Axillary Nerve Block in Comparison with Intravenous Midazolam/Fentanyl for Painless Reduction of Upper Extremity Fractures

Hossein Alimohammadi[1], Mohammad-Reza Azizi[1], Saeed Safari[1], Afshin Amini[1*], Hamid Kariman[1], and Hamid Reza Hatamabadi[2]

[1] *Department of Emergency Medicine, Imam Hossein Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran*
[2] *Safety Promotion and Injury Prevention Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran*

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Abstract- The painful nature of fractures has made it inevitable to use various anesthetic techniques to reduce or immobilize fractured parts. In the present study, axillary nerve block was compared with intravenous midazolam/fentanyl to induce anesthesia for Painless Reduction of Upper Extremity Fractures. The subjects in the present clinical trial consisted of 60 patients with upper extremity fractures. They were randomly divided into two equal groups of intravenous sedation (IVS) with midazolam/fentanyl and axillary nerve block (ANB). Rate of anesthesia induction, recovery time, and pain intensities at baseline, during the procedure and at the end of the procedure were recorded in both groups. Data was analyzed and compared between the two groups with SPSS 18 statistical software using appropriate tests. Demographic data, vital signs and means of pain intensities at the beginning of the procedure were equal in the two groups. In the IVS group, the overall duration of the procedure was shorter with more rapid onset of anesthesia ($P<0.05$). In contrast, the recovery time was much shorter in the ANB group ($P<0.001$). No life or organ threatening complications were observed in the two groups. Axillary nerve block can be considered an appropriate substitute for intravenous sedation in painful procedures of the upper extremity.

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Keywords: Axillary nerve block; Intravenous sedation; Midazolam/fentanyl; Fracture reduction

Introduction

Traumatic injuries to the upper extremities constitute the most common reasons for referrals to emergency departments (1). The painful nature of these injuries necessitates the use of various anesthetic techniques to reduce or immobilize the fractured organ. Familiarity of emergency physicians with the advantages and disadvantages of each of these procedures is of utmost importance in selecting the most appropriate procedure based on the clinical characteristics and background medical conditions of each patient. Two of these techniques are intravenous procedural sedation and analgesia (PSA) and nerve block. IVS is always associated with the possibility of rare but serious consequences and require a constant hemodynamic monitoring (2). In recent years, the use of nerve block techniques has been on the increase for painless emergency procedures due to ease of application, efficacy and reasonable safety (3, 4). Nerve block of the upper extremity can be achieved at different levels with the help of surface landmarks or with the use of a nerve stimulator or ultrasound technique (5, 6). The main propose of the present study was to compare ANB with intravenous midazolam/fentanyl in the induction of anesthesia to reduce fractures of the upper extremity.

Materials and Methods

Sixty patients with upper extremity fractures were included in the present randomized clinical trial study. All the patients had referred to the emergency department of Imam Hossein Educational Hospital during May and June 2011. Patients with concomitant traumatic injuries to other locations, diabetes, drug hypersensitivities, cardiopulmonary problems, concomitant neurovascular injuries and drug abuse were excluded from the study. Subsequent to a definite diagnosis of fracture with plain radiographic techniques, the advantages and disadvantages of the two anesthetic

Corresponding Author: A. Amini
Department of Emergency Medicine, Imam Hossein Hospital, Tehran, Iran
Tel: +98 21 77558081, Fax: +98 21 77556069, E-mail address: a.amini@sbmu.ac.ir

techniques with ANB and IVS were fully explained to each patient and informed written consent was obtained. Then random numbers table was used to randomly assign patients to IVS or ANB group. In IVS group, a combination of midazolam with a dose of 0.1 mg/kg and fentanyl with 3µg/kg was intravenously administered under complete cardiopulmonary monitoring and direct supervision of an emergency physician. In ANB group, subsequent to thorough neurovascular examination, a total of 20 mL of 1% lidocaine was administered in a transarterial technique by palpating the axillary pulse in the affected side. Visual analog scale (VAS) was explained to the subjects and severity of pain before the procedure was recorded as numbers ranging from 1 to 10. After anesthesia took effect, the fractured bones were reduced in both groups and the patients were monitored until they achieved the criteria indicating the completion of the procedure, which included full consciousness, stability of vital signs, patency of the airways and the ability to speak, sit without any assistance and completely carry out the orders. The severity of pain was recorded once during the procedure and once 30 minutes after the procedure was completed in both groups. Finally, demographic data, procedure initiation and completion times, the rate of the onset of anesthesia, recovery time, and severity of pain at baseline, during the procedure and at the end of the procedure were collected and recorded. Data was analyzed and compared between the two groups with SPSS 18 statistical software. In the present study, the overall time interval between the entry into and exit from the operating room was considered the total duration of the procedure. In addition, the rate of anesthesia induction was defined as the time interval between the beginning of injection and adequate anesthesia to initiate reduction of the fracture based on the patient's report. The recovery time was defined as the time interval between the completion of the reduction and exit of the patient from the operating room. It should be pointed out that the researchers themselves paid all the costs and no extra costs were imposed on the patients. This study was approved by the Medical Ethics Committee of Imam Hossein Hospital, Tehran, Iran and was based on the Principles of Medical Ethics issued by the Ministry of Health and Medical Education.

Result

The A total of 60 patients with upper extremity fractures were equally divided into two groups. Table 1 presents the demographic data and the vital signs at the beginning of the procedures in the two groups. Table 2 presents means of pain severities at the beginning, during and 30 minutes after completion of the procedures.

Table 1. Demographic data and vital signs at the beginning of the procedures in the two groups

Variable	Group 1	Group 2	*P* value
Age (year)	38.1 ± 19.4	38.1 ± 16.9	0.24
Sex (Male)	21/9 (70%)	20/10 (66.7%)	
Weight (Kg)	66.4 ± 16.4	68.4 ± 11.7	0.56
Pulse Rate (beat/min)	86 ± 8	82 ± 9	0.32
Systolic BP*(mmHg)	120 ± 11	117 ± 12	075
Diastolic BP(mmHg)	75 ± 10	75 ± 8	0.64
Saturation O_2 (%)	98 ± 2	98 ± 2	0.39
Respiratory Rate (/ min)	14 ± 2	13 ± 1	0.54

*Blood presure

Table 2. Means of pain severities* at the beginning, during and 30 minutes after completion of the procedures in the two groups

Time	Group 1	Group2	Diff (95% CI)	P value
Baseline	9.3 ± 0.7	9.8 ± 0.5	-0.5 (-0.8 to -0.2)	0.812
During Procedure	3.2 ± 0.9	3.1 ± 1	0.1 (-0.4 to 0.6)	0.727
Change	6.1 ± 1	6.7 ± 1.1	-0.6 (-1.1 to 0)	0.052
Change %	66 ± 9	68 ± 10	-2.4 (-7.5 to 2.7)	0.322
Post Procedure	1.3 ± 0.5	1.1 ± 0.3	0.2 (-0.1 to 0.4)	0.187
Change	8 ± 0.9	8.7 ± 0.7	-0.7 (-1.1 to -0.3)	0.001
Change %	86 ± 6	88 ± 4	-2.4 (-5 to 0.3)	0.001

*Based on visual analog scale (VAS)

The mean pain severity at the beginning of the procedure and the amount of decrease in pain severity were similar in both groups; however, pain severity 30 minutes after completion of the procedure was significantly less in the ANB group (P<0.001). Table 3 compares the total procedure durations, the rate of the onset of anesthesia and the recovery time. As the table shows, the total procedure time was shorter, and the rate of anesthesia induction was faster in IVS group (P<0.001). In contrast, the recovery time was significantly shorter in the ANB group (P<0.001). No complications, including intra-arterial injection, convulsions, drug hypersensitivity reactions and neurovascular problems were observed in ANB subjects.

Discussion

As the results of the present study indicated intravenous use of midazolam/fentanyl has a more rapid onset of anesthesia with less total procedure time compared to ANB. Recovery time was much shorter in the ANB group. In other words, although the IVS has a much faster rate of anesthesia induction, the longer recovery time overshadows the total procedure duration. Exactly the opposite holds in the case of the ANB technique, i.e. the recovery time was short, but the induction of anesthesia was much slower than the intravenous technique. Locating an appropriate injection site in the ANB technique with the use of surface landmarks lengthens the overall procedure time. Fortunately, in recent years use of ultrasound and nerve stimulators has resulted in more rapid identification of nerve location and decreasing the overall procedure duration (7, 9). The two techniques did not reveal any significant differences in relation to pain severity and the amount of decrease in pain severity. However, pain was less severe in the ANB technique 30 minutes after the procedure, indicating a longer anesthetic effect in this group. In the ANB, the physician spends less time for the face-to-face monitoring of the patient during the recovery period, which is very important given the fact that there are a lot of patients in trauma emergency departments (10). No life or limb threatening complications were observed in the present study. In general, it can be concluded that both techniques have some advantages and disadvantages, and it is the responsibility of the physician to select the appropriate technique by carefully considering the clinical situation, hemodynamic state and the background medical condition of each trauma patient.

Axillary nerve block can be considered an appropriate substitute for intravenous sedation in painful procedures of the upper extremity.

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