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Original Research Article

Vitamin C supplementation as adjuvant analgesic therapy in post-operative pain management in patients undergoing surgical decompression in a case of prolapsed intervertebral disc

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ABSTRACT

Background: The management of postoperative pain has been a major challenge for the operating surgeons. Vitamin C has shown analgesic effects in specific clinical conditions, reducing patient suffering and improving the quality of life. The objective of this study was to evaluate the efficacy of vitamin C as an adjuvant in postoperative pain management and its effect on analgesia requirements in patients undergoing spinal decompression surgery.
Methods: The present study was a prospective study of 50 patients aged 30-60 years with low back pain due to prolapsed intervertebral disc requiring surgical decompression, conducted in a tertiary care institute from 2018 to 2020. All patients underwent open discectomy. 25 patients each were randomized into two groups, those that were given vitamin c supplementation (group A) and those that weren't (group B). The patients were then followed up 1st, 2nd, 4th, and 6th week and the pain was graded at each follow-up according to the NRS scale. The total amount of diclofenac sodium consumed in the 6 weeks was calculated.
Results: The mean NRS (A vs B) at 2 (2.68 vs 3.56) and 4 (0.88 vs 1.48) weeks follow-up showed a statistically significant difference between the two groups, but the difference was not significant at 6 (0.16 vs 0.36) weeks follow up. The difference in the consumption of analgesic (3.56 vs 5.46) at 6 weeks was statistically significant.
Conclusions: In this clinical outcome-based study, we suggest that for postoperative pain management, vitamin C acts as an efficacious adjuvant with a dose-sparing effect on the consumption of analgesics.

Keywords: Vitamin C, Ascorbic acid, Post-operative pain

INTRODUCTION

Despite advances in pain treatment, post-operative pain, an unavoidable consequence of surgery, poses a challenge to the operating surgeon.[1,2] Inadequate pain relief after surgery hampers patient satisfaction due to increased hospital stay, longer rehabilitation and may adversely affect the functional outcome delaying return to regular activities.[3-5] It increases the health care expenditure while impairing the quality of life.[6] Commonly used analgesic medications present side effects at higher doses resulting in inadequate postoperative pain management.

The major aim in postoperative pain management is to provide adequate analgesia at a minimal dose of medications to lessen the side effects.[7] Routinely used strategies use multimodal analgesic therapy. Opioids and NSAIDs are the most commonly used drugs but are associated with various side effects like nausea, vomiting, respiratory depression, and gastric ulceration.[8,9] Gabapentin has also been used for pain management

postoperatively, but has conflicting reports; some studies show efficacy while others give no effect.[10]

Vitamin C, also known as ascorbic acid, is a water-soluble vitamin required for normal growth and development. It exhibits antioxidant properties limiting tissue injury and has neuroprotective and neuromodulating effects.[11,12]

Clinical studies support vitamin c supplementation as an adjuvant analgesic without any significant side effects.[12] Vitamin C supplementation has been shown to reduce pain in patients with hip and knee osteoarthritis.[13] Studies have also shown vitamin C supplementation to reduce the occurrence of chronic regional pain syndrome in patients after wrist, ankle, and foot surgery.[14] A recent study has shown that oral supplementation of vitamin C has significantly reduced the dose of morphine post-operatively after laparoscopic cholecystectomy.[12]

The objective of this study was to evaluate the efficacy of vitamin C as an adjuvant in post-operative pain management and its effect on analgesia requirements in patients undergoing spinal decompression surgery.

METHODS

The present study was a prospective study, conducted in the department of orthopaedics at Sir J. J. Group of Hospitals from December 2018 to February 2020 with prior approval from the institutional ethics committee. The study population comprised of the patients presenting to the institute low back pain due to prolapsed intervertebral disc (PIVD) requiring surgical decompression and who satisfied the selection criteria for the study.

A total of 50 patients presenting to our tertiary care institute with low backache with PIVD requiring surgical decompression were selected for the study. Written valid informed consent was obtained from the patients at the first presentation.

The 50 patients were serially numbered from 1 to 50 as per chronology of presentation and 25 patients each were randomized into two groups, those that were given vitamin c supplementation (group A) and those that were not given vitamin c supplementation (group B). Randomization was done using a random number table.

Inclusion criteria

Patients of either sex in the range of 30-60 years with normal neurology were included in the study. The patients had disc space reduction on X-rays with MRI showing prolapsed disc causing compression of the nerve root in the dorso-lumbar region with minimal degenerative changes in lumbar spine.

Patients were not receiving pain modulation therapy like Transcutaneous electrical nerve stimulation or acupuncture therapy.

Exclusion criteria

Patients with any pathological diseases of the spine including DISH, spondylolisthesis, spondylolysis, inflammatory conditions, benign or secondary tumors, and infective pathology of the spine. Patients having undergone spinal surgeries previously were excluded from the study.

Patients meeting the inclusion and exclusion criteria were included in the study after obtaining informed valid consent. All patients underwent open discectomy to decompress the involved nerve root. Patients were interviewed after surgery and pain was graded according to the Numeric rating scale (NRS).

Pain intensity was measured on an 11-point pain scale, anchored at ‘no pain’ at 0 and ‘worst pain I have ever experienced’ at 10. Patients in group A were then started on supplementation of vitamin C 1000/day dosing orally for 6 weeks. The patients were then followed up at the 1st, 2nd, 4th, and 6th week and the pain was graded at each follow-up. The patients in both groups were also administered diclofenac sodium 75 mg twice a day for 5 days for acute pain relief and then as and when required. The patients were instructed to maintain a record of the number of diclofenac sodium tablets consumed for 6 weeks. The total amount of diclofenac sodium consumed in the 6 weeks was calculated in grams.

Statistical analysis

All data were collected, and was recorded into Microsoft excel spreadsheet. The nominal data (such as gender) was presented as number. Continuous data (such as age, NRS scores, analgesic consumed) was expressed as mean, standard deviation and range. At the end of the study, the data was collected and analyzed by student t-test. A p value of <0.05 was considered as statistically significant.

RESULTS

The study was conducted in a tertiary care hospital after obtaining permission from the Institutional Ethics Committee. A total of 50 patients presenting to our tertiary care institute with chronic low backache with pivd requiring surgical decompression were included in the present study. The patients were divided into 2 groups, i.e.; group A- patients administered vitamin C, and group B- patients not supplemented with vitamin C.

The average age of the patients in group A was 45.68±6.6 years and of the patients in group B was 47.84±5.29 years in the range of 30-60 years. The difference in the mean ages of the two groups was not statistically significant ($p>0.05$).

In our study, the majority 30 (60%) of the patients were females. There were 11 males and 14 females in group A and 9 males and 16 females in group B. In the present

study, maximum patients 35 (70%) were from the lower class, 10 (20%) from the middle class, and 5 (10%) were from high-class society (socio-economic status).

Table 1: Demographic data of the patients.

Variables	Group A (N=25)	Group B (N=25)
Age (years) average	45.68±6.6	47.84±5.29
Male/female	11/14	9/16

The NRS calculated at one-week follow-up was 4.16±1.17 in group A and 4.76±1.2 in group B, the difference between the two groups was statistically insignificant (p=0.08). The NRS score at 2nd, 4th, and 6th week follow up was 2.68±1.21, 0.88±0.83, and 0.16±0.37 in group A and 3.56±1.29, 1.48±1.04, and 0.36±0.48 in group B respectively. There was a statistically significant difference in NRS score between the two groups at 2nd and 4th week follow-up (p=0.01 and 0.02 respectively), group A scores being significantly lower than group B scores. The difference between the two groups at 6 weeks was statistically insignificant (p=0.11).

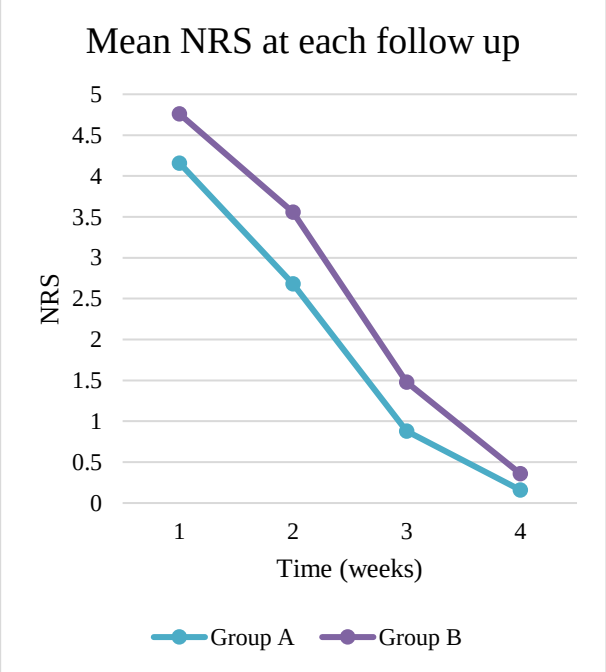

Figure 1: Mean NRS at each follow up in either group.

The mean amount of the analgesic consumed was 34.65% lower in patients in group A as compared to the patients in group B. The mean amount of analgesia used at the end of 6 weeks, in group A was 3.56±1.28 g and in group B was 5.46±1.15 g. The difference in the amount of analgesia consumed between the two groups was statistically significant (p<0.05), with group B consuming significantly more analgesia. The difference in consumption of analgesic seen was higher in males (37.03%) as compared to females (31.5%).

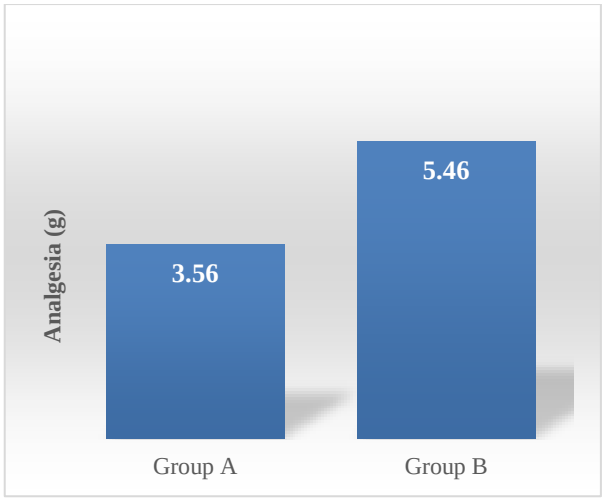

Figure 2: Mean analgesic consumed (in g) in each group at end of 6 weeks.

DISCUSSION

The management of post-operative pain has been a major challenge for the operating surgeons.[1,2] Despite patients receiving some form of post-operative pain management, around 75% of patients do not achieve adequate pain relief.[15]

Vitamin C (L-ascorbic acid) is an organic acid required for a number of biochemical reactions in the body, exhibiting antioxidant properties. Vitamin C is also necessary for normal human growth and development. Vitamin C is required for the synthesis of intercellular substances, including collagen, the matrix of bone, intercellular cement of the capillary endothelium. Vitamin C also acts as a neuro-protective and neuro-modulating antioxidant. Long et al in their study demonstrated low plasma levels of vitamin C following trauma and infection.[16]

Vitamin C has shown analgesic effects in specific clinical conditions, reducing patient suffering and improving the quality of life. The site of action responsible for the analgesic effect of vitamin C is not yet fully understood. However, vitamin C supplementation at doses of 0.5-3 g/day has been shown to be effective in the reduction of pain.[13,17,18] Vitamin C is involved in the synthesis of neurotransmitters like dopamine, serotonin, and norepinephrine and is also involved in cholinergic and GABAergic transmission.[19,20] These neurotransmitters function as the main components of the pain inhibitory pathway.[21] Vitamin C being water-soluble is easily excreted in the urine, and therefore supplementation with high doses has little adverse effect.

In our study, the NRS score was significantly lower in the group of patients who received vitamin C (group A) at the second and fourth-week follow-up as compared to group B (p=0.008 and 0.003 respectively). The above observation suggests that vitamin C is effective as an adjuvant in reducing pain in the post-operative period.

The amount of analgesia consumed by the patients taking vitamin C was significantly lower than the patients not supplemented with vitamin C ($p<0.05$). The patients in group A showed 34.65% less consumption of analgesics as compared to the patients in group B. This suggests that vitamin C helps reduce the analgesic dose required in post-operative pain management. The decrease in the consumption of analgesic seen was higher in males (37.03%) as compared to females (31.5%).

In the present study, patients in both groups had achieved adequate pain relief as seen by the comparable NRS scores at 6 weeks follow-up. However, this result was achieved at the expense of significantly higher analgesic consumption in patients not supplemented with vitamin C as compared to the patients administered vitamin C. This indicates that oral supplementation with 1 g of vitamin C has a dose-sparing effect on analgesic consumption. The dose of vitamin C was based on the review of various clinical trials which suggested the effective analgesic dose of vitamin C in the range of 0.5-3 g/day. Hence, we chosed a dose of 1 in our study.

The limitations in our study were the small number of cases. Future high-quality studies are required to confirm these findings. Future studies concentrating on the measurement of vitamin C concentrations at baseline and following intervention, determination of the optimal route of administration (i.e.; enteral or parenteral), may help in the better understanding of the role of vitamin C in the management.

CONCLUSION

Vitamin C has demonstrated analgesic qualities in specific clinical conditions, reducing patient suffering and improving the quality of life. Post-operative pain management plays an important role in improving patient satisfaction ensuring faster rehabilitation and earlier return to regular activities. In this clinical outcome-based study, we suggest that in post-operative pain management, vitamin C acts as an efficacious adjuvant with a dose-sparing effect on the consumption of analgesics. Future high-quality studies are required to confirm these findings with the additional objective of determining the optimal dosage and route of administration of vitamin C.

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