

Intra-articular lidocaine versus intravenous sedation for the reduction of anterior shoulder dislocations in the emergency department

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ABSTRACT

Objective: The objective was to compare intra-articular lidocaine (IAL) versus intravenous sedation (IVS) for the reduction of acute, anterior shoulder dislocations in the emergency department (ED) in terms of ED length of stay, rate of successful reductions, patient satisfaction, and complications.

Methods: This was a prospective, randomized trial. Patients in the IAL group received 4 mg/kg (up to 200 mg) of 1% lidocaine injected into the glenohumeral joint using a lateral approach. Patients in the IVS group received medications for sedation as per the discretion of the treating physician. Follow-up was arranged within 2 weeks of the ED visit to assess for complications.

Results: Forty-four patients (25 IAL, 19 IVS) were included. This trial was stopped early owing to a combination of unexpected findings in success, resource limitations, and difficulty in patient enrolment. Median time from first physician assessment to patient discharge was not different between the IAL (170 minutes) group and the IVS (145 minutes) group (Δ -25 minutes; 95% CI -32, 70; $p = 0.46$). There was a significantly lower rate ($p < 0.001$) of successful closed reduction in the IAL group (48%) compared to the IVS group (100%). Patient satisfaction and physician ease of reduction were higher in the IVS group compared to the IAL group ($p < 0.05$). There were no reported complications in either group at time of reduction or follow-up.

Conclusions: There was no difference in ED length of stay between groups. There was a lower rate of successful reductions and lower satisfaction scores in the IAL group.

RÉSUMÉ

Objectif : L'objectif consistait à comparer l'injection de lidocaïne intra-articulaire (LIA) avec la sédation intraveineuse

(SIV) dans la réduction d'une dislocation antérieure aiguë de l'épaule au service des urgences (SU) quant à la durée du séjour, au taux de réussite de la réduction, à la satisfaction des patients et aux complications.

Méthodes : Il s'agissait d'un essai randomisé prospectif. Les patients du groupe de la LIA ont reçu 4 mg/kg (jusqu'à 200 mg) de lidocaïne à 1 % par injection dans l'articulation de l'épaule abordée par voie latérale. Les patients du groupe de la SIV ont reçu des médicaments sédatifs choisis par le médecin traitant. Le suivi était prévu deux semaines après la visite au SU afin d'évaluer les complications.

Résultats : L'essai comptait 44 sujets (25 pour la LIA et 19 pour la SIV). Il a été interrompu de manière précoce en raison d'une combinaison de facteurs, soit des résultats imprévus quant à la réussite, des ressources limitées et le recrutement difficile des sujets. Le temps médian écoulé entre la première évaluation par le médecin et le congé du patient n'était pas différent dans les deux groupes : 170 minutes pour le groupe de la LIA et 145 minutes pour la SIV (D : 225 minutes; IC à 95 % : 232, 70; $p = 0,46$). Le taux de réussite de la réduction par manipulation était significativement plus faible ($p < 0,001$) dans le groupe de la LIA (48 %) que dans le groupe de la SIV (100 %). La satisfaction des patients et la facilité avec laquelle les médecins ont effectué la réduction étaient plus élevées dans le groupe de la SIV que dans celui de la LIA ($p < 0,05$). Aucune complication n'a été signalée dans les deux groupes tant au moment de la réduction que du suivi.

Conclusions : Aucune différence n'a été observée entre les deux groupes quant à la durée du séjour au SU. Par contre, on a constaté des taux plus faibles de réussite de la réduction et de satisfaction dans le groupe de la LIA.

Keywords: emergency department, intra-articular lidocaine, procedural sedation, shoulder reduction

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Shoulder dislocations are common and occur more frequently than dislocations of all other major joints combined.¹ The annual incidence of glenohumeral dislocations is approximately 17 per 100,000 or 0.017%.¹ The large range of motion of the shoulder predisposes it to instability and injury. The majority of patients with shoulder dislocations are treated in the emergency department (ED); thus, emergency physicians need to be familiar with the appropriate management of this injury.

Intravenous sedation (IVS) is commonly used to overcome both muscle and psychological tension to facilitate shoulder reduction. Although IVS is the most frequently used technique, it can be time and labour intensive, requiring the appropriately monitored setting and available personnel to be performed safely. Previously published studies have suggested that intra-articular lidocaine (IAL) injection is an effective alternative method to IVS.²⁻⁸ IAL does not require monitoring, is less time and labour intensive, and has limited side effects, the most serious being potential joint space infection. Two studies found significantly decreased ED length of stays when IAL was used compared to IVS.^{3,8} A recent systematic review of published studies comparing the two methods found that there was no difference in the success rate between IAL and IVS and the immediate complication rate was significantly higher in the IVS groups.⁹ The authors concluded that IAL should be considered as a first-line therapy for shoulder reductions in the ED.

The objective of this study was to compare the ED length of stay, rate of successful closed reductions, patient satisfaction, physician ease of reduction, and both immediate and delayed complications when IAL was used compared to IVS for the reduction of an acute, anterior shoulder dislocation in the ED.

METHODS

Study design and setting

This prospective, randomized, controlled study was conducted in three tertiary care academic EDs (combined annual volume 150,000) in London, Ontario. The study protocol was approved by The University of Western Ontario Research Ethics Board prior to patient recruitment, and written consent was obtained from all participants.

From July 2007 to January 2010, patients aged 16 years and older presenting to an academic ED requiring closed reduction for an acute anterior shoulder dislocation were invited to participate. Patients were excluded if they had a regional fracture other than Hill-Sachs, multitrauma, Glasgow Coma Scale (GCS) score less than 15, or allergies to any study medications or if they were previously enrolled.

Intervention

After informed written consent, patients were randomly assigned to receive IAL or IVS to facilitate shoulder reduction. Randomization was achieved using a fixed 1:1 allocation ratio using a computer-based random number generator. Small random block sizes of two or four were used to optimize equal allocation to each treatment arm. Group allocation was concealed from physicians, nurses, and patients using sealed, opaque envelopes. Patients in the IAL group received 4 mg/kg (up to 200 mg) of 1% lidocaine injected into the glenohumeral joint using a lateral approach. In this technique, the coracoid and the acromion are localized with the attending physician's index finger and thumb. The correct needle placement is midway between these two points, approximately 2 cm inferior to the acromion (Figure 1). It is here that the lateral sulcus can be palpated, which is the soft spot formed by the absent humeral head. We recommended using a 22-gauge needle and advancing the syringe perpendicular to the humerus. Aspiration of blood confirmed intra-articular placement; however, blood was not



Figure 1. Appropriate landmarking for injection into the glenohumeral joint using the lateral approach.

always aspirated. To ensure that enrolling physicians were familiar with this method, model demonstrations of the technique were performed and a description and a photograph delineating the proper land marking were included in all study packages.

Patients in the IVS group received sedation medications and dosing as per the discretion of the treating physician. As there is no procedural sedation protocol in effect at our ED, we felt that leaving the choice of medications and dosing to the treating physician was the current standard of care in our department.

Preprocedural analgesia use during initial assessment or while obtaining radiographs was left to the discretion of the treating physician. Postreduction, patients were asked to rate their satisfaction with the procedure using a 7-point ordinal scale ranging from 1 (very dissatisfied) to 7 (very satisfied). Physicians recorded the ease of reduction on a similar 7-point ordinal scale from 1 (very easy) to 7 (very difficult). Reduction technique and number of attempts were also recorded. If reduction of the shoulder was not possible after multiple attempts, shoulder reduction was facilitated by alternate medications, as determined at the discretion of the attending physician. Procedural complications and failure to reduce the shoulder were also recorded. All physicians were asked to document if they were unable to locate anatomic landmarks, if there was inadequate analgesia, or if the patient had an allergic reaction. Additionally, there was a blank space on the data collection form labeled "other complications" for the attending physician to document any other complications, which may have included hypotension, respiratory depression, or hypoxia that occurred during the procedure. Follow-up was arranged in an outpatient sport medicine clinic within 2 weeks of the ED visit to assess for potential late complications.

Outcome measures

The primary outcome was ED length of stay, defined as the time from initial physician assessment to ED discharge. Secondary outcomes included the percentage of successful closed reductions, patient satisfaction score, physician ease of reduction score, and the occurrence of complications. To have an 80% chance of detecting a clinically meaningful difference in ED length of stay of 60 minutes between the two groups, assuming α of 0.05 and a standard deviation (SD) of

90 minutes, it was estimated that 36 patients would need to be enrolled in each group.

Data analyses

Data are reported using descriptive statistics (SPSS version 13.0, SPSS Inc, Chicago, IL). Continuous variables are summarized as means with SDs or medians with interquartile ranges (IQRs) and 95% confidence intervals (CIs) for the delta where appropriate. Categorical data are presented as frequency counts and proportion of occurrence. Differences in median ED length of stay between the IAL and IVS groups were assessed using the nonparametric Mann-Whitney U test with a two-sided level of significance of $p = 0.05$ and are presented with effect sizes and 95% CIs based on the Hodges-Lehmann method. Differences in proportions of successful closed reductions, patient and physician satisfaction scores, and complications between groups were assessed using the nonparametric chi-square test with one degree of freedom ($df = 1$) and two-sided level of significance of $p = 0.05$. If the expected frequency count in any cell was less than five, results from the Fisher exact test were used. All data were analyzed based on the intention-to-treat principle.

RESULTS

This trial was stopped prior to reaching the calculated sample size owing to a combination of unexpected findings in success, resource limitations, and difficulty in patient enrolment. Forty-four patients were enrolled (Figure 2). Twenty five (56.8%) were allocated to the IAL group and 19 (43.2%) were allocated to the IVS group. Median (IQR) age was 27 (21–54) years, and 35 (79.5%) were male. Nineteen (43.2%) had a known previous ipsilateral dislocation(s). Twenty-two of the 44 patients received preprocedural analgesia, with doses and medication choice left to the discretion of the attending physician. Medications used for preprocedural analgesia included ketorolac, fentanyl, and morphine. Patient characteristics can be found in Table 1. Of the patients in the IVS group, physician choice of procedural medication was propofol in all cases, either alone ($n = 13$) or in combination with fentanyl ($n = 5$) or ketamine ($n = 1$).

Median (IQR) time from first physician assessment to patient discharge was 170 (125–249) minutes in the

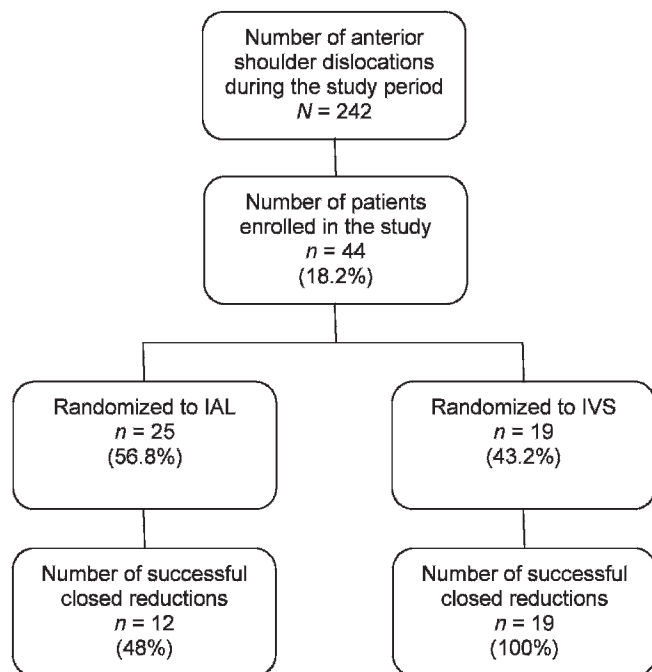


Figure 2. Flow diagram of participants. IAL = intra-articular lidocaine; IVS = intravenous sedation.

IAL group; which was not statistically different from 145 (125–220) minutes in the IVS group ($\Delta -25.0$; 95% CI $-32, 70$; $p = 0.46$). Length of stay times were not improved in the IAL group when only successful cases were examined. There was a significantly lower rate ($p < 0.001$) of successful closed reduction in the IAL group (12; 48%) compared to the IVS group (19; 100%). In all cases, physicians reported inadequate analgesia as the reason for failure of IAL. All IAL failures were subsequently reduced in the ED with IVS. There were no differences in age, gender, previous dislocation status, reduction technique, or preprocedural analgesia use between IAL successes and failures. The majority of patients were reduced with one to two attempts. Four patients (two IVS, two IAL) required three to four attempts, and one patient in the IAL group required five to six attempts prior to

reduction. Patient satisfaction and physician ease of reduction were higher in the IVS group compared to the IAL group (Table 2). Follow-up was available for 28 of 44 patients (63.6%). There were no reported complications in either group at the time of reduction or follow-up.

DISCUSSION

Compared to other published studies, we found unexpected differences in the rate of successful reductions, ED length of stay, and complication rate. ED length of stay was not significantly different between the two groups. Patients in the IVS group were given either propofol alone or in combination with fentanyl or ketamine. These medications have a rapid onset and short half-lives and are easily titratable, allowing for rapid offset of effect and faster recovery compared to medications used in previously reported studies, such as morphine and meperidine in conjunction with either diazepam or midazolam.⁹ However, despite this, mean ED length of stay for the IVS group in our study (172 minutes) was similar to previously published times (186 minutes,³ 185 minutes⁸). However, the ED length of stay for the IAL group (197 minutes) was greater than those previously published (78 minutes,³ 75 minutes⁸). It remains unclear why this discrepancy occurred. Perhaps these results reflect the flow of patients in our ED, with procedural time representing only a small fraction of total ED length of stay. Another possibility could be that there were no a priori discharge criteria, so patients may have been observed as per past experience rather than on their ability to leave.

A recent systematic review involving 283 participants from six randomized, controlled trials reported an 89.9% (129 of 135) success rate for IAL and 95.6% (129 of 135) for patients who received IVS.⁹ In our

Characteristic	IAL	IVS	Total
Number (%) of patients	25 (56)	19 (43)	44
Median (IQR) age, yr	43 (22–54)	27 (20–46)	27 (21–54)
Male gender, <i>n</i> (%)	20 (80)	15 (78.9)	35 (79.5)
Previous ipsilateral dislocation(s), <i>n</i> (%)	10 (43)	9 (47)	19 (43.2)
Preprocedural analgesia use, <i>n</i> (%)	13 (52)	13 (68)	26 (44)

IAL = intra-articular lidocaine; IQR = interquartile range; IVS = intravenous sedation.

Table 2. Summary of results

Result	IAL (<i>n</i> = 25)	IVS (<i>n</i> = 19)	Effect size (95% CI)
Number (%) of successful closed reductions	12 (48)	19 (100)	−52 (−70, −27)
Median (IQR) time from first physician assessment to patient discharge, min	170 (125–249)	145 (125–220)	−25 (−32, 70)
Mean (SD) time from first physician assessment to patient discharge, min	197 (116)	172 (83)	−25 (−38, 88)
Number (%) of patients extremely satisfied with level of sedation	12 (48)	15 (79)	−31 (−53, −3)
Number (%) of physicians extremely satisfied with ease of reduction	6 (24)	13 (68)	−44 (−65, −15)

IAL = intra-articular lidocaine; IQR = interquartile range; IVS = intravenous sedation.

study, the success rate for IAL was only 48%. The injection technique and medication used in our study were similar compared to the majority of published studies. To ensure that enrolling physicians were familiar with this method, model demonstrations of the IAL technique were performed and a description and a photograph delineating the proper land marking were included in all study packages. We believe that the physicians participating in our study were confident with the IAL procedure; however, we cannot comment directly on the individual physician competence.

Our results did not show any complications in either group at the time of the procedure or at follow-up 2 weeks later. Not all patients were available for follow-up, and it is possible that late complications were missed. In the previously mentioned systemic review, there was a combined complication rate of 0.67% for IAL and 13.3% for IVS, with some patients requiring intervention or admission to hospital. It is likely that the use of shorter-acting sedation agents with better safety profiles used by the enrolling physicians in our study accounted for this difference.

This study had several limitations. There were difficulties in enrolling patients, and after a 2.5-year recruitment time, only half of the required sample size was enrolled. One year into the study, an informal survey was sent to physicians and residents working in our centre. The two most frequently cited reasons for failure to recruit were not encountering an anterior shoulder dislocation meeting specified inclusion and exclusion criteria and patient refusal to participate. It was felt that inclusion and exclusion criteria could not be changed in a way to meaningfully increase recruitment

while still capturing the specified outcome measures. Reasons for patient unwillingness to participate are difficult to speculate but may have been due to receiving IVS for a similar injury in the past or patients' desire to avoid what they may have perceived to be a painful injection. Some physicians reported not feeling comfortable with the IAL technique and therefore refused to enrol patients in the study. The study protocol did not define an objective evaluation method to ensure that patients received lidocaine in the glenohumeral joint. There was no objective measure to show that anesthesia had occurred. Given the lack of physician experience with IAL, it is possible the lidocaine was not in the desired place; such objective measures might have identified this and shown why IAL was less successful than in other studies. IVS, on the other hand, is used frequently for procedures in the ED, and our emergency physicians are quite proficient in and comfortable with this method.

One variable that was not collected in our study was the length of time from the onset of dislocation until attempted reduction. Kosnik and colleagues suggested that if time to treatment was 5.5 hours or greater, more treatment failures were expected in the IAL group.⁶ A prolonged dislocation time may lead to increased muscular spasm and pain, yet an intra-articular injection anesthetizes the glenohumeral joint only and does not provide analgesia or relaxation of the surrounding shoulder girdle muscles, which could lead to a decreased success rate. Interestingly, a 2002 study identified insufficient analgesia in 21% of IAL patients, which was not statistically different from 4% in the IVS group, yet all of the reductions were successful in both groups.⁷

Two-week follow-up was available for 28 of 44 patients (63.6%). It is unknown if the patients who did not attend their scheduled appointment had any complications once they left the ED.

CONCLUSIONS

Patients in the IAL and IVS groups had a similar ED length of stay and there was a lower rate of successful reductions and lower satisfaction scores in the IAL group compared to the IVS group. There was no identifiable subgroup for which IAL was more successful, and physicians recorded inadequate analgesia as the reason for failure of IAL. Because this study was stopped early owing to a combination of unexpected findings in success, resource limitations, and difficulty in patient enrolment, we were unable to definitively conclude whether there is a true difference between the two groups.

Competing interests: None declared.

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