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Intra-articular lidocaine versus intravenous meperidine/diazepam in anterior shoulder dislocation: a randomised clinical trial

R Shariat Moharari,1 P Khademhosseini,1 R Espandar,1 H Asl Soleymani,1 M T Talebian,1 P Khashayar,2 A Nejati1

ABSTRACT

Background: Anterior shoulder dislocation is one of the most common complaints of patients referred to emergency departments. Intravenous opiates and benzodiazepines are traditionally prescribed in order to relieve the pain in this group of patients; however, complications always pose a problem.

Objective: To compare the pain relief and complications following intra-articular lidocaine and intravenous meperidine/diazepam in patients with anterior shoulder dislocation.

Methods: 48 patients with non-habitual traumatic anterior dislocation of the glenohumeral joint admitted to Imam Khomeini hospital emergency department were enrolled in this randomised clinical trial. They were divided into two groups: one group of patients received intra-articular lidocaine 1%, while the other received intravenous meperidine and diazepam. Closed reduction using the countertraction–traction method was performed by a single person in all the patients. Utilising a 100 mm visual analogue scale, each patient’s pain was recorded before injection, before reduction, and after reduction.

Results: Mean pain (mm) recorded before injection, before reduction, and after reduction in the intra-articular lidocaine group was 84.3 (95% confidence interval (CI) 79.8 to 88.8), 52.6 (95% CI 45.2 to 60.1), and 27.3 (95% CI 19.9 to 34.7), respectively. The corresponding rates in the intravenous meperidine/diazepam group were 83.2 (95% CI 79.2 to 87.2), 57.9 (95% CI 53.8 to 62.0), and 23.9 (95% CI 18.9 to 28.8), respectively. Both groups demonstrated a similar significant decline in pain after injection (p<0.005). No severe complications were reported in either of the groups.

Conclusion: Intra-articular injection of lidocaine before closed reduction of anterior shoulder dislocation produces the same pain relief as intravenous meperidine and diazepam.

The shoulder is the most commonly dislocated joint. Often, little or no trauma is involved and the arm position alone has resulted in dislocation. The clinical diagnosis of anterior shoulder dislocation is simple. Patients typically present the dislocation with one arm slightly abducted and extended with the elbow flexed and the opposite arm supporting it. Most shoulder dislocations are anterior, and in most such dislocations, the humeral head assumes a subcoracoid position. Subglenoid, infraclavicular, and intrathoracic dislocations are uncommon variants of anterior dislocation.1,2

Different reduction methods are applied in patients with anterior shoulder dislocation. All of the dislocations are believed to be painful, difficult for medical staff, and potentially traumatic (theoretically, neurovascular injuries could be caused or exacerbated).2,3 Administration of a combination of different sedatives, hypnotics and analgesics has brought about successful results, while accompanying complications have always proved challenging.

Many studies have tried to find out an alternative to the above combinations. Intra-articular injection of lidocaine is one such alternative.4 Several studies have reported the pain relief following intra-articular administration of lidocaine as being similar to that achieved with intravenous morphine/diazepam or intravenous midazolam/fentanyl. According to these studies, the reduction process was easier for both patients and physicians using intra-articular injection.5-6

In contrast, other studies have reported that this method of administration does not result in the same degree of pain relief as is achieved using intravenous opiates and benzodiazepines.7

The objective of our study was to compare the level of pain relief and resulting complications following intra-articular lidocaine and intravenous meperidine/diazepam in patients with anterior shoulder dislocation.

PATIENTS AND METHODS

This non-blind, randomised clinical trial was performed at Imam Khomeini hospital, a university affiliated hospital. The human clinical research ethics committee of Tehran University of Medical Sciences approved the study. Patients who presented to the emergency department with acute non-habitual traumatic anterior dislocation of the glenohumeral joint, confirmed at x-ray, from May 2005 until 2006 were eligible for inclusion in the study. The patients selected were aged between 18 and 80 years. Those patients with a simultaneous fracture, multisystem multiple traumas, distal neural injury in the upper extremity, dermal infection of the shoulder, haemorrhagic disorders, and allergies to the drugs administered during this study, as well as those requiring reduction in more than a joint, were excluded. Addicted individuals, who used opioids regularly, were also excluded. The procedures and the objectives of the study were described for all the patients and they all signed an informed consent form.

The patients were randomly assigned into two groups using a computer random number generator. In the first group, intravenous meperidine
25 mg and diazepam 5 mg was slowly injected over 1–2 min, and the reduction was performed in 5 min. In the second group, an intra-articular injection of lidocaine 1% was administered via the anterior method, as it was much easier. Initially, 1 ml of lidocaine 1% was used to achieve skin anaesthesia, and then a needle was inserted in the inferior lateral site of the coracoid in a posterior direction, until it reached the glenoid hole. Then 20 ml of lidocaine 1% was injected into the shoulder joint. At least 15 min were allowed to elapse before the reduction attempt. A traction–countertraction method was applied to reduce the dislocation. In this method, traction is applied along the abducted arm while an assistant applies countertraction using a folded sheet by wrapping it across the chest. It should be noted that the physician and the resident, who were respectively responsible for undertaking the injections and performing the reductions, had both gone through the necessary learning curve and participated in this study only when they had reached an adequate level of skill in performing the procedures.

All the patients were monitored with ECG, pulse oximetry and capnography throughout the reduction period. Closed reduction was performed via traction–countertraction by a single physician in all of the patients. In the event of a reduction failure, the protocol allowed the crossover into the other group. Complications such as hypotension (systolic blood pressure <90 mm Hg), bradycardia, respiratory depression (SpO2 <92%, Et CO2 >40%), pain and drowsiness were recorded by a technician blind to the study objectives and the patient’s group. Pain was measured subjectively using a 100 mm visual analogue scale (VAS). Each patient was interviewed by the technician and was asked to rate their pain before injection, before reduction, and after reduction. Drowsiness was calculated based on the Ramsay Sedation Scale (RSS). An RSS level of 5 was the goal sedation level in the group who received intravenous diazepam/meperidine. In this group, drowsiness was considered as a complication when the patient presented with an RSS level of ≥4. In the intra-articular lidocaine group, as no sedation was expected, drowsiness was considered as a complication in those patients with an RSS level of 3 (responds to commands only).

During the pilot study, the difference between the pain score (VAS) of the two groups were calculated (mean difference 7.5); according to this finding, and with α = 0.05 and a power of 80%, a sample size of 48 (24 patients in each group) was required. The statistical analyses were performed using SPSS10 software. We used repeated measurements analysis of variance (ANOVA) and Student’s t test, if indicated, to compare pain scores between and within the groups. If the data series were not normally distributed, non-parametrical tests were used. Fisher’s exact test was also used to compare the complications between the two groups. A value of p<0.05 was considered significant.

RESULTS
Forty-eight patients were enrolled in the study and were divided into two groups, each comprising 24 patients, including 22 males (91.7%). Mean (SD) age in the intravenous meperidine/diazepam (IVMD) and intra-articular lidocaine (IAL) groups were 38.9 (15.6) and 31.7 (9.2) years, respectively (t = 1.941, p = 0.058). The mean weight of the patients was 75 (4.6) kg (range 58–95 kg).

Pain assessment based on the 100 mm VAS is outlined in table 1. As shown in table 2, significant pain relief was achieved in both groups (F = 207.493, p = 0.001), and the duration of pain relief was similar (F = 5.077, p = 0.056).

The first attempt at reduction was successful in 19 cases (79.2%) in the IVMD group and in 14 cases (58.3%) in the IAL group; however, a second attempt was required in five (20.8%) and four (16.7%) cases in the IVMD and IAL groups, respectively. It should be noted that six patients (25%) in the IAL group required a third attempt at reduction. The Mann–Whitney test did not reveal a significant difference between the two groups in the number of attempts required for a successful reduction to be achieved (Z = 1.994, p = 0.05). In addition, reduction was performed more rapidly in the IVMD group (t = 3.660, p = 0.001), while patients in the IAL group had to stay in the emergency department for a shorter period of time (t = 2.454, p = 0.018) (table 3).

Complications were reported in 14 (58.3%) and three (12.5%) patients in the IVMD and IAL groups, respectively (χ2 = 11.021, p = 0.001). These complications are listed in table 4. Respiratory depression requiring intervention occurred in five of the patients in the IVMD group, whose situation improved following bag mask ventilation. Intubation was performed in none of these cases.

All the patients were reported to have an RSS level of 1 (anxious, agitated or restless) at the time of admission. Three of the patients in the IAL group had an RSS level of 3 and were considered to be drowsy. On the other hand, this complication was more frequent in the IVMD group; five patients were reported to have an RSS level of 4.

DISCUSSION
The results of the present study revealed that the administration of intra-articular lidocaine has the same pain relieving effects as intravenous meperidine and diazepam; in addition, it resulted in fewer complications. In other words, intra-articular lidocaine did not have any significant sedative, musculoskeletal or anxiolytic effects compared to diazepam; moreover, according to the present study, it provided pain relief before

### Table 1. Changes in pain scores (mean difference between two times and 95% confidence intervals) from before injection to after reduction

<table>
<thead>
<tr>
<th></th>
<th>IVMD</th>
<th>IAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before injection</td>
<td>83.2 (9.5)</td>
<td>84.3 (10.8)</td>
</tr>
<tr>
<td>Before reduction</td>
<td>79.2 to 87.2</td>
<td>79.8 to 88.8</td>
</tr>
<tr>
<td>After reduction*</td>
<td>57.9 (9.7)</td>
<td>52.6 (17.7)</td>
</tr>
<tr>
<td></td>
<td>53.8 to 62.0</td>
<td>45.2 to 60.1</td>
</tr>
<tr>
<td></td>
<td>23.9 (11.8)</td>
<td>27.3 (17.5)</td>
</tr>
<tr>
<td></td>
<td>18.9 to 28.8</td>
<td>19.9 to 34.7</td>
</tr>
</tbody>
</table>

IAL, intra-articular lidocaine; IVMD, intravenous meperidine/diazepam.

*15 min after IAL injection.
reduction similar to that obtained with intravenous meperidine/diazepam.

In a study conducted by Orlinsky et al., it was shown that, compared with intra-articular lidocaine, intravenous meperidine and diazepam was more effective in reducing pain score (before reduction). The difference between the pain scores following the injection (before reduction) and at the time of discharge, and also between the time of admission and discharge, was shown to be the same in the two groups. It also stated that sufficient pain relief was not achieved in 24% and 4% of the patients who had received intra-articular lidocaine and intravenous meperidine/diazepam, respectively. As a result, the success rate in the two groups was stated to be 44% and 55%, respectively. In the study by Kosnik et al., failure was reported in five of the patients who had received IAL; four of them were cured by changing the treatment protocol. As a result, they documented the success rate to be higher in the group who had received intravenous diazepam and morphine (IV: 100%; IA: 97%). Conversely, Lippitt et al. showed a 100% success rate in the group who had received intra-articular lidocaine, and a 75% success rate in the group who received the intravenous drugs. Likewise, Suder et al. stated a nearly similar success rate in the two groups (IV: 94%; IA: 97%). Mathews and Roberts did not state any failure using either of the above mentioned medications.

In the current study, an acceptable result was achieved despite the number of attempts performed. The first attempt at reduction was successful in 79% of the cases in the IVMD group and 58% in the IAL group. However, reduction was accomplished following a second attempt in the remaining patients in the IVMD group; a third attempt was required for some patients in the IAL group. There was no significant difference between the two groups (p = 0.058). In our study the time required for the manoeuvre to be performed in the IVMD group was less than in the IAL group; however, recovery time was less in the IAL group (p = 0.012). It should be noted that an interval of 15 min is needed before the effect of lidocaine begins, while reduction can be done in a shorter time in the IVMD group. Such a result has never been reported in other studies.

Following intra-articular injection of lidocaine, no severe complications were reported in the present study. Intra-articular injection is a very rare event under normal circumstances, and therefore the finding of no infection in this trial is not surprising. This potential type II error is one of the limitations of the study. Conversely, several complications were seen in the IVMD group, none of which interfered with the treatment course or was life threatening. Drowsiness was reported in three of the cases in the IAL group. Further investigations revealed that these patients had used analgesics (tramadol) before being enrolled in this study in order to reduce their pain. They had not mentioned this fact before and so it was a limitation of the study. The weight of our patients ranged from 58–93 kg; as a result, lidocaine toxicity following the administration of 210 mg lidocaine was not troublesome in these patients.

Complications secondary to intra-articular injection of lidocaine was not seen in any of the studies by Kosnik et al., Suder et al., Lippitt et al. and Matthews and Roberts. Complications following intravenous injection in the aforementioned studies were 5%, 11%, 12%, and 30%, respectively; it should be noted that, except for the Suder study, none of the complications were reported to be severe. Cunningham has stated the possibility of joint infection following an intra-articular injection of lidocaine, which is not reported in any other study.

**CONCLUSION**

According to our study’s findings, intra-articular lidocaine appears to be a suitable analgesia alternative to intravenous opiates and benzodiazepines for the reduction of spontaneous anterior shoulder dislocation. Further studies addressing the issues surrounding the associated complications are required before definite conclusions regarding safety can be made.

**Competing interests:** None declared.

**Ethics approval:** This study has been approved by the Human Clinical Research Ethics Committee of Tehran University of Medical Sciences.

**Patient consent:** Informed consent was obtained from all patients participating in this study.

**REFERENCES**