ARAŞTIRMA MAKALESİ / *RESEARCH ARTICLE*

Evaluation of the Effectiveness of Intercostal Nerve Block for Pain Management in Patients with Traumatic Rib Fractures

Travmatik Kosta Fraktürlerinde Interkostal Sinir Blokajının Ağrı Yönetimi Üzerindeki Etkisinin Araştırılması

Guntug Batihan

Department of Thoracic Surgery, Kars Harakani State Hospital, Kars, Türkiye

ABSTRACT

Aim: *Pain palliation is the most critical content of the treatment in traumatic rib fractures. The study aimed was to investigate the effect of including intercostal nerve block in the treatment of rib fractures on pain control.*

Material and Method: *Patients treated for traumatic rib fractures in the thoracic surgery clinic of our center between February 2022 and June 2022 were evaluated retrospectively. The characteristics of the patients, their visual analogue scale scores, analgesic medication needs, and hospital stay were recorded. The data of the patients who underwent intercostal nerve blockade and those who were treated with standard analgesic medications were compared.*

Results: *A total of 49 patients were included in the study. A total of 18 (36.7%) patients underwent daily intercostal nerve block. Standard pain treatment was applied to 31 (63.3%) patients. In the group of patients who underwent intercostal nerve blockade, the mean pain score on the third day and the mean need for non-steroidal anti-inflammatory medication were significantly lower.*

Conclusion: *In our study, the adding an intercostal nerve block to the treatment of rib fractures provided better pain control and reduced the need for analgesic medication.*

Key words: *chest trauma; intercostal nerve block; rib fractures*

ÖZET

Amaç: *Travmatik kosta fraktürü bulunan hastalarda ağrı palyasyonu tedavinin en önemli parçasını oluşturur. Bu çalışmada interkostal sinir blokajının kot fraktürlü hastalarda ağrı yönetimi üzerine etkisinin araştırılması amaçlanmıştır.*

Materyal ve Metot: *Şubat 2022 ile Haziran 2022 tarihleri arasında travmatik kot fraktürü tanısı ile takip edilmiş olan hastalar retrospektif olarak incelendi. Hastaların karakteristik özellikleri, vizüel analog skala skorları, analjezik medikasyon ihtiyaç durumları ve hastane yatış süreleri kaydedildi. İnterkostal sinir blokajı uygulanan ve uygulanmayan hastaların verileri karşılaştırıldı.*

Bulgular: *Çalışmaya toplamda 49 hasta dâhil edildi. 18 (%36,7) hastaya anajezik tedavinin bir parçası olarak interkostal sinir blokajı, 31(%63,3) hastaya ise standart ağrı tedavisi uygulanmıştı. İnterkostal sinir blokajı uygulanan grupta 3. Günde ölçülen ortalama vizüel analog skala skoru ve ortalama non-steroid antienflamatuvar ilaç doz ihtiyacı istatistiksel anlamlı olarak daha düşük bulundu.*

Sonuç: *Çalışmamız travmatik kot fraktürü bulunan hastaların yönetiminde tedaviye interkostal sinir blokajının eklenmesinin daha az analjezik medikasyon ile daha iyi ağrı kontrolü sağladığını göstermiştir.*

Anahtar kelimeler: *göğüs travması; interkostal sinir blokajı; kot fraktürü*

Introduction

Rib fractures are seen in approximately 10% of all traumas, and approximately 30% of severe chest traumas[1,2]. The location, number, and form of rib fractures are related to the severity and mechanism of trauma. The clinical spectrum can range from localized pain to the dramatic picture accompanied by severe hemopneumothorax and flail chest. Pain management is one of the most important components of treatment in patients with rib fractures[3]. Analgesic step therapy (analgesic ladder) recommended by the World Health Organization (WHO) is frequently used in pain palliation, and it can be combined with analgesic procedures including intercostal nerve block (INB), serratus ± pectoralis plane nerve block, and epidural anesthesia[4–6].

İletişim/Contact: *Güntuğ Batıhan, Department of Thoracic Surgery, Kars Harakani State Hospital 36110, Yenişehir, Ismail Aytemiz Street 55, Kars, Türkiye* • ***Tel:*** *0474 212 56 68* • ***E-mail:*** *gbatihan@hotmail.com* • ***Geliş/Received:*** *18.06.2022* • ***Kabul/Accepted:*** *14.07.2023*

ORCID: *Güntuğ Batıhan: 0000-0001-5258-2856*

This study aimed to evaluate the efficiency of intercostal nerve blockade on pain palliation in patients with rib fractures accompanying isolated chest traumas.

Material and Method

This study was approved by the Institutional Ethics Committee. Patients who were treated for isolated thoracic trauma in the thoracic surgery clinic of our center between February 2022 and June 2022 were evaluated retrospectively. Patients with at least 1 rib fracture detected radiologically were included in the study. Patients who underwent emergency or elective surgical intervention, had flail chest, underwent tube thoracostomy due to pleural complications, and were intubated due to respiratory failure were excluded from the study.

The WHO analgesic ladder strategy as a standard pain assessment (SPA) was used for the pain palliation of the patients. Additionally, INB was performed on the patients who accepted it. Intercostal nerve block was applied posteriorly, approximately 6 cm lateral to the midline, by injecting 2–3 cc of 0.25% cc bupivacaine at each level, covering the two upper and two lower sides of the affected ribs. This procedure was repeated daily. The patients were divided into two groups according to the application of INB. Pain follow-up of the patients was performed with a visual analogue scale (VAS) (0=No pain, 10=Worst pain). Characteristics of the patients, VAS scores, the administered non-steroidal anti-inflammatory drug (NSAID) doses, opioid drug needs, and hospitalization times were recorded from patient files and the hospital information system. The obtained data were compared between the two groups (INB vs SPA-only).

Statistical Analyses

Statistical analyses were performed via Statistical Package for Social Sciences (SPSS) program version 25.0 (SPSS Inc., Chicago, IL, USA). Normality of distribution was tested with the Shapiro-Wilk test for all numerical variables. Chi-squared or Fischer's exact tests were used to compare frequencies. Continuous variables are expressed as mean value ± standard deviation (SD) and discrete variables are expressed as numbers and percentages. The student's t-test was performed to analyze the differences between group means. Statistical significance was set at P-value <0.05 (All P values presented were 2-sided).

Results

A total of 49 patients were included in the study. The mean age was found to be 57.5±11.2. Four of the patients were female and 45 were male. The characteristics of the patients are summarized in Table 1.

A total of 18 (36.7%) patients underwent daily INB. Standard pain treatment was applied to 31 (63.3%) patients.

The number of median rib fractures was 3 (range, 1–7). The mean length of hospital stay was 4.7±1.7 days. Twenty-one (42.9%) patients needed opioid medication at least once. Tramadol hydrochloride 50 mg/ml (iv) was preferred as an opioid medication and was re-administered as needed.

The mean VAS score of the patients at the time of admission was 6.7±1.1, 3.9±1.0 on the first day, and 2.7±0.7 on the third day.

Table 1. *Patient characteristics*

Characteristic	INB (n=18)	SPA-only (n=31)	P-value
Age (mean ± SD)	58.8±10.7	56.7±11.6	0.54
Sex (male), n (%)	18 (100)	27 (87.1)	0.28
Comorbidities, n (%)			0.62
None	8 (44.4)	18 (58.1)	
HT	2 (6.5)	2 (11.1)	
DM	7 (38.9)	8 (25.8)	
COPD	1 (5.6)	1 (3.2)	
CAD	0 (0)	2 (6.5)	
Current smoker (yes), n (%)	15 (83.3)	19 (61.3)	0.20
Rib fracture (mean ± SD)	2.9±1.4	3.4±1.8	0.41
Pulmonary contusion (yes), n (%)	5 (27.8)	10 (32.3)	1.0
Pneumothorax (yes), n (%)	1 (5.6)	5 (16.1)	0.39
Hemothorax (yes), n (%)	2 (11.1)	7 (22.6)	0.45

CAD: Coronary artery diseases, COPD: Chronic obstructive pulmonary disease, DM: Diabetes mellitus, HT: Hypertension, INB: Intercostal nerve block, SD: Standard deviation, SPA: Standard pain assessment.

Table 2. *Outcomes associated with pain management*

Variables	INB (n=18)	SPA-only (n=31)	P-value
NSAID medication* need-Day 1, (mean ± SD)	2.1±0.8	3.3±0.9	<0.001
NSAID medication* need-Day 2, (mean ± SD)	1.8±0.7	3.0±0.8	<0.001
NSAID medication* need-Day 3, (mean ± SD)	1.7±0.8	2.9±0.8	<0.001
Opioid analgesic need (yes), n (%)	5 (27.8)	16 (51.6)	0.14
VAS-0 (mean ± SD)	6.9±0.9	6.7±1.1	0.44
VAS-1 (mean ± SD)	4.0±1.2	3.8±0.9	0.61
VAS-3 (mean ± SD)	2.4±0.6	2.9±0.7	0.019
Hospital stays (mean ± SD)	4.6±1.2	4.8±1.9	0.58

* Number of oral administration or injection.
INB: Intercostal nerve block, NSAID: Non-steroidal anti-inflammatory drug, SD: Standard deviation, SPA: Standard pain assessment, VAS: Visual analogue scale.

The comparison of VAS score, NSAID and opioid medication needs, and hospitalization days according to INB and SPA-only groups is summarized in Table 2. The mean number of NSAID doses needed on the first, second, and third days in the INB group was found to be significantly lower (Table 2). Although the rate of opioid use was higher and mean hospital stays were longer in the SPA group, this difference was not statistically significant (p=0.14; 0.58).

The mean VAS score measured on the 3rd day (VAS-3) was found to be statistically significantly lower in the INB group (2.4±0.6 vs 2.9±0.7, p=0.019).

No complication related to INB was observed in any of the patients.

Discussion

In this study, it was observed that INB provided better pain control than standard analgesic medications in traumatic rib fractures. Although INB has been emphasized as a fast and easy-to-apply and successful method in pain control in the literature, the number of comparative studies is few[6–8]. In the study of Yetim et al.[8], patients who followed up for rib fractures were examined in two groups according to the application of INB, and the amount of tramadol used in the group that was administered intercostal nerve block was found to be significantly lower. In a similar study, Hwang et al.[6] demonstrated rapid regression in pain scores after INB in patients with rib fractures compared to the control group. While we found a significant difference in the VAS scores measured only on the 3rd day in our study, the NSAID medication requirement on the first, second, and third days was significantly lower in the INB group.

Sheets et al.[9] compared the data of 116 patients (58 vs 58) who underwent epidural anesthesia and INB with liposomal bupivacaine for the management of rib fractures and found less intubation rate, shorter intensive care unit, and hospital stay in the group that underwent INB (p=0.015, 0.007, 0.020).

Although there are theoretical risks such as pneumothorax, intercostal artery-vein injury, intraneuronal-intrathecal injection, and skin-subcutaneous infection, the complication rates of intercostal nerve block are very low[10]. No complications related to INB were observed in our study.

There are also studies suggesting a continuous block system with the help of a special catheter as an alternative to repetitive injections[7–11]. Uhlich et al.[11], in their study of 933 patients with multiple rib fractures, showed that mortality and morbidity rates were significantly lower in the group in which continuous intercostal nerve block was added to the standard treatment.

Our study has some limitations. First, this is a retrospective study and there is a possibility of bias due to the nature of the study design. Secondly, due to the small number of patients, we were not able to homogenize the parameters, and this may have affected the results of the study.

Conclusion

Our study observed that INB provided better pain control and reduced the need for additional analgesic medication. Since it can be applied quickly and easily, it can be preferred for pain palliation in rib fractures.

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