ORIGINAL ARTICLE

Comparison of hematoma block and dexmedetomidine for reduction of distal radius fractures in the emergency department: a prospective randomized controlled study

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ABSTRACT

BACKGROUND: This study aimed to compare the effects of hematoma block (HB) and dexmedetomidine administration on pain control, reduction quality, and physician satisfaction during the reduction of distal radius fractures (DRFs) in the emergency department (ED).

METHODS: A total of 60 patients presenting to the ED with DRFs were enrolled. Patients were randomly assigned to two groups: one received HB, while the other underwent conscious sedation with dexmedetomidine. Pain levels were assessed using the Visual Analog Scale (VAS) at three time points: before the procedure, 10 minutes after administration of the intervention, and post-reduction. Physician satisfaction during reduction was measured using the 5-point Likert Satisfaction Scale (LSS). Post-reduction quality was evaluated on control radiographs using the Sarmiento criteria.

RESULTS: Among the patients included in the study, 28 were female, 19 were male, and 13 were children (<12 years). The mean age was 32.97±20.48 years in the dexmedetomidine group (DG) and 35.25±18.92 years in the hematoma block group (HBG), with no statistically significant difference between the groups (t=-0.448, p=0.65). There was no significant difference in physician satisfaction during reduction between the two groups according to LSS results (χ^2=2.296, p=0.512). Pre-procedure VAS scores were comparable between the two groups (t=-0.148, p=0.883). However, VAS scores 10 minutes after the intervention were significantly lower in the DG compared to the HBG (p=0.009, t=-2.773). Post-reduction quality based on the Sarmiento criteria showed no significant difference between the groups (χ^2=0.64, p=0.89). No adverse effects related to either method were observed in any of the patients.

CONCLUSION: Dexmedetomidine provides faster and more effective pain management than HB for DRF reduction in the ED. Given its minimal systemic side effects, dexmedetomidine may represent a viable alternative for procedural sedation and analgesia (PSA) in fracture reductions requiring sedation in the ED.

Keywords: Distal radius fracture; dexmedetomidine; hematoma block; emergency department.

INTRODUCTION

Distal radius fractures (DRFs) are among the most common upper extremity fractures presenting to the emergency department (ED), accounting for approximately one-sixth of all fractures treated there. DRFs typically result from high-energy trauma in young and otherwise healthy individuals, whereas in elderly and osteoporotic patients, they are usually caused by low-energy trauma.[1,2]

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Table 1. Sarmiento Radiological Score (Modified Lidström Criteria)

Outcome	Loss of Palmar Tilt	Radial Shortening	Loss of Radial Deviation
Excellent	<0°	<3 mm	<4°
Good	1-10°	3-6 mm	5-9°
Fair	11-14°	7-11 mm	10-14°
Poor	>15°	12 mm	>15°

The primary goal in the management of DRFs is proper joint reconstruction and alignment of fracture fragments. Consequently, closed reduction followed by casting plays a crucial role in treatment.[3-6] The success of reduction depends heavily on patient cooperation, which is directly influenced by the level of pain experienced during the procedure. Pain not only causes discomfort and stress but also compromises the quality of the reduction. Reduction quality in DRFs is commonly evaluated using the Sarmiento criteria (Table 1).[7]

Effective sedation and analgesia are essential for ensuring patient compliance. Procedural sedation and analgesia (PSA) is defined as the administration of sedatives or dissociative agents, with or without analgesics, to induce a state that allows patients to tolerate painful procedures while maintaining cardiorespiratory function. PSA is widely used in the ED to minimize patient discomfort during the manual reduction of displaced DRFs outside the operating room.[8,9] Benzodiazepines, either alone or in combination with opioid analgesics, are commonly used for PSA in the ED.[10] Other sedatives, including etomidate and propofol, are also incorporated into PSA protocols.[11] However, conventional PSA agents are associated with significant systemic side effects such as apnea, hypotension, and respiratory depression, which may prolong post-procedure observation in the ED.[12]

Hematoma block (HB) involves the direct injection of lidocaine into the fracture hematoma. Due to concerns about PSA-related complications, HB is often preferred for analgesia before DRF reduction. The most immediate adverse effect of HB is an allergic reaction to the local anesthetic, while delayed complications may include compartment syndrome and local infection.[13] Despite its advantages, HB is an invasive technique, and the inherently painful and stressful nature of DRFs, particularly in pediatric patients, often shifts physician preference toward PSA. Furthermore, unlike PSA, HB does not induce muscle relaxation, which can make reduction more challenging.[12,14]

Dexmedetomidine is a selective α_2-adrenergic agonist with analgesic, sedative, and anxiolytic properties. Its analgesic effects make it useful for procedural and minor surgical interventions. The primary side effects of dexmedetomidine include bradycardia, hypotension, and hypertension.[15,16] Although not yet routinely used in the ED, dexmedetomidine is increasingly employed for sedation in intensive care patients, non-invasive mechanical ventilation, endoscopic procedures, endoscopic retrograde cholangiopancreatography (ERCP), and various minor surgical interventions.[17-19]

This study aimed to compare dexmedetomidine with hematoma block in terms of reduction success, patient compliance, and physician satisfaction during DRF reduction in the ED.

MATERIALS AND METHODS

Study Design and Participants

This prospective randomized controlled study was conducted between June 2024 and December 2024 in a tertiary-level ED. A total of 60 patients presenting with DRFs were randomly assigned to two groups. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the Clinical Research Ethics Committee of Selçuk University (Approval Date: 04.04.2024, Document No: KAD-FR-42, Decision No: 2024/33).

1. Hematoma Block Group (HBG):

Thirty patients diagnosed with DRF based on direct radiographs were randomly assigned to this group. The HB was performed by an emergency physician. Patients were not continuously monitored but had intravenous access maintained in case of potential allergic reactions to the local anesthetic. After disinfecting the dorsal wrist with povidone-iodine, 10 mL of 1% lidocaine solution was prepared for injection. Before administration of the anesthetic into the fracture site from the dorsal aspect of the wrist, an attempt was made to aspirate the hematoma into the syringe. Lidocaine was then injected into the fracture site (Fig. 1 and 2). Pain was assessed using the Visual Analog Scale (VAS) at three time points: pre-procedure (Pre-Method VAS), 10 minutes post-procedure (Post-Method-10 minute VAS), and post-reduction (Post-Reduction VAS). Reduction was performed, and physician satisfaction was evaluated using the Likert Satisfaction Scale (LSS). Reduction quality was assessed on post-reduction radiographs according to the Sarmiento Criteria.

2. Dexmedetomidine Group (DG):

Thirty patients were randomly assigned to receive dexmedetomidine for PSA. Patients were continuously monitored

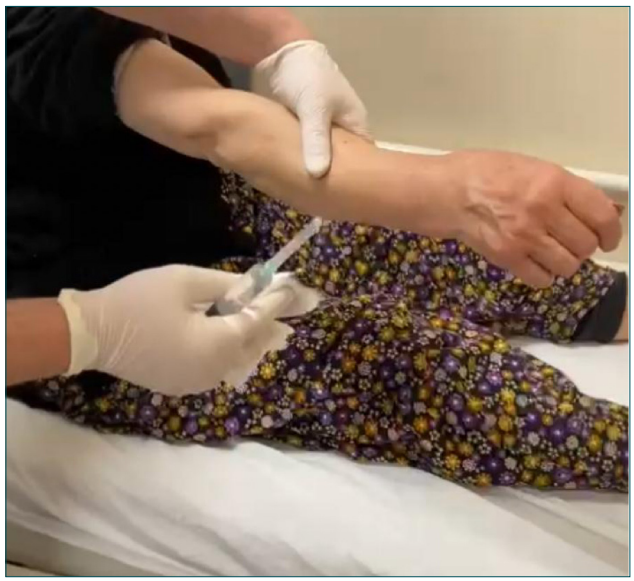

Figure 1. Fracture site from the dorsal aspect of the wrist.

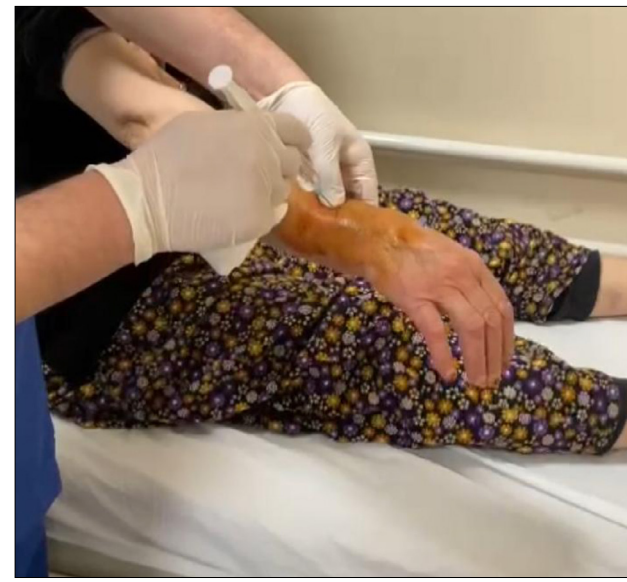

Figure 2. Injection of lidocaine into the fracture site.

throughout the procedure, and intravenous access was maintained. Dexmedetomidine (Precedex) was administered at a dose of 0.5-1 μg/kg via intravenous infusion over 10 minutes. In the literature, the Post-Method-10 minute VAS score is typically measured 10 minutes after the infusion of dexmedetomidine, based on studies evaluating its analgesic activity using the VAS.[20,21] The same pain assessment protocol was applied in the HBG. Reduction was performed by the orthopedic team, and physician satisfaction was documented. Reduction quality was evaluated using the Sarmiento criteria.

In both groups, the post-reduction VAS score was obtained 10 minutes after the reduction procedure, at the same time point for all patients.

Evaluation Criteria:

1. Demographic characteristics

2. Pain levels (VAS: 0=no pain, 10=worst pain)

- Pre-Method VAS
- Post-Method VAS (10 minutes)
- Post-Reduction VAS

3. Reduction quality (Sarmiento classification) (Table 1)

4. Physician satisfaction (Likert Satisfaction Scale) (Table 2).

Statistical Analysis

Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized as means and standard deviations. Differences between groups were analyzed using the t-test, chi-square test, and Mann-Whitney U test, with statistical significance set at $p<0.05$. The normality of continuous variables was assessed using the Shapiro-Wilk test. Depending on whether statistical assumptions were met, within-subjects tests were used to compare continuous variables between the two groups. All analyses were performed using IBM SPSS Statistics, Version 20.0, with a significance threshold of 0.05.

RESULTS

A total of 60 patients were included in the study: 28 (46.6%) females, 19 (31.6%) males, and 13 (21.6%) pediatric patients (<12 years). Although the proportion of female patients was higher overall, there was no significant difference in gender distribution between the two groups when pediatric patients were excluded ($\chi^2=0.102$, $p=0.942$). Similarly, no significant

Table 2. Comparison of hemorrhage, edema, vasocongestion, inflammation, and Johnsen scores between rat groups

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatis-fied
How would you evaluate the patient's compliance with reduction?					
How would you evaluate your own comfort during reduction?					

Table 3. Comparison between groups by age, gender, Sarmiento criteria, Visual Analog Scale (VAS), and Likert Satisfaction Scale (LSS)

	Total Patients	Hematoma Block Group (n=20)	Dexmedetomidine Group (n=20)	P Value *	χ^2 Value **	t Value ***
Age (years)		39.95±3.003	41.25±2.92	0.758		0.310
Gender						
Male/Female	16/24	9/11	7/13	0.342	0.902	
Sarmiento						
Criteria				0.868	0.722	
Excellent	17	9	8			
Good	12	6	6			
Moderate	6	2	4			
Poor	5	3	2			
VAS						
Pre-Method VAS		8.65±0.23	8.60±0.24	0.883		-0.148
Post-Method VAS (10 min)		3.5±0.30	2.40±0.25	0.009		-2.773
Post-Reduction VAS		1.7±0.17	1.95±0.19	0.356		0.938
LSS						
(Physician Satisfaction)				0.512	2.296	
Very Satisfied		10	12			
Satisfied		11	10			
Neutral		7	8			
Dissatisfied		2	0			
Very Dissatis-fied		0	0			

Differences between groups were evaluated using the (***) t-test and (**) chi-square test. *p<0.05 was considered statistically significant.

difference was found between the groups regarding pediatric patient distribution (χ^2=0.10, p=0.75).

The mean age was 32.97±20.48 years in the dexmedetomidine group and 35.25±18.92 years in the hematoma block group, with no significant difference between the groups (t=-0.448, p=0.65).

Each patient underwent three VAS evaluations. Comparisons revealed that in the Pre-Method VAS there was no significant difference between the groups (t=-0.148, p=0.883). In the Post-Method VAS (10 minutes), pain scores were significantly lower in the DG compared with the HBG (t=-2.773, p=0.009). In the Post-Reduction VAS, no significant difference was observed between the groups (t=0.935, p=0.356), although the DG demonstrated a more pronounced reduction in pain 10 minutes after intervention.

Table 3 presents a comparative analysis of age, gender, Sarmiento criteria, VAS scores, and Likert Satisfaction Scale scores between the groups.

Within-subject tests indicated significant changes in VAS scores over time (F=646.585, p<0.001), with these changes being statistically significant in both groups. According to pairwise comparisons:

• In the Dexmedetomidine Group, Pre-Method VAS was 8.6, Post-Method VAS was 2.4, and Post-Reduction VAS was 1.95.

• In the Hematoma Block Group, Pre-Method VAS was 8.65, Post-Method VAS was 3.5, and Post-Reduction VAS was 1.7.

The reduction in pain was more pronounced in the DG (Fig. 3).

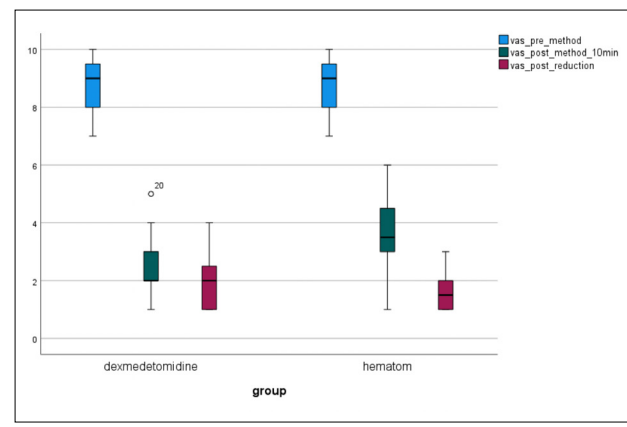

Figure 3. Box plots of Visual Analog Scale (VAS) scores.

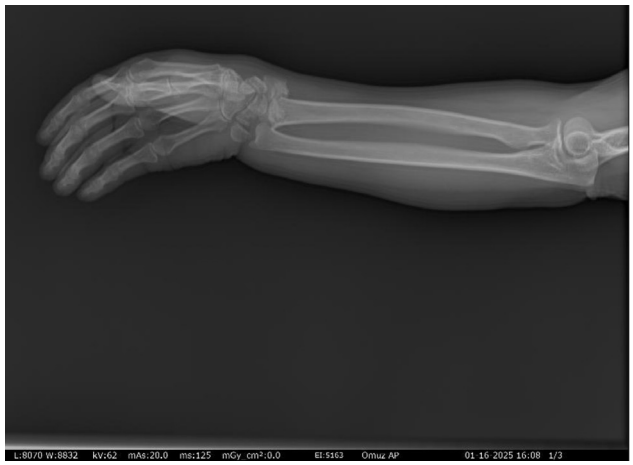

Figure 4. Pre-reduction radiograph of a 52-year-old female patient with a Type V distal radius fracture (DRF).

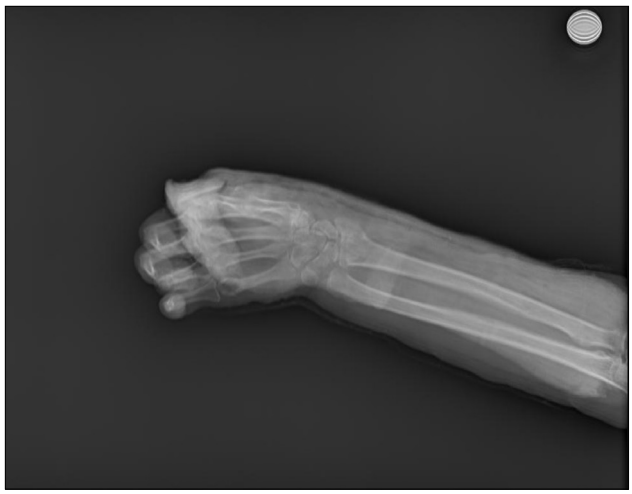

Figure 5. Post-reduction radiograph of a 52-year-old female patient with a Type V distal radius fracture (DRF).

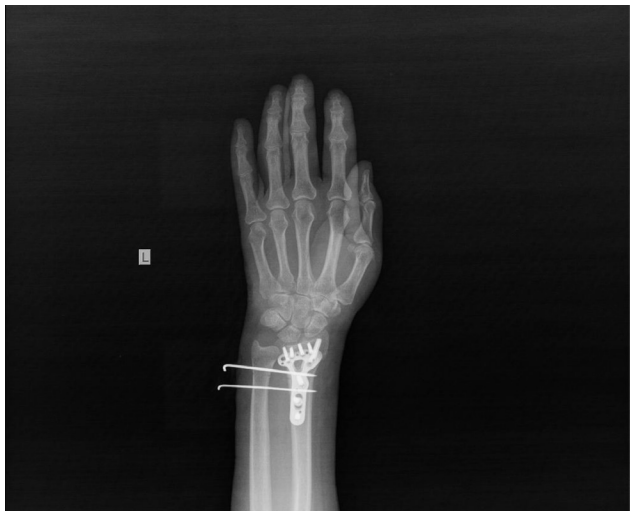

Figure 6. Post-surgical radiograph of a 52-year-old female patient with a Type V distal radius fracture (DRF).

Physician satisfaction was assessed using the Likert Satisfaction Scale:

• HBG: 10 orthopedic surgeons rated the reduction as "very satisfied," 11 as "satisfied," 7 as "neutral," and 2 as "dissatisfied."

• DG: 12 orthopedic surgeons rated the reduction as "very satisfied," 10 as "satisfied," and 8 as "neutral."

There was no statistically significant difference in physician satisfaction between the two groups (χ^2=2.296, p=0.512).

Reduction quality was evaluated using the Sarmiento criteria.

• HBG: 13 cases were classified as "excellent," 10 as "good," 4 as "fair," and 3 as "poor."

• DG: 12 cases were classified as "excellent," 10 as "good," 6 as "fair," and 2 as "poor."

No significant difference was observed between the two groups regarding reduction quality (χ^2=0.64, p=0.89).

No adverse effects related to either method were observed in any patient. Of the 60 patients included in the study, 12 required surgical intervention, with a mean age of 33.75±21.56 years.

DISCUSSION

The lifetime risk of distal radius fractures is 18% in women and 2% in men, primarily due to the higher prevalence of osteoporosis in females.[6] In our study, 46.6% of patients were female, consistent with findings in the literature. Previous studies comparing PSA (typically with benzodiazepines and opioids) with HB in terms of reduction quality (according to the Sarmiento criteria) have shown that PSA results in better reduction quality than HB.[22,23] However, in our study, no significant difference was observed between the DG and the HBG in terms of reduction quality. This discrepancy may be attributed to the consistency of the orthopedic team performing all reductions in our study.

The decision to treat DRFs non-surgically depends on factors such as patient age, comorbidities, and osteoporosis.[24] Among the 12 patients who required surgery, the mean age was higher than that of the overall study population, which aligns with previous reports (Figures 4, 5, and 6 depict pre-reduction, post-reduction, and post-surgical radiographs of a 52-year-old female patient with a Type V DRF).

A previous study comparing HB and PSA with benzodiazepine-opioid combinations found that HB had a superior safety profile.[25]

In our study, all patients had intravenous (IV) access secured prior to the procedure, and patients in the DG were continuously monitored throughout the intervention and reduction process. Additionally, bedside post-reduction radiographs were obtained for DG patients. No early complications re-

lated to either method were observed. Previous studies have suggested that a major advantage of HB over PSA is a shorter ED observation time and hospital stay.[26] However, in our study, the time elapsed after intervention (before reduction), the duration of reduction and casting, radiographic evaluations, and post-procedural monitoring provided sufficient observation time for both the DG and HBG groups. Thus, no significant difference was observed in ED observation time or length of hospital stay between the two groups.

There was also no statistically significant difference between the groups in the distribution of responses on the LSS, which was used to assess procedural ease and physician satisfaction during reduction. Similar findings have been reported in studies comparing PSA with agents other than dexmedetomidine against HB.[27] Pain sensitivity is typically higher in pediatric patients than in adults, making PSA the preferred option for fracture reduction in children. The use of dexmedetomidine in pediatric PSA has increased significantly in recent years.[14] Thus, dexmedetomidine may represent a promising alternative for pediatric procedural sedation in the ED, particularly for minor surgical procedures and fracture reductions.

One study comparing HB and PSA (with benzodiazepines and opioids) for pain control in DRFs found HB to be more effective.[28] However, another study reported no significant difference between the two methods.[13]

In our study, baseline VAS scores were similar between the two groups (t=-0.148, p=0.883).

However, 10 minutes post-intervention, VAS scores were significantly lower in the DG compared to the HBG (t=-2.773, p=0.009). Recent studies support our findings, showing that HB provides moderate analgesia at the wrist level but is ineffective for pain experienced in the fingers.[29] Another study reported that HB was ineffective for post-operative pain control in pediatric supracondylar humerus fractures and recommended the use of non-opioid PSA agents instead.[30] Furthermore, multiple studies have demonstrated that dexmedetomidine provides faster and more effective analgesia than traditional PSA agents such as benzodiazepines and opioids.[31,32]

To date, no study has directly compared the analgesic effects of dexmedetomidine and HB. Our study is the first to assess their analgesic efficacy in DRF reduction, demonstrating that dexmedetomidine provides stronger and faster pain relief than HB. This finding is of particular importance for guiding future research.

CONCLUSION

Procedural sedation and analgesia play a crucial role in fracture reduction and minor surgical procedures in the ED. Our findings indicate that dexmedetomidine is superior to HB for pain control, suggesting its potential future integration into standard PSA protocols for DRF reduction and other orthopedic procedures.

Ethics Committee Approval: This study was approved by the Selçuk University Ethics Committee Ethics Committee (Date: 04.04.2024, Decision No: 2024/33).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: E.F.V., D.A., E.E.; Design: E.F.V., B.K., M.G.; Supervision: E.F.V., D.A.; Resource: E.F.V., O.L.D., D.A.; Materials: E.F.V., B.K.; Data collection and/or processing: E.F.V., M.G., D.A.; Analysis and/or interpretation: E.F.V., D.A., E.E.; Literature review: E.F.V., O.L.D.; Writing: E.F.V., D.A., B.K.; Critical review: E.F.V., M.G.

Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Acil serviste distal radius kırıklarının redüksiyonunda hematom bloğu ile deksmedetomidin kullanımının karşılaştırılması: Prospektif randomize kontrollü bir çalışma

AMAÇ: Distal radius kırıklarının (DRKs) redüksiyonu öncesinde yapılan hematom bloğu (HB) ile deksmedetomidin uygulamasının ağrı kontrolüne, redüksiyon kalitesine ve doktor memnuniyetine olan etkilerini karşılaştırmayı amaçladık.
GEREÇ VE YÖNTEM: Çalışmamıza acil servise (AS) başvuran DRK'lı 60 hasta dahil edildi. Hastalar rastgele iki gruba ayrıldı. İlk gruba HB, ikinci gruba ise deksmedetomidin ile bilinçli sedasyon uygulandı. Her iki grupta ağrı düzeyleri; Görsel Analog Skala (VAS) ile, yöntem öncesi, yöntemden 10 dakika sonra ve redüksiyon sonrası olmak üzere her bir hasta için 3 kez değerlendirildi. Redüksiyonu yapan doktorların redüksiyon sırasındaki konfor ve memnuniyetleri 5'li Likert Memnuniyet Ölçeği (LMÖ) kullanılarak ölçüldü. Redüksiyon sonrası kontrol direk grafi ile Sarmiento kriterlerine göre redüksiyon kalitesi değerlendirildi.
BULGULAR: DRK ile AS'ye başvuran hastaların 28'i kadın, 19'u erkek, 13'ü çocuk (<12 yıl) idi. Hastaların yaş ortalaması; deksmedetomidin grubunda (DG) 32.97±20.48, hematom bloğu grubunda (HBG) 35.25±18.92 idi. İki grup arasında yaş ortalaması açısından anlamlı fark yoktu (t=-0.448, p=0.65). Redüksiyon sırasındaki hasta uyumuna ilişkin doktor memnuniyetinin değerlendirildiği LMÖ sonuçlarında iki grup arasında anlamlı fark bulunmadı (χ^2=2.296, p=0.512). Yöntem öncesi VAS değerleri açısından da iki grup arasında anlamlı fark yoktu (t=-0.148, p=0.883). Yöntem sonrası 10. dakikadaki VAS değerleri ise DG'de, HBG'ye göre anlamlı derecede düşüktü (t=-2.773, p=0.009). Bununla birlikte, Sarmiento kriterlerine göre değerlendirilen redüksiyon kalitesinde iki grup arasında anlamlı fark yoktu (χ^2=0.64, p=0.89). Her iki gruptaki hastaların hiçbirinde uygulanan yönteme bağlı yan etki görülmedi.
SONUÇ: Deksmedetomidin AS'de DRK redüksiyonu öncesinde hızlı ve etkili ağrı yönetimi ve hasta memnuniyeti açısından HB'ye üstün, etkili bir yöntemdir. Sistemik yan etkilerinin az olması nedeniyle de, prosedürel sedasyon ve analjezi (PSA) gerektiren kırık redüksiyonlarında AS'de rutin olarak kullanılabilecek alternatif bir PSA yöntemi olabilir.

Anahtar sözcükler: Acil servis; distal radius kırığı; deksmedetomidin; hematom bloğu.

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