra-articular	22	20	42
Total	60	60	120



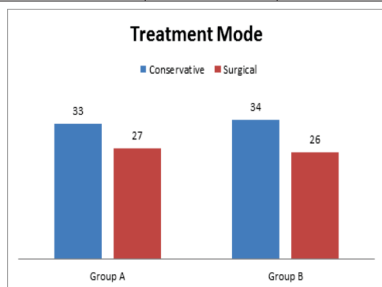
Graph 3: Fracture Type

4. Treatment Mode

Surgical and conservative treatments were evenly distributed across groups ($p=0.91$). This ensures that treatment method did not bias results (Table 4).

Table 4: Treatment Mode

Treatment Type	Group A	Group B	Total
Conservative	33	34	67
Surgical	27	26	53
Total	60	60	120



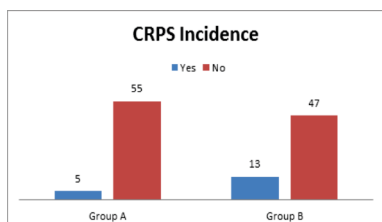
Graph 4: Treatment Mode

5. CRPS Incidence

CRPS incidence was significantly lower in the vitamin C group (8.3%) compared to the control group (21.6%), showing a protective effect ($p=0.03$) (Table 5).

Table 5: CRPS Incidence

CRPS Status	Group A	Group B	Total
Yes	5	13	18
No	55	47	102
Total	60	60	120



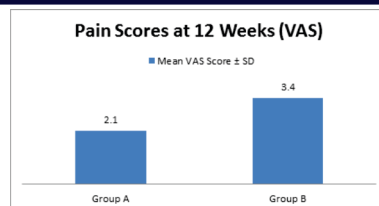
Graph 5: CRPS Incidence

6. Pain Scores at 12 Weeks (VAS)

Mean pain scores were significantly lower in Group A (2.1 ± 0.9) compared to Group B (3.4 ± 1.2) at 12 weeks ($p<0.001$), indicating improved pain control (Table 6).

Table 6: Pain Scores at 12 Weeks (VAS)

Group	Mean VAS Score $\pm$ SD
Group A	2.1 ± 0.9
Group B	3.4 ± 1.2



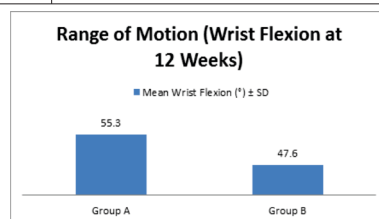
Graph 6: Pain Scores at 12 Weeks (VAS)

7. Range of Motion (Wrist Flexion at 12 Weeks)

Group A had better wrist flexion (mean 55.3°) compared to Group B (mean 47.6°), showing improved functional recovery ($p=0.01$) (Table 7).

Table 7: Range of Motion (Wrist Flexion at 12 Weeks)

Group	Mean Wrist Flexion ($^\circ$) $\pm$ SD
Group A	55.3 ± 5.2
Group B	47.6 ± 6.1



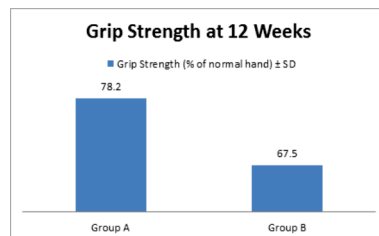
Graph 7: Range of Motion (Wrist Flexion at 12 Weeks)

8. Grip Strength at 12 Weeks

Vitamin C group had higher grip strength (mean 78.2%) compared to control (67.5%), indicating better rehabilitation outcomes ($p=0.02$) (Table 8).

Table 8: Grip Strength at 12 Weeks

Group	Grip Strength (% of normal hand) $\pm$ SD
Group A	78.2 ± 7.4
Group B	67.5 ± 8.1



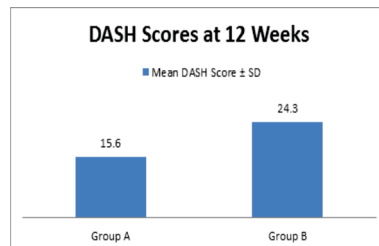
Graph 8: Grip Strength at 12 Weeks

9. DASH Scores at 12 Weeks

Group A had significantly better functional outcomes with a lower DASH score (15.6) than Group B (24.3) ($p=0.001$), confirming clinical benefit (Table 9).

Table 9: DASH Scores at 12 Weeks

Group	Mean DASH Score $\pm$ SD
Group A	15.6 ± 4.3
Group B	24.3 ± 5.1



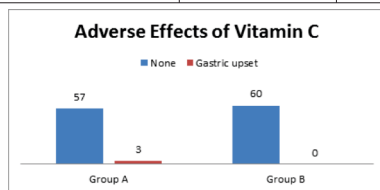
Graph 9: DASH Scores at 12 Weeks

10. Adverse Effects of Vitamin C

No serious adverse effects were reported. Mild gastric upset occurred in 3 patients in Group A, confirming safety of vitamin C (Table 10).

Table 10: Adverse Effects of Vitamin C

Adverse Effects	Group A	Group B
None	57	60
Gastric upset	3	0
Total	60	60

**Graph 10: Adverse Effects of Vitamin C**

DISCUSSION

Our findings demonstrate that prophylactic vitamin C significantly reduced the incidence of Complex Regional Pain Syndrome (CRPS) in patients with distal radius fractures. The CRPS rate in the vitamin C group was 8.3% compared to 21.6% in the control group ($p=0.03$), supporting its preventive effect. These results are consistent with previous research, including trials by Zollinger et al. and a meta-analysis by Meena et al., which similarly showed that daily vitamin C supplementation significantly reduced CRPS risk.

Furthermore, our study found that the vitamin C group experienced significantly better functional outcomes, including lower pain scores, improved wrist flexion, and greater grip strength at 12 weeks. While some conflicting evidence exists, likely due to study heterogeneity, the majority of well-controlled trials support our conclusions. Importantly, we also confirmed the safety of vitamin C, with only a few cases of mild gastric upset and no serious adverse effects reported. In summary, our results reinforce the existing evidence that vitamin C is a simple, safe, and effective strategy for CRPS prevention and improved functional recovery in patients with distal radius fractures.

CONCLUSION

Vitamin C supplementation effectively reduces the incidence of Complex Regional Pain Syndrome (CRPS) following distal radius fractures. In addition to preventing CRPS, it improves functional recovery, including pain management, wrist mobility, and grip strength. Given its low cost, safety, and ease of use, vitamin C is a promising adjunct in fracture care. Early administration, ideally starting at the time of injury, should be recommended to prevent CRPS in at-risk patients. These findings highlight the potential of vitamin C as a simple, effective prophylactic treatment.

REFERENCES

- Shah AS, Verma MK, Jebson PJ. Use of oral vitamin C after fractures of the distal radius. *J Hand Surg Am.* 2009;34(9):1736-1738.
- Malik SH, Islam MU. Role of vitamin C in prevention of complex regional pain syndrome (CRPS) after distal radius fractures. *Natl J Clin Orthop.* 2022;6(2):359.
- Meena S, Sharma P, Gangary S, Chowdhury B. Role of vitamin C in prevention of complex regional pain syndrome after distal radius fractures: a meta-analysis. *Eur J Orthop Surg Traumatol.* 2015;25(4):637-641.
- Evaniew N, McCarthy C, Kleinlugtenbelt Y, Ghert M, Bhandari M. Vitamin C to prevent complex regional pain syndrome in patients with distal radius fractures: a meta-analysis of randomized controlled trials. *J Orthop Trauma.* 2015;29(11):e235-e241.
- Keef T, Keef S. The efficacy of vitamin C in the prevention of complex regional pain syndrome after distal radius fractures: a synthesis. *J Pain Palliat Care Pharmacother.* 2018;32(4):208-211.
- Malay S, Chung KC. Testing the validity of preventing chronic regional pain syndrome with vitamin C after distal radius fracture. *J Hand Surg Am.* 2014;39(11):2251-2257.
- Sane R, Samant P, Butala R. Effectiveness of prophylactic vitamin C supplementation in the prevention of complex regional pain syndrome after distal end radius fractures in the aging population. *J Orthop Trauma Rehabil.* 2021;28:1-6.
- Alimian M, Eraghi AS, Chavoshizadeh SA, Mohseni M, Mousavi E, Movassaghi S. Regional vitamin C in Bier block reduces the incidence of CRPS-1 following distal radius fracture surgery. *Eur J Orthop Surg Traumatol.* 2020;31(4):689-693.
- Seth I, Bulloch G, Seth N, Siu A, Clayton S, Lower K, Roshan S, Nara N. Effect of perioperative vitamin C on the incidence of complex regional pain syndrome: a systematic review and meta-analysis. *J Foot Ankle Surg.* 2021;60(5):1025-1031.
- Ekrol I, Duckworth A, Ralston S, Court-Brown C, McQueen M. The influence of vitamin C on the outcome of distal radial fractures: a double-blind, randomized controlled trial. *J Bone Joint Surg Am.* 2014;96(17):1451-1459.
- Zollinger PE, Tuinebreijer WE, Kreis RW, Breederveld RS. Effect of vitamin C on frequency of reflex sympathetic dystrophy in wrist fractures: a randomized trial. *Lancet.* 1999;354(9195):2025-8.
- Ebrahimpour A, Biglari F, Sabaghzadeh A, Barazandeh Rad S, Sadighi M, Moradian T, Jafari Kafiabadi M. Comparing the effects of vitamins C and D in preventing complex regional pain syndrome after distal radius fracture treatment. *J Res Orthop Sci.* 2022;9(3):987.2.