Original Research Article

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Feasibility of Hematoma Block for Closed Reduction of Fractures of Distal End of Radius: A Comparison with General Anesthesia

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Abstract

Background: Fractures of distal radius are common and there are different modes of anesthesia to obtain pain relief prior to closed reduction. The aim of this study was to prospectively compare hematoma block alone and general anesthesia for the reduction of distal radius fractures, with respect to pain perception before and after manipulation using a visual analogue scale (VAS), patients' acceptance and surgeons' acceptance. *Methods:* In this randomized, controlled study, 60 ASA-I and II patient were divided into HB group (n=30) who received Hematoma block, compared with GA group(n=30) who received general anesthesia. Pain was assessed preoperatively and postoperatively by VAS, and intraoperatively by change in heart rate and mean arterial blood pressure from the baseline levels. Patients' and surgeons' acceptance with the nature of procedure were assessed using patients score and surgeons score respectively. *Results:* Intraoperatively, HB group patients had better hemodynamic variables when compared to GA group. The mean of postoperative VAS of HB group and GA group were 2.1 and 3.83 respectively which was statistically significant. The difference of mean score between the two groups with respect to surgeons' score ($p<0.001$) and patients' score ($p<0.001$) were statistically significant. Post-manipulation pain was significantly greater in patients who received general anesthesia (VAS=3.83±0.64). *Conclusion:* Patient acceptance and surgeons' satisfaction is greater with a correctly performed hematoma block and is a safe and effective alternative to general anesthesia.

Keywords: Closed Reduction; Distal Radius Fracture; Hematoma Block; General Anesthesia; Visual Analogue Scale.

Introduction

Over 5-16% of all fractures treated at trauma unit of emergency department are distal radius fractures and are common in all age groups especially elderly people [1-4]. Various techniques of anesthesia for fracture reduction include intravenous sedation, general anesthesia, intravenous regional anesthesia, nerve blocks and hematoma block [2,5-10]. Hematoma block is achieved by administering local anesthetic within the hematoma in between the fracture ends [9,10]. Several studies were done comparing different techniques and each has its own associated risk and drawbacks [7,8]. Comorbidities and drug interactions additionally add risks to the patient who is undergoing fracture reductions under any of the above mentioned techniques. Hematoma block serves to block the free and open nerve endings in between the fracture ends resulting in effective blockade and analgesia [9].

Methods

This prospective, randomized study was undertaken after obtaining ethics committee approval and written informed consent from the patients. A total of sixty ASA-I, II patients in the age range of 20 to 60 years, scheduled forisolated closed reduction of distal radius fracture were

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selected for the study. Patients with injury more than 96 hours, analgesic consumption during the past 8 hours, any associated injuries, systemic illness, patients with smoking or alcoholism and those with coagulopathy were excluded from the study.

All patients were randomly allocated by envelope method into two groups. First group received hematoma block (HB group) whereas second group received general anesthesia (GA group). Pre-anesthetic evaluation of the patients was done in both the groups assessing for systemic illness and airway examination, compartment syndrome and neurological deficits secondary to fracture. After fulfilling inclusion and exclusion criteriaa minimum of 8 hours of nil per oral for solids and 4 hours for clear waterwas obtained. Preoperative visual analogue scale (VAS) were noted in both the groups before administering anesthesia. Patients rated their pain from 0 (no pain) to 10 (severe pain) prior to fracture manipulation. Duration from the time of injury and analgesic consumption 8 hours prior to induction of anesthesia technique were noted. Intradermal test dose was administered 30 minutes prior to institution of hematoma block.

In all patients intravenous access was secured using 20G i.v. cannula in non-operating limb. Intraoperative monitoring in both the groups included electrocardiography, non-invasive blood pressure and plethysmography.Under strict aseptic precautions, patients in HB group received hematoma blockusing a 22G needle and by injecting 10 ml of preservative free 2% Inj.lignocaine in the dorsal aspect of forearm in between the fractured ends. An elastic bandage was applied above the fracture site for 10 minutes after administration of hematoma block for proper anesthesia. After lapse of 10 minutes,pain at the fracture site was assessed, elastic bandage removed and it was manipulated and reduced by surgeon.

Patients in GA group received general anesthesia using Inj.fentanyl 2µg/kg, Inj.propofol 2 mg/kg and according to the response and anesthesia was maintained using N_2O:O_2 in 66:33 ratio and Isoflurane(1-1.5%). Patients were monitored for heart rate and mean arterial blood pressure at 0, 5, 10, 15, 20, 25 and 30 minutes. In majority of the patients fracture was reduced within 5 minutes and in all patients by the end of 10 minutes.

At the end of procedure after the application of cast and when patients were fully awake, patients visual analogue scale (VAS), patients' satisfaction about the anesthesia technique used (patients' score) and surgeons' satisfaction on the reduction of the fractured ends, radiological correction of fracture and anesthesia technique administered (surgeons' score) were noted.

Descriptive and inferential statistical analysis has been used in our study. Results on continuous measurements are presented on Mean±SD (Minimum-Maximum) and results on categorical measurements are presented in percentage numbers (%). 'p' < 0.05 was considered to be significant. The following assumptions on data were made-dependent variables were normally distributed, random sampling from the population was ensured and the patients chosen were independent.

Student t test (two tailed, independent) and Chi-square/Fisher Exact test were used to assess the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters and categorical scale between two or more groups respectively. Levens test for homogeneity of variance has been performed to assess the homogeneity of variance and $p \leq 0.01$ was considered to be strongly significant. Data was collected and statistics done using 17.0.2 version of SPSS.

Results

The two groups did not vary significantly in age, sex, ASA grade and duration from the time of injury (Table 1). Baseline (0 min) heart rateand mean arterial pressure were statistically insignificant between the two groups and also at 5^{th} and 10^{th} minute (Tables 2,3 Figure 1,2). Following manipulation and reduction of fracture the mean heart rateand mean arterial blood pressure between the two groups at 15, 20, 25 and 30 minutes varied significantly (Tables 2,3 Figure 1,2).

The average duration since the time of injury (p=0.337) (Table 1) and preoperative Visual Analogue Scale(VAS) did not vary significantly between the two groups(Table 4, Figure 3). The mean of postoperative VAS of HB group and GA group were 2.1 and 3.83 respectively and there was statistically significant difference between the two groups (Table 4, Figure 3). Within the group there was significant reduction in VAS from preoperative to postoperative period in both groups and the difference was higher in HB group (5.10±0.711) when compared to GA group (3.36±0.927) and it was statistically significant (p<0.001) (Table 4). The mean surgeons' score of GA and HB group were 7.26 and 8.1 respectively (Table 4, Figure 4). The mean patients' score of GA and HB group were 6.8

and 7.9 respectively (Table 4, Figure 4). The difference of mean score between the two groups with respect to surgeons' score ($p<0.001$) and patients' score ($p<0.001$) werestatistically significant (Table 4).

Hematoma block resulted in good pain relief and surgeons' could reduce the fracture with ease. There was no incidence of failed hematoma block. Post-manipulation pain was significantly greater ($p<0.001$) in patients who received general anesthesia (Postoperative VAS=3.83±0.64) (Table 4). There were no complications related to eitherof the anesthetic methods used.

Table 1: Patient characteristics (n=30). Data are mean (range) or Mean ± SD*

Time	Group-HB (n=30)	Group-GA (n=30)	p-value
Age (years)	46.66±4.84	48.03±4.37	0.085(ns)
Sex (Male:Female)	10:20	9:21	0.781(ns)
ASA (I:II)	19:11	19:11	1.000(ns)
Mean duration since time of injury (hours)	10.53 ± 2.09	11.03± 1.90	0.337(ns)

Abbreviations: SD=standard deviation, $p<0.05$ significant, ns=statistically not significant

Table 2: Comparison of mean heart rate (bpm) changes in response to manipulation and closed reduction of radius fracture between Group:HB and Group:GA

Time	Group-HB	Group-GA	p-value
0 min	93.06±3.77	91.26±3.94	0.076(ns)
5 min	89.66±4.00	87.73±3.95	0.065(ns)
10 min	85.06±4.25	84.00±4.48	0.349(ns)
15 min	89.40±4.14	95.00±3.85	<0.001(hs)
20 min	86.46±4.19	92.80±3.80	<0.001(hs)
25 min	84.13±3.96	91.06±3.43	<0.001(hs)
30 min	81.60±4.14	89.66±3.79	<0.001(hs)

T-time intervals as mentioned in the Methods of study. ns= statistically not significant, hs=highly significant

Table 3: Comparison of mean arterial pressure changes (MAP in mm Hg) in response to manipulation and closed reduction of radius fracture between Group:HB and Group:GA

Time	Group-HB	Group-GA	p-value
0 min	97.66±3.79	96.30±2.71	0.114(ns)
5 min	94.26±3.92	93.80±2.69	0.593(ns)
10 min	91.13±3.47	92.33±2.73	0.142(ns)
15 min	92.26±3.81	95.36±2.23	<0.001(hs)
20 min	90.20±3.72	93.20±2.38	<0.001(hs)
25 min	89.06±3.55	91.73±2.39	<0.001(hs)
30 min	87.33±3.76	91.33±2.42	<0.001(hs)

T-time intervals as mentioned in the Methods of study. ns= statistically not significant, hs=highly significant

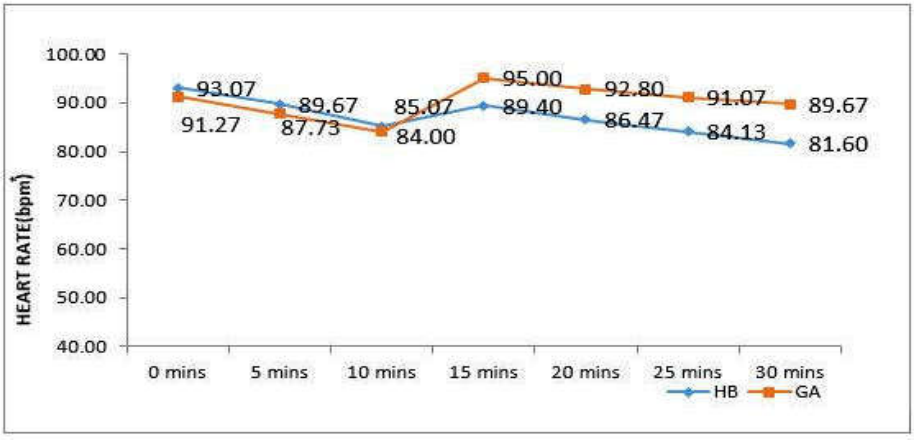

Fig. 1: Comparison of heart rate between HB group and GA group at various intervals of time

Table 4: Comparison of Visual Analogue Score (VAS), Surgeons' score and Patients' score between Group:HB and Group:GA

TIME	Group-HB	Group-GA	p-value
Preoperative VAS	7.18±0.92	7.42±0.24	p=0.92 (ns)
Postoperative VAS	2.10±0.48	3.83±0.64	p<0.001 (hs)
Pre-Post VAS*	5.10±0.711	3.36±0.927	p<0.001 (hs)
Surgeons' score	8.10 ± 0.661	7.266±0.583	p<0.001 (hs)
Patients' score	7.90 ± 0.711	6.80±0.846	p<0.001 (hs)

p<0.05 significant, ns=statistically notsignificant. *difference of preoperative and Postoperative VAS

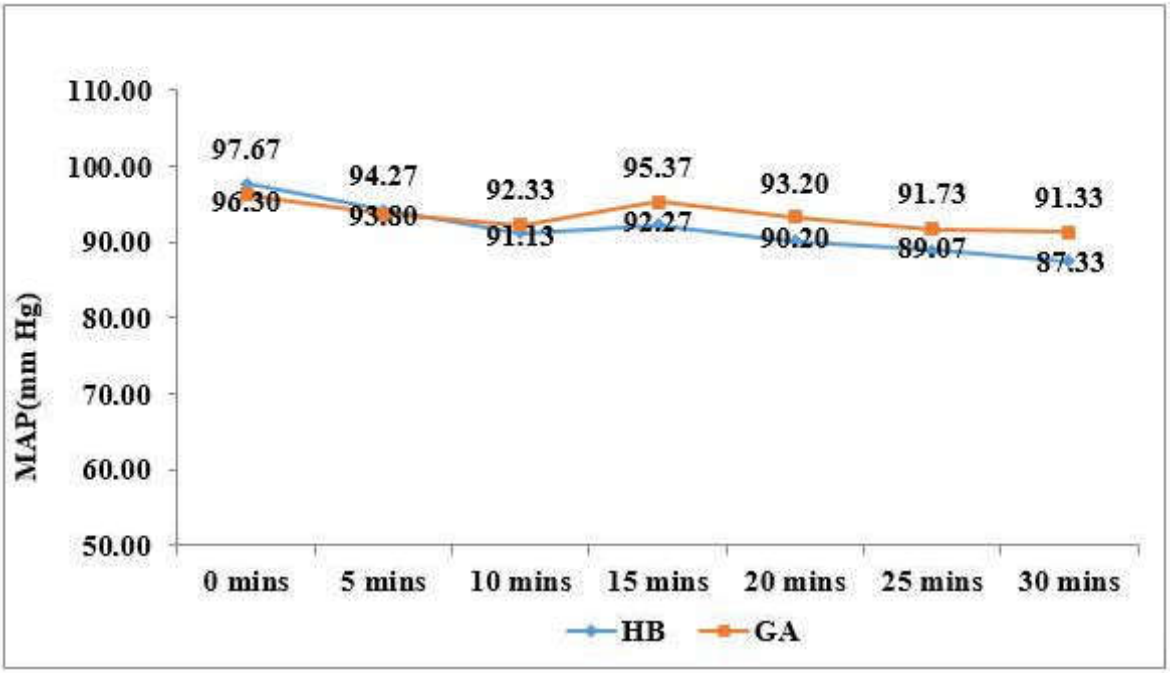

Fig. 2: Comparison of mean arterial blood pressure between HB group and GA group at various intervals of time

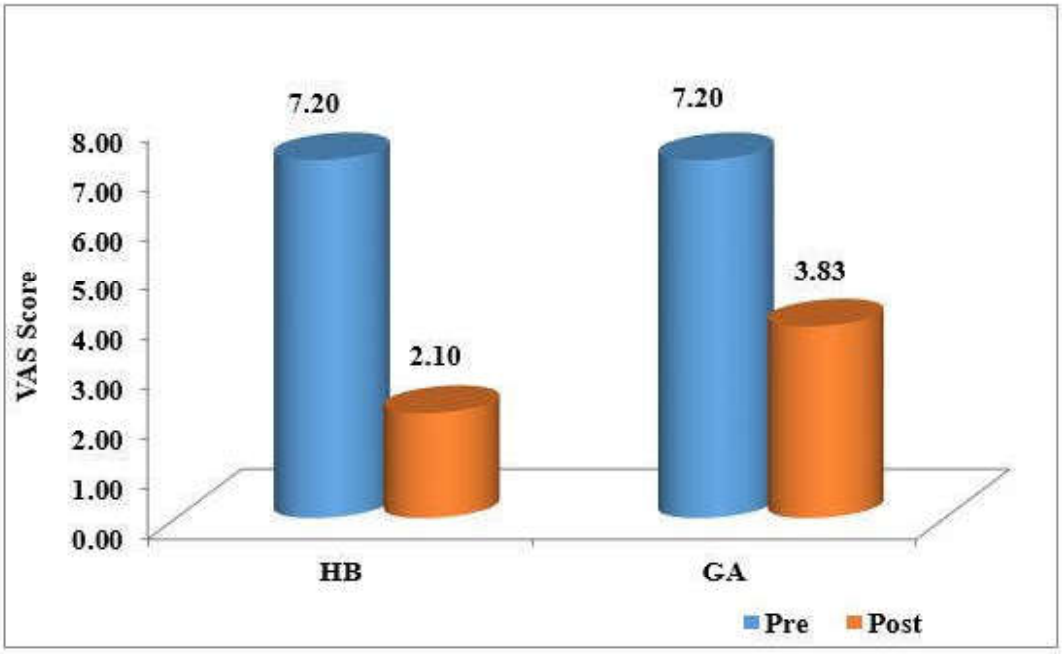

Fig. 3: Comparison of preoperative and postoperative VAS in between HB group and GA group

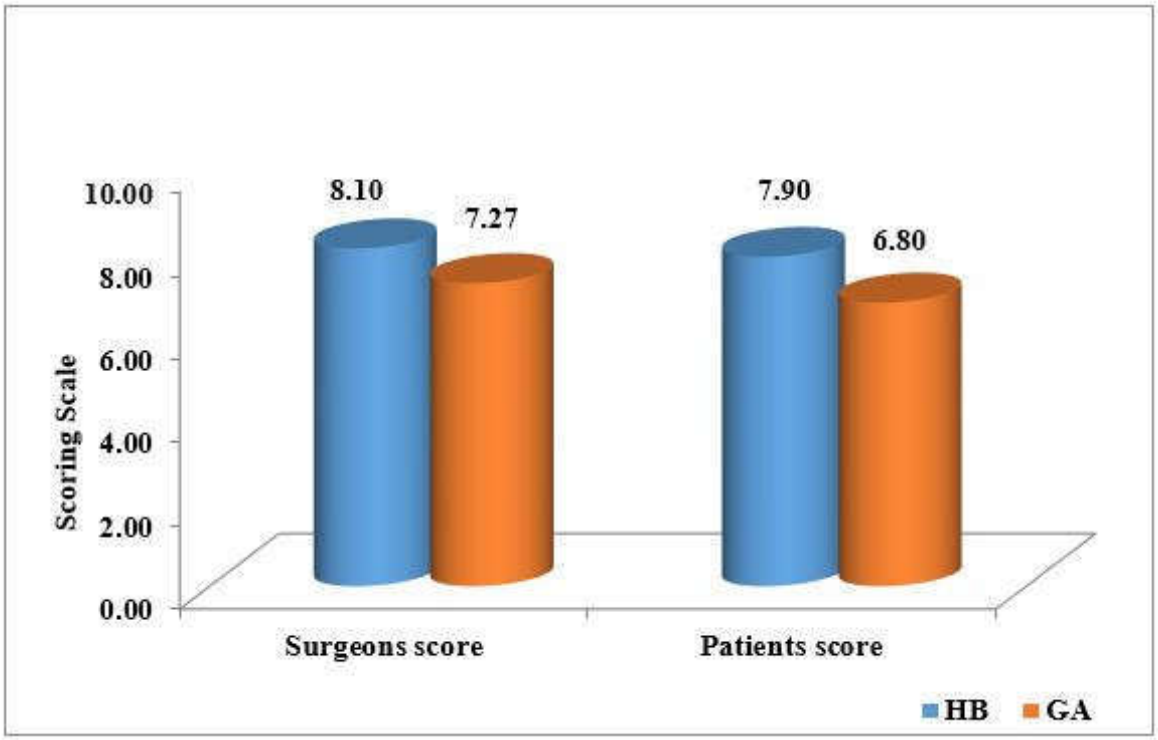

Fig. 4: Comparison of Surgeons' score and Patients'score between HB group and GA group

Discussion

Fractures of the distal radius are common and methods of obtaining pain relief prior to their reduction include general anesthesia, intravenous regional anesthesia, drugs e.g. midazolam and ketamine [11], modified forearm intravenous regional anesthesia, brachial plexus block and local infiltration of the fracture hematoma (hematoma block) [5-10]. Studies have been done comparing these techniques (general anesthesia, sedation alone, sedation with hematoma block, hematoma block alone) but with varying results [5,7-9]. Major advantages of regional anesthesia are early recovery, early ambulation and cost-effectiveness [12].

Hematoma block is commonly used for closed reduction of distal radius fractures. Studies have done have using lignocaine as common drug. The infiltration of local anesthetic agent within the fracture site serves to block the nerve fibers of the surrounding soft tissues and the periosteum around the fracture [9]. Recently ultrasonography has been used to assist in institution of hematoma block [13]. Studies have been done using buffered lignocaine and hyaluronidase but with no added resultant advantage [11,14].Study concluded that if appropriate precautions are taken hematoma block is safe with no increased risk of infection [15]. Advantages of hematoma block are shorter waiting time, manipulation time, early recovery, early ambulation, good patient acceptance and cost-effectiveness [7].

Funk et al [7] studied by administering hematoma block and general anesthesia in 40 people and concluded that patients experienced pain during manipulation with hematoma block while patients under general anesthesia had no pain. Myderrizi and Mema [9] conducted a study and concluded that there is no significant difference between two modes of anesthesia in pain intensity after hematoma block and 10-15 minutes waiting for analgesic effect induction. In our study, we waited for 10 minutes for analgesia to be inducted for hematoma block action and its effectiveness. Application of an elastic bandage above the fracture site before administration of hematoma block would limit the spread of local anesthetic and result in better blockade. None of these studies used elastic bandage before hematoma block was given. But in our study we used elastic bandage. This could have resulted in better pain relief as assessed by patients' hemodynamic variables intraoperatively and VAS scores post-reduction.

In our study following reduction of fracture, patients who received hematoma block had better

pain relief when compared with those who received general anesthesia. Patients had better acceptability of hematoma block (Patients' score= 7.90±0.711) ($p<0.001$, Table 4, Figure 4) as their choice because they could be awake during procedure, had good pain relief during and following reduction of fracture and early discharge from hospital. Surgeons too had better acceptability of hematoma block (Surgeons' score= 8.10±0.661) ($p<0.001$, Table 4, Figure 4) as their choice because of equally good radiological correction of fracture, early ambulation and early discharge from the hospital. We did not use sedation in addition to hematoma block so as to assess the effectiveness of this technique alone. Previous studies done showed that general anesthesia or hematoma block with sedation as their technique of choice when compared to hematoma block alone. Patients who received analgesics within 8 hours prior to reduction were excluded because this could bias the results obtained. Hematoma block may fail or be ineffective when, the time since injury is beyond 96 hours as the clot organizes.[6] In our study we excluded patients who had their injury beyond 96 hours.

Pain reduction was significant ($p<0.001$) (Table 4) following hematoma block (Pre-Post VAS=5.10±0.711) during manipulation and reduction of fracture compared to presentation during admission. Following reduction of fracture, pain was significantly greater ($p<0.001$) in GA group (Postoperative VAS=3.83±0.64) when compared to HB group (Postoperative VAS=2.10±0.48) (Table 4, Figure 3). We did not notice any adverse events/ effects in either groups. A correctly performed hematoma block will have good patients' acceptance compared to general anesthesia.Even though a formal cost-effectiveness analysis was not done in our study, the difference in expenses was obvious, with significant savings in the HB group.

Infection at the injection site [16], local anesthetic toxicity[17] and compartment syndrome [18] are the possible complications with hematoma block but the probability is very low. Dorf E et al [17] recorded a case of lignocaine toxicity after hematoma block by injecting 10 ml of 2% Inj.lignocaine. Younge D et al [18] documented a case of compartment syndrome after hematoma block used for wrist fracture. There were no complications associated with any of the procedures in our study.

Conclusion

Hematoma block using 2% Inj.lignocaine is a safe and effective alternative to general anesthesia in reducing fractures of distal end of radius. Patient acceptance is greater with a correctly performed hematoma block compared to general anesthesia. It would be beneficial in clinically high risk patients in whom administration of general anesthesia would be detrimental.

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Nil

Conflicts of Interest: Nil.

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