



ARAŞTIRMA / RESEARCH

Comparison of hematoma block and sedoanalgesia for analgesia before reduction of distal radius fractures

Distal radius kırıklarının redüksiyonu öncesi analjezi yöntemi olarak hematoma bloğu ve sedoanaljezi yöntemlerinin karşılaştırılması

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Abstract

Purpose: The aim of this study was retrospective assessment of the reduction quality, hospitalization time, and relief of pain in hematoma block assisted closed reduction versus sedoanalgesia assisted closed reduction.

Materials and Methods: There were 106 patients included who diagnosed as isolated displaced distal fracture of radius and treated with closed reduction. Hematoma block was used in 45 patients and sedoanalgesia was used in 61 patients. Midazolam (0,1 mg/kg) and fentanyl (1 mcg/kg) combination was administered as the sedoanalgesic agent, and lidocaine (10 ml, 1%) as the local anaesthetic. Demographic data, fracture type according to Frykman classification, and mechanism of trauma were noted. Pain status of patients were recorded by using the Visual analog scale (VAS). Sarmiento criteria was used for the evaluation of the reduction quality. Cost of the analgesic procedure was assessed based on the prices of the analgesia procedures, used pharmaceuticals and medical consumables.

Results: Both groups were similar in terms of gender, age, fracture type and affected side., Hospitalization time was shorter in hematoma block group, and VAS was significantly lower. Quality of reduction was similar in both groups. Cost per patient was four times higher in sedoanalgesia group compare to hematoma block group.

Conclusion: Hematoma block is an effective, easily performed method that can be used prior to the closed reduction of the distal radius fractures to relieve the pain. Older patients can be susceptible to adverse effects of sedoanalgesia and hematoma block can be chosen as a more reliable method to provide the analgesia.

Keywords: radius fracture, hematoma block, sedoanalgesia

Öz

Amaç: Bu çalışmanın amacı deplase distal radius kırıklarının redüksiyonu sırasında, analjezi amaçlı kullanılan hematoma bloğu ve sedoanaljezi tekniklerinin redüksiyon kalitesi, hastanede kalış süresi ve ağrı kontrolü açısından retrospektif olarak karşılaştırılmasıdır.

Gereç ve Yöntem: İzole deplase distal radius kırığı tanısı ile kapalı redüksiyon uygulanan 106 hasta değerlendirildi. Hastaların 45'ine hematoma bloğu, 61'ine sedoanaljezi uygulandı. Sedoanaljezik olarak midazolam (0,1mg/kg) ve fentanyl (1 mcg/kg), lokal anestetik olarak da lidokain (10 ml %1) kullanıldı. Demografik veriler, Frykman sınıflamasına göre kırık tipleri ve travma mekanizmaları değerlendirildi. Hastaların ağrı değerlendirilmesi Vizüel analog skala (VAS) ile yapıldı. Redüksiyon kalitesi Sarmiento kriterlerine göre değerlendirildi. Analjezi yöntemlerinin maliyet değerlendirilmesi prosedürlerin ücretleri, kullanılan ilaçlar ve medikal malzemeler üzerinden yapıldı.

Bulgular: Her iki grup cinsiyet, yaş, kırık tipi ve etkilenen taraf açısından benzerdi. Hematom bloğu grubunda hastanede kalış süresi daha kısa idi ve VAS skoru belirgin olarak daha düşüktü. Redüksiyon kalitesi her iki grupta benzerdi. Hasta başı maliyet, sedoanaljezi grubunda hematoma bloğu ile karşılaştırıldığında dört kat fazla idi.

Sonuç: Hematom bloğu, distal radius kırıklarının redüksiyonu öncesi ağrıyı azaltmak için kullanılan kolay ve etkili bir yöntemdir. Özellikle sedoanaljezi yönteminin yan etkilerine daha hassas olan yaşlı hastalarda, analjezi sağlamak için daha güvenli bir yöntem olan hematoma bloğu tercih edilebilir.

Anahtar kelimeler: radius kırığı, hematoma bloğu, sedoanaljezi

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INTRODUCTION

Distal radius fracture is one of the main clinical entities mostly seen in the emergency department ¹. Low energy trauma such as simple fall can cause this fracture in an osteoporotic patient, while comminuted fracture may emerge as a result of a high energy trauma in younger age group. Main objective of the treatment of these fractures is to restore an acceptable alignment and joint reconstruction ². Closed reduction and cast application is sufficient for minimal displaced fractures or pediatric fractures ^{3,4}. Excessive displaced, unstable fractures require closed reduction and maintaining the adequate alignment to reduce the pressure over the adjacent soft tissue as the first step^{5,6}. Index treatment is generally applied at emergency service and leads to severe pain, and patient discomfort. An effective analgesia is mandatory to acquire patient comfort and a high quality of reduction ^{3,5,7}.

Frequently used methods for analgesia are sedoanalgesia, peripheral nerve block, regional intravenous block, general anaesthesia, and hematoma block. However, none of these techniques appears to be optimal ⁸. Sedoanalgesia is a well-known technique which is feasible to perform and obtained by administration of benzodiazepines, or benzodiazepines combined with opioids ⁵. Another simple method is the direct injection of lidocaine into the fracture hematoma and provides local anaesthesia which spares the systemic adverse effect of forementioned method⁹. There are orthopedic surgeons who think that the risk of infection increases with the HB method⁸. In addition, complications such as respiratory depression can be seen with the SA method, especially in elderly patients ⁵. In addition, few studies compared two analgesic modalities in the literature ¹⁰⁻¹². Therefore, we think that our study can contribute to the literature in this respect.

In this retrospective study, we compared hematoma block, and sedoanalgesia assisted closed reduction in terms of the effect of pain relief, quality of reduction, hospitalization time, and cost-effectiveness.

MATERIALS AND METHODS

Ethical approval was obtained from the Cukurova University Non Interventional Clinical Research Ethics Committee before the study (Decision No:83;07.12.2018). In our study, patients who

applied to Cukurova University Faculty of Medicine, Balçalı Hospital Emergency Department with distal radius fracture were evaluated. These patients were evaluated primarily in terms of other system traumas. After radiological evaluation, reduction for displaced fractures was performed by the orthopedic team in the emergency room. Sedoanalgesia or hematoma block was preferred as the pre-reduction analgesia method. The choice between the two methods was made according to the patient's age, additional traumas and co-morbidities.

Sample

The data of 832 patients who were admitted to the hospital due to distal radius fracture between 2015 and 2019 were retrospectively extracted. Acute fractures (within the first 12 hours), one sided displaced fractures (>5 ° dorsal tilt and >2 mm of shortness), and adult patients (18 years and older) who were initially treated with closed reduction and short arm or long arm splint subsequent to hematoma block or sedoanalgesia, were determined as the inclusion criteria.

Pediatric patients, patients with polytrauma, open fractures, concomitant neurovascular injuries, unstable hemodynamics, and who had co-morbid diseases such as heart disease, renal failure, hepatic failure, were excluded. Remaining 106 patients were investigated. Forty-five patients were received hematoma block and 61 patients were administered sedoanalgesia.

Additionally, only patients who were questioned according to Visual Analog Scale (VAS) were also enrolled for the study. The Visual Analog Scale is a 10 cm line with anchor statements on the left (no pain) and on the right (extreme pain). The patient is asked to mark their current pain level on the line. We usually evaluate pre- and post-procedural pain with VAS in patients with fracture reduction. Side, age, and gender were noted. After obtaining of adequate two-plane radiographic views, type of the fracture was determined according to Frykman classification.

Frykman classification system identifies the involvement of the radiocarpal and radioulnar joint, as well as the presence or absence of an ulna styloid fracture (Type 1: Extra-articular fractures, Type 2: Type 1 with ulnar styloid fracture, Type 3: Intra-articular fractures involving the radio-carpal joint, Type 4: Type 3 with ulnar styloid fracture, Type 5: Intra-articular fractures involving the distal radio-

ulnar joint, Type 6: Type 5 with ulnar styloid fracture, Type 7 : Intra-articular fractures involving both the radio-carpal and the distal radio-ulnar joint, Type : 8 Type 7 with ulnar styloid fracture)¹³.



Figure 1. Clinical photograph of distal radius fracture before reduction



Figure 2. Hematoma block application from the wrist dorsum. Confirmation of the needle position by withdrawal of the fracture hematoma.

In the hematoma block group pain of the patients with and without ulna styloid fractures were also compared. Hematoma block (HB) and Sedoanalgesia (SA) group patients were also compared in terms of hospitalization time, and complications. Radiographs were evaluated by two blinded orthopedic surgeon, according to Sarmiento criteria (radial length, radial inclination and volar tilt)¹⁴. Radial length is measured on the Postero-anterior radiograph. The average radial length is 11–12 mm. In this classification system, radial length loss or radial shortening is defined as; less than 3 mm Excellent, 3-6 mm Good, 7-11 mm Fair and at least 12 mm Poor. Radial inclination is measured on the Postero-anterior radiograph too. The average inclination is 21°. Loss of radial inclination is defined as; 5° Excellent, 5-9° Good, 10-14° Fair and more than 14° Poor. Volar tilt

is measured on the lateral radiograph. The average volar tilt is 11°. Loss of volar tilt is defined as; 0° Excellent, 1-10° Good, 11-14° Fair and more than 15° Poor. Cost of the analgesic procedure was assessed based on the prices of the analgesia procedures, used pharmaceuticals and medical consumables. Additional costs arising from the work of the emergency physicians during the reduction, or hospitalization time of the patients were not included in the sedoanalgesia group.

Analgesic procedures

Sedoanalgesia

Patients were monitored (pulse, blood pressure, respiratory rate, and oxygen saturation) before and after the procedure. Fasting was not stipulated. Midazolam (total dose of 0.1 mg/kg) was applied as three divided doses. Fentanyl was started as 1 mcg/kg and increased to 3mcg/kg in case of necessity. Emergency department staff performed the medication and vital findings follow-up. When the patient was unresponsive to pain, or enough muscular relaxation was obtained, reduction protocol was initiated. Reductions were made by orthopedic team. In the presence of concomitant ulna styloid fracture long arm splint, otherwise short arm splint was made. Control radiographies were obtained after the closed reduction. Patients were discharged or hospitalized to inpatient clinic after the emergency department staff were convinced for the patient's recovery.

Hematoma block

Patients were considered only for the vital findings by the emergency department staff at the initial come up. Analgesia was performed by the orthopedic team. No monitoring was required for the patients, however for the preparation of the possible adverse effects of lidocaine, vascular access was established. Patients were warned about possible lidocaine toxicity and continuous verbal communication was established. Disinfection of the dorsal skin of the wrist was provided by povidone iodine solution. Ten ml of the 1% lidocaine solution was drawn up to the syringe. Twenty gauge needle was entered to the fracture side from the dorsal site of the wrist. Firstly, hematoma was tried to be aspirated (Figure 1,2). If the hematoma was filled into the syringe, anesthetic was injected into the area in a controlled manner, from the single entry to the different sites of the fracture hematoma. Ten minutes of interval was waited for the anesthesia to settle. In patients who

had sustained pain, 15th minute was waited. Reduction was performed and controlled by roentgenogram instantaneously. Following the control radiographies, patients were discharged or if surgery was decided, patients were hospitalized.

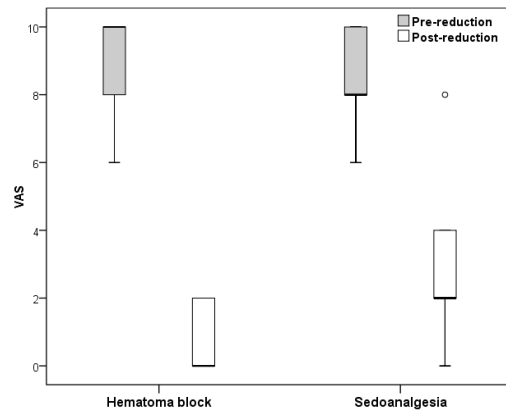
Statistical analysis

Categorical variables were expressed as numbers and percentages, whereas continuous variables were summarized as mean and standard deviation, or median and minimum-maximum where appropriate. Chi-square test was used to compare categorical variables between the groups. The normality of distribution for continuous variables was confirmed with the Shapiro Wilk test. For comparison of continuous variables between two groups, the Student's t-test or Mann-Whitney U test was used depending on whether the statistical hypotheses were fulfilled or not. All analyses were performed using IBM SPSS Statistics Version 20.0 statistical software package. The statistical level of significance for all tests was considered to be 0.05.

RESULTS

A total of 106 patients, 45 (42.5%) in the HB group and 61 (57.5%) in the SA group, were evaluated in the study. Thirty-two (30.2%) of the patients were male and 74 (69.8%) were female. The mean age was 51.07 ± 12.57 years in the hematoma block group and 53.84 ± 11.84 years in the SA group. Sixty-four (60.4%) of the fractures were in the right wrist, 42 (39.6%) were in the left wrist. Distribution of gender, age, and the affected side was similar between groups (Table 1).

Fracture type was similarly dispersed in two groups which was given in Table 2 ($p = 0.283$). In the HB and SA groups, the mean pre-reduction VAS scores of the patients were 10 (6-10) and 8 (6-10), respectively. The mean post-reduction VAS scores were 0 (0-2) and 2 (0-8), respectively. There was no statistically significant difference between the two groups in terms of pain scores before reduction ($p > 0.005$). Besides, pain scores after the reduction were found to be significantly better in the HB group ($p = 0.000$) (Figure 3). In the HB group, there was no statistically significant difference between pre-reduction and post-reduction VAS scores in patients with or without ulna styloid fracture (Frykman type 2-4-6-8 and type 1-3-5-7) ($p = 0.751, 0.394$).



VAS: Visual analog scale

Figure 3. Distribution of VAS scores before and after reduction between groups

The duration of the patients' stay in the emergency room was 84.42 ± 25.67 minutes in the HB group and 145.77 ± 26.72 minutes in the SA group. Hospitalization time was statistically significantly longer in the sedoanalgesia group ($p = 0.000$) (Figure 4).

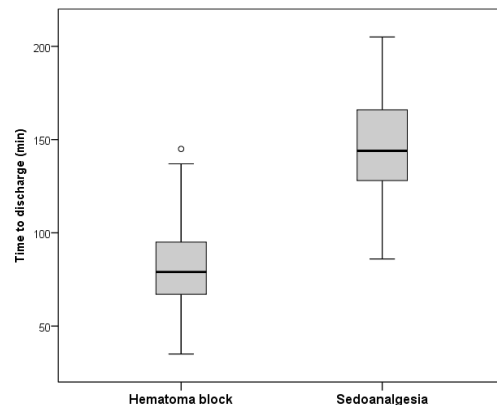


Figure 4. Hospitalization duration in Hematoma block and Sedoanalgesia groups

Complications were evaluated in groups. Five patients (8.2%) had nausea and vomiting following drug administration in the sedoanalgesia group, whereas in the HB group, there was no sign of lidocaine toxicity or infection during the follow-up. Quality of reduction was assessed according to Sarmiento criteria (radial height, radial slope, volar tilt and ulnar variance). There were 36 (80%) excellent and 9 (20%) good results in the HB group, while 44 (72.1%) had excellent and 17 (27.9%) good results in the SA group. According to these results, the

reduction quality was similar in both groups ($p = 0.352$). In our study, the cost per patient in the HB

group was 1,35 USD, while the cost per patient in the SA group was 6,08 USD.

Table 1. General characteristics of patients

	Hematoma Block group (n = 45)	Sedoanalgesia group (n = 61)	<i>P</i>
Age (years)	51.07±12.57	53.84±11.84	0.259
Male/Female	14/31	18/43	0.859
Left/Right Wrist	20/25	22/39	0.383

Values are the mean ± SD.

Table 2. Distribution of fractures between groups according to the Frykman Classification

Fractures types	Hematoma Block Group (n.%)	Sedoanalgesia Group (n.%)	Total (n.%)	<i>p</i>
1	0 (0)	0 (0)	0 (0)	0.283
2	3 (6.7)	3 (4.9)	6 (5.7)	
3	5 (11.1)	0 (0.0)	5 (4.7)	
4	3 (6.7)	6 (9.8)	9 (8.5)	
5	8 (17.8)	10 (16.4)	18 (17.0)	
6	8 (17.8)	16 (26.2)	24 (22.6)	
7	10 (22.2)	17 (27.9)	27 (25.5)	
8	8 (17.8)	9 (14.8)	17 (16.0)	
Total (n.%)	45 (100.0)	61 (100.0)	106 (100.0)	

DISCUSSION

In our study, we compared the HB and SA methods used for analgesia prior to reduction in displaced distal radius fractures, and we obtained better pain control with HB. Although similar results were reported in studies comparing the two methods in terms of pain control in the literature, it was emphasized that pain control was preserved for a longer period, especially after reduction with HB^{5,15,16}. In a randomized controlled study in which Singh et al. compared HB and SA methods for pre-reduction analgesia in distal radius fractures, they reported better pain control provided by HB¹⁷. In our study, fracture types and pre-reduction VAS scores of the patients were similar in both groups. In the post-reduction VAS scores, we found that there was significantly better pain reduction in the HB group. In the sedoanalgesia group, although the standard dose of medication was administered to the patients according to their weight, post-reduction VAS values were found to be worse than HB. We think that this is related to the dose of medication administered. The most important drawback regarding the use of higher doses of medication in the sedoanalgesia procedure is respiratory depression and

associated complications (such as aspiration)^{8,18}. Considering that the majority of these fractures are treated on an outpatient basis, it is normal that respiratory complications be quite distressing for both the patient and the practitioner. Moreover, this concern is even greater in the elderly and pediatric patient group. Therefore, it has been reported in publications that the HB technique is safe and effective in both patient groups^{3,19,20}.

In the literature, it has been emphasized that a second injection should be made to the ulna styloid area when performing hematoma block in cases where distal radius fracture is accompanied by ulna styloid fracture^{21,22}. In our study, a single injection was applied and no additional injection was performed in cases with ulna styloid fracture. In the patient group in which we applied hematoma block, there was no difference in VAS scores before and after reduction, when patients with and without ulna styloid fractures were compared. However, this situation can be better evaluated with a comparative study in which a separate injection was applied to this area in fractures accompanied by ulna styloid fracture.

Fernandez suggested that HB application in distal radius fractures, especially dorsal impacted cortex, would cause difficulty in reaching the fracture site and

the injection should be applied through volar skin²¹. We also experienced some difficulty in reaching the fracture hematoma in our HB applications, especially in patients with dorsal impaction or comminution. But we did not need volar application of the analgesic. An important issue here is the correct evaluation of the presence of a fracture hematoma during injection in a wrist with edema leading to loss of anatomical markers. In the literature, there is a case report of seizures due to intravenous lidocaine administration during HB in such a fracture²³. Therefore, in HB, it is important to apply the injection to different regions from the same entry site to avoid a possible intravenous injection.

In our study, it was found that the duration of patients' stay in the emergency room was approximately one hour shorter in the SA group than in the HB group. Similar results were obtained in studies comparing these two methods in reduction of distal radius fractures in the literature^{3,12,16}. Monitoring of the patient and recovery after sedation is the main time-consuming factors in the sedoanalgesia procedure. At the same time, the organization of the emergency service team to perform the application and follow-up of the patient extends the time even more. Sometimes this situation can be troublesome for the patient and both teams within the workload of the emergency department. In addition, in these days when a worldwide viral pandemic is experienced, the lengthening of duration in the emergency room can be also hazardous. In this respect, HB application stands out as a method that can be applied alone by the orthopedic team, and that the hospital resources are used more effectively.

Complications were also discussed in the similar studies before. Sedoanalgesia is notorious as a cause of respiratory depression, nausea, and vomiting, while infection in the fracture site is one of the possible foreseen complication of the HB. Five patients (8.2%) in the SA group had nausea and vomiting following the drug administration, and no other complication was found. The main concern in hematoma block application is that the fracture hematoma becomes associated with the external environment⁹. However, many studies have emphasized that there is no problem associated with infection after HB application^{3,5,9,10,17}. In our study, no sign of infection was found in the follow-up of the patients in the HB group.

In the literature, there are controversial results in studies comparing the reduction capability obtained

with the HB or SA method. Fernandez emphasized that HB is more suitable for simpler fractures, or fractures that lead to less soft tissue swelling²¹. Funk et al compared general anesthesia and HB, Koren et al. compared sedoanalgesia and HB in their studies, and both reported that regaining of the volar tilt and reduction was easier in general anaesthesia and sedoanalgesia groups^{10,11}. They attributed these results to the inability of HB to provide muscle relaxation and insufficient analgesia. On the contrary, there are studies reporting that adequate reduction can be achieved with HB^{3,5,17,20}. In the present study, the reduction quality was evaluated according to the Sarmiento criteria and similar results were obtained in both study groups. We evaluated the first control radiographs after reduction. Especially in unstable fractures, initial reduction may not be a permanent cure. Fracture reduction may be impaired and surgical treatment may be required. Our study also includes fractures that were presumed to be unstable from the outset and may require surgical treatment. It can be thought that these fractures are already an indication for surgery and temporary splint application can be performed. However, it is known that the decision of surgery depends on many factors such as the patient's age, gender, job and expectation, as well as the type of the fracture⁷. In addition, closed reduction is important in reducing pain, and the pressure on soft tissue and skin in such fractures. Therefore, the reduction maneuver or technique we applied in these unstable fractures was not different from other fracture types. Therefore, we think that HB application can be applied regardless of the type of fracture and, when a sufficient period of time is waited, an adequate reduction can be performed painlessly.

Another factor that directly affects the success of hematoma block is the necessity of its application to acute fractures. Since the fracture hematoma will be organized 12 hours after the fracture occurs, the spread of lidocaine and thus its effectiveness will be reduced by passing time¹⁰. There is not enough data in the literature regarding the upper limit of this period and further studies are needed.

The present study showed that HB is much more cost effective than SA. Moreover, the additional work costs of the emergency team performing the procedure in the SA group and the extra costs of the patient's stay in the emergency department were not included in the calculation.

The weaknesses of our study are its retrospective

planning and the small number of patients. However, the similarity of demographic data, fracture types and pre-reduction VAS scores in the HB and SA groups in our study makes the study strong for comparison. The results of our study highlight HB as an effective, fast and easy method. However, there are not many publications comparing these two methods in the literature and prospective randomized controlled studies are needed.

In conclusion, HB is an easy-to-apply, safe and effective method of pain control before reduction of distal radius fractures. HB stands out as a method that should be kept in mind in all adult age group patients, especially in the advanced age group, where the side effect profile of SA is more important. Therefore, we think that as the awareness of HB increases, its use will increase.

Yazar Katkıları: Çalışma konsepti/Tasarımı: MB; Veri toplama: AM, MT, ÖSB; Veri analizi ve yorumlama: MB, AM, CÖ, MT; Yazı taslağı: MB, AM; İçeriğin eleştirel incelenmesi: CÖ, ÖSB; Son onay ve sorumluluk: MB, AM, MT, ÖSB, CÖ; Teknik ve malzeme desteği: -; Süpervizyon: ÖSB, CÖ, MT; Fon sağlama (mevcut ise): yok.

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