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ORIGINAL ARTICLE

Efficacy of 3 ML local anesthetic versus 5 ML in terms of pain relief for closed manipulation of distal radius fracture.

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ABSTRACT… Objective: To determine the efficacy of 3 ml vs. 5 ml local anaesthetic Xylocaine in terms of pain relief for closed manipulation of a distal radius fracture. **Study Design:** Quasi-experimental Research. **Setting:** Carried out on patients visiting the Emergency Department (ED) of Ziauddin University Hospital, Karachi with DRFs,. **Period:** February 2024 to July 2024. **Methods:** A total of 68 patients diagnosed with DRF were consecutively selected and randomly placed in two groups. Group A patients were managed with 3 ml and group B patients with 5 ml of local anaesthetic Xylocaine before the procedure. The orthopaedic surgeon pursued the standard procedure of closed reduction for DRFs. Before and after surgery, each patient was evaluated for pain using the visual analogue scale (VAS). Statistical interpretation was done with SPSS version 26 by taking a significant p-value of ≤ 0.05. **Results:** Of the 68 DRF patients, gender was similar in both groups; male patients were 5 (14.7%), and female patients were 29 (85.3%) in each group. The mean pain score on VAS was 9.26 ± 0.51 and 9.12 ± 0.54 before surgery (p-value = 0.252) and 5.91 ± 1.64 and 4.59 ± 1.99 after surgery (p-value = 0.004) in group A (3 ml local anaesthetic) and group B (5 ml local anaesthetic), respectively. The efficacy of local anaesthesia Xylocaine in the management of DRF was significantly higher in group B (5 ml local anaesthetic) as compared to group A (3 ml local anaesthetic) [13 (38.2%) vs. 5 (14.7%); p-value=0.028]. **Conclusion:** It was concluded that adequate analgesia is provided by 5 ml of local anaesthetic xylocaine applied as a haematoma block for closed manipulation of a distal radius fracture.

Key words: Anaesthesia, Distal Radius Fractures, Orthopaedic, Pain.

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INTRODUCTION

Distal radius fractures (DRFs) are the most commonly reported upper extremity and fall-related fractures experienced by orthopaedic surgeons in emergencies.[1] These are associated with serious health problems such as increased morbidity, dysfunctionality, and permanent disability. Prolonged hospital stays, readmission after discharge, and increased cost burden not only on patients but also on the healthcare system are some of the other common drawbacks of DRFs.[1,2] The elderly population is at a higher risk of developing DRFs with even low-energy falls, either from a seated or standing position. Women are more prone to DRFs due to osteoporosis, osteoarthritis, etc.[3] Approximately 20% of all DRFs are managed in emergency departments.[4] DRFs are the third most prevalent site of fractures associated with osteoporosis and account for 15–21% of all fractures.[5] Recent studies from Sweden report a 2% increase of distal radius fracture (DRF) in men and a 3.4% increase of DRF in women with ages ranging from 17 to 64 years. The majority of the sufferers of DRFs were women.[6,7]

As the prevalence of DRF increases, so does the need for different approaches to better manage DRFs in the quest to enhance patients' quality of life and reduce the cost burden.[8] Various surgical and non-surgical techniques are used for the management of DRFs, along with various anaesthetic techniques. These techniques include closed reduction and casting, the pins and plaster technique, percutaneous pinning, external fixation, limited open reduction and ORIF (open reduction and internal fixation). Managing DRFs and reported pain is a real challenge for the orthopaedic surgeon.[9,10]

Surgical and nonsurgical management of DRFs requires the use of anaesthesia. Various anaesthesia

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techniques, such as general, local or combined anaesthesia, are used to achieve perioperative care. The choice of dosage of local anaesthetic agent is also very important to achieve satisfactory numbness in a limited area of the body and to control pain. There is currently insufficient evidence available to advocate for the appropriate dosage of local anaesthesia for pain control.[11,12]

Pain management during and after closed manipulation of DRF is a big challenge for an orthopaedic surgeon. Choosing the appropriate anaesthetic dose from among the different types of local anaesthesia is also very important and can help relieve the patient's pain. Internationally, very limited data are available on comparing local anaesthetics in different doses in closed manipulation of DRFs, while, to our knowledge, no local study has been conducted yet. Therefore, the present study will be helpful internationally and locally in deciding the effective dose of local anaesthetic in pain management during closed manipulation of DRFs.

METHODS

Quasi-experimental research was carried out on patients visiting the emergency department (ED) of Ziauddin University Hospital, Karachi, with DRFs, from February 2024 to July 2024. During the six-month study, 68 consecutive patients were enrolled from the emergency department. The study includes (1) patients of either gender with age of ≥ 40 years, (2) patients with DRFs with a duration of ≤ five days, and (3) patients with DRFs managed by closed manipulation. The study excludes (1) patients with intra-articular or open fractures, (2) pregnant or lactating mothers, and (3) patients not interested in the study who refused to provide written informed consent.

The study proposal was submitted to the research committee of Ziauddin University Karachi for approval before initiating the study and was approved via letter number 8101123BVEM, dated 15-02-2024. The details of the study were explained to our patients before including them in the study, after which a written informed consent was obtained. Demographic and medical details of each patient were obtained, including duration, side and mechanism of fracture. Each patient was enquired about and evaluated for presenting symptoms, including pain, swelling, bruising and decreased wrist movement. An AP or lateral x-ray view of the fractured side was performed. An experienced orthopaedic surgeon evaluated the x-ray and classified the DRF on the basis of Colles and Smith. A total of 68 patients diagnosed with DRF were consecutively selected and randomly placed in two groups. Group A patients were managed with 3 ml and group B patients with 5 ml of local anaesthetic Xylocaine before the procedure. The orthopaedic surgeon pursued the standard procedure of closed reduction for DRFs. Before and after surgery, each patient was evaluated for pain using the visual analogue scale (VAS).

A distal radius fracture is defined as a fracture of the radius within 2.5 cm of the radiocarpal joint. An AP or lateral x-ray view of the fractured side was performed for confirmation of DRF and its types, i.e., Colles and Smith. Relief of pain from DRFs was determined by the efficacy of doses (3 ml and 5 ml) of local anaesthetic Xylocaine for a patient. The Visual Analogue Scale (VAS) was used for measuring pain relief before and after surgery. VAS for pain relief was classified as satisfactory (VAS score ≤ 3) and unsatisfactory (VAS score ≥ 4). Statistical interpretation was done with SPSS version 26. The chi-square test, independent samples t-test and paired samples t-test were used for comparing both group variables by using a p-value ≤ 0.05 as significant.

RESULTS

Of the 68 DRF patients, gender was similar in both groups; male patients were 5 (14.7%), and female patients were 29 (85.3%) in each group. The mean age was 49.91 ± 6.60 years and 49.56 ± 8.03 years in group A (3 ml local anaesthetic) and group B (5 ml local anaesthetic), respectively. Pain, swelling, bruising, and decreased wrist movement were similar in both groups and were reported in each patient with DRF. The mean duration of DRF fracture was also similar in both groups: 1.41 ± 0.93 days and 1.15 ± 0.36 days in group A (3 ml local anaesthetic) and group B (5 ml local anaesthetic), respectively. Right-sided DRFs were observed in 7 (20.6%) and 6 (17.6%) patients and left-sided DRFs were observed in 27 (79.4%) and 28 (82.4%)

patients in group A (3 ml local anaesthetic) and group B (5 ml local anaesthetic), respectively. The mechanisms of DRFs were similar in both groups: fracture due to fall in 28 (82.4%) patients and fracture due to accident in 6 (17.6%) patients in each group. Colles DRFs were diagnosed in 25 (73.5%) and 23 (67.6%) patients, and Smith DRFs were diagnosed in 9 (26.5%) and 11 (32.4%) patients in group A (3 ml local anaesthetic) and group B (5 ml local anaesthetic), respectively [Table-I].

Before surgery, the mean pain score on VAS was similar in both groups: 9.26 ± 0.51 and 9.12 ± 0.54 in group A (3 ml local anaesthetic) and group B (5 ml local anaesthetic), respectively (p-value=0.252). After surgery, the mean pain score on VAS was different in both groups: 5.91 ± 1.64 and 4.59 ± 1.99 in group A (3 ml local anaesthetic) and group B (5 ml local anaesthetic), respectively (p-value=0.004). The paired samples t-test shows a significant reduction in pain scores on the VAS in both groups before and after surgery (p-value < 0.001) [Figure-1].

The efficacy of local anaesthesia Xylocaine in the management of DRF was satisfactory in 5 (14.7%) and 13 (38.2%) patients and unsatisfactory in 29 (85.3%) and 21 (61.8%) patients in group A (3 ml local anaesthetic) and group B (5 ml local anaesthetic), respectively (p-value=0.028) [Figure-2].

FIGURE-1

Mean VAS before and after surgery in Group A and B

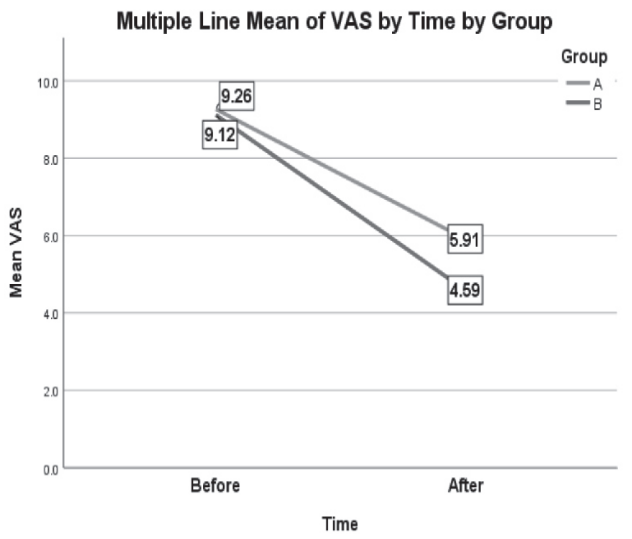
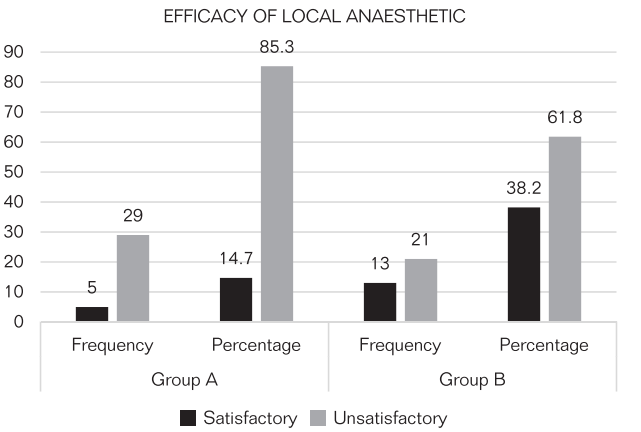


FIGURE-2

Efficacy of local anaesthesia xylocaine in Group A and B



DISCUSSION

Distal radius fractures (DRFs) are the most commonly reported musculoskeletal injuries, with a high prevalence amongst adults. Young adults present with DRFs secondary to trauma, primarily due to road traffic accidents (RTAs). In the elderly population, DRFs are commonly caused by falls or slips due to osteoporosis, osteoarthritis, and other bone-related problems. Therefore, management of DRFs and reported pain is a real challenge for an orthopaedic surgeon.[13-15]

Various surgical, non-surgical, and anaesthetic techniques are used to reduce pain, reduce the risk of complications, initiate the healing process, and restore the fracture. DRF management with appropriate anaesthesia technique and dosage is important. Choosing the appropriate anaesthetic dose from among the different types of local anaesthesia is also very important and can help relieve the patient's pain and enhance the quality of life.[15-17]

Various approaches are utilised for the management of DRFs to induce analgesia and decrease the patient's pain. Some of the commonly used methods include general anaesthesia (GA), intravenous regional anaesthesia, local haematoma block, Bier block, intramuscular sedation, demand valve nitrous oxide, conscious sedation, intravenous sedation and analgesia.[18] Haematoma blocks are generally safe and effective in the management of DRFs.

TABLE-I

Baseline characteristics in DRFs patients (n=64)

Variables		Group A	Group B	P-Value
Gender	Male	5 (14.7%)	5 (14.7%)	1.000
	Female	29 (85.3%)	29 (85.3%)	
Age (Years)	Mean ± SD	49.91 ± 6.60	49.56 ± 8.03	0.844
Sign & Symptoms	Pain	34 (100.0%)	34 (100.0%)	---
	Swelling	34 (100.0%)	34 (100.0%)	---
	Bruising	34 (100.0%)	34 (100.0%)	---
	Decreased wrist movement	34 (100.0%)	34 (100.0%)	---
Duration of Fracture (Days)	Mean ± SD	1.41 ± 0.93	1.15 ± 0.36	0.125
Side of Fracture	Right	7 (20.6%)	6 (17.6%)	0.758
	Left	27 (79.4%)	28 (82.4%)	
Mechanism of Fracture	Fall	28 (82.4%)	28 (82.4%)	1.000
	Accident	6 (17.6%)	6 (17.6%)	
Classification of Fracture	Colles	25 (73.5%)	23 (67.6%)	0.595
	Smith	9 (26.5%)	11 (32.4%)	

Group A: 3 ml Local Anesthetic
Group B: 5 ml Local Anesthetic

In the closed manipulation and reduction technique of DRF, local anaesthesia is injected into the fractured haematoma area for attaining numbness and relieving the patient's pain.[18-20]

Pain management during and after closed manipulation of the DRF is a major challenge for the orthopaedic surgeon. Different types of local anaesthetics are used in different doses that can help relieve the patient's pain. In this study we selected two doses (3 ml and 5 ml) of the local anaesthetic Xylocaine to compare their effectiveness in patients with DRF for pain relief.

In this study, both local anaesthetic doses effectively decreased the pain score measured on VAS. In group A patients who were managed with 3 ml of the local anaesthetic Xylocaine, the mean pain score before surgery was 9.26 ± 0.51, which significantly decreased to 5.91 ± 1.64 after surgery (p-value < 0.001). Similarly, in group B patients who were managed with 5 ml of the local anaesthetic Xylocaine, the mean pain score before surgery was 9.12 ± 0.54, which significantly decreased to 4.59 ± 1.99 after surgery (p-value < 0.001). When we compare both groups, the mean pain score was similar before surgery but significantly decreased in group B patients who were managed with 5 ml of the local anaesthetic Xylocaine (p-value=0.004). In this study, the efficacy of local anaesthesia Xylocaine in the management of DRF was significantly higher in group B (5 ml local anaesthetic) as compared to group A (3 ml local anaesthetic) [13 (38.2%) vs. 5 (14.7%); p-value=0.028].

Different other researchers utilised various levels of local anaesthetic in their investigations to recommend the appropriate volume of anaesthetic solution to be used in haematoma block. They all found that a large volume of local anaesthetic offers better relief from pain after the surgery. A study by Khan et al. on the comparison of two doses (3 ml and 5 ml) of lignocaine as a local anaesthetic in closed reduction of a Colle's fracture. The study was conducted on one hundred patients: 50 patients in group A with 3 ml lignocaine and 50 patients in group B with 5 ml lignocaine. VAS was used for assessing pain relief before and after surgery. In group A, 10.0% of patients had satisfactory pain control (VAS score ≤ 3) with an average VAS score of 2 ± 1, and 90.0% of patients had unsatisfactory pain control (VAS score ≥ 4) with an average VAS score of 5 ± 1. In group B, 94.0% of patients had satisfactory pain control (VAS score ≤ 3) with an

average VAS score of 1 ± 1, and 6.0% of patients had unsatisfactory pain control (VAS score ≥ 4) with an average VAS score of 5 ± 1. Therefore, as seen, group B with 5 ml of lignocaine had satisfactory pain control compared to group A with 3 ml of lignocaine in closed manipulation and fracture reduction.[20]

Orbach et al. compared the two doses (10 ml of 2% and 20 ml of 1%) of lidocaine as a local anaesthetic in closed manipulation of a DRF and reported no significant difference in mean VAS score. However, better pain control was observed with 20mL of 1% lidocaine as compared to 10mL of 2% lidocaine.[21] Siddiq et al. compared the haematoma block (10 ml of 1% lidocaine) and general anaesthesia in the management of DRF and reported a significant difference in mean pain score. They found that haematoma block is more effective in pain control as compared to general anaesthesia.[22]

Thusoo et al. uses 10 to 15 ml of 2% lignocaine in the management of DRF and reported a significant drop in mean pain score. They found that haematoma block is more effective in pain control during manipulation or reduction of DRFs.[23] Inam et al. used 1.5% Xylocaine with the dose depending on the weight of the patient (4.5 mg/kg) presented with DRF and reported a significant drop in pain score in 85.3% of patients. They also found that haematoma block is more effective in pain control during reduction of DRFs.[24]

Our study, when compared to other studies, also shows that a larger volume of local anaesthetic gives better analgesia during the closed manipulation process of DRFs. Analgesia at lower volumes is also significantly controlling pain, but when the volume is increased, it shows significantly better outcomes.

CONCLUSION

It was concluded that adequate analgesia is provided by 5 ml of local anaesthetic xylocaine applied as a haematoma block for closed manipulation of a distal radius fracture. 3 ml of the local anaesthetic Xylocaine is also significantly controlling pain, but 5 ml provides better outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Muhammad Asad Khan:** Manuscript writing.
2	**Inayat Ali Khan:** Data collection.
3	**Bella Virk:** Topic selection.
4	**Pawan Kumar:** Data entry.
5	**Adina Muhammad Aslam:** Data analysis.
6	**Hani Suhail:** Revisions.