ARAŞTIRMA MAKALESİ / *RESEARCH ARTICLE*

The Importance of Intense Pain Management for the Treatment Success of Extracorporeal Shock Wave Lithotripsy

Ekstrakorporeal Şok Dalga Litotripsinin Tedavi Başarısında Yoğun Ağrı Yönetiminin Önemi

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ABSTRACT

Aim: *Shockwave lithotripsy is a painful procedure and requires adequate analgesia. This study aimed to determine the effect of effective pain management in extracorporeal shock wave lithotripsy on objective parameters such as radiation dose and operation time.*

Material and Method: *A total of 202 patients were included in the study. The patients were divided into two groups. The first group was administered a triple analgesia combination (hyoscine N-butylbromide, metamizole, pethidine) for adequate pain control. The second group was administered diclofenac sodium alone.*

Results: *There were 100 patients in group 1 and 102 in group 2. There was a statistically significant difference between the groups in the duration of treatment, lithotripsy period, frequency of shock waves, and radiation doses used (p<0.05).*

Conclusion: *Effective pain management in ESWL reduces the procedure time, period, and radiation dose, thus increasing the success of the treatment.*

Key words: *ESWL; renal stone; lithotripsy*

ÖZET

Amaç: *Şok dalgası litotripsi ağrılı bir işlemdir ve yeterli analjezi gerektirir. Bu çalışmada ekstrakorporeal şok dalga litotripsisinde etkin ağrı yönetiminin radyasyon dozu ve ameliyat süresi gibi objektif parametrelere etkisinin belirlenmesi amaçlanmıştır.*

Materyal ve Metot: *Çalışmaya toplam 202 hasta dâhil edildi. Hastalar iki gruba ayrıldı. Birinci gruba etkili ağrı kontrolü için üçlü analjezi kombinasyonu (hiyosin N-bütilbromür, metamizol, petidin) uygulandı. İkinci gruba tek başına diklofenak sodyum verildi.*

Bulgular: *Grup 1'de 100, grup 2'de 102 hasta vardı. Tedavi süresi, litotripsi süresi, şok dalgalarının sıklığı ve kullanılan radyasyon dozları açısından gruplar arasında istatistiksel olarak anlamlı fark vardı (p<0,05).*

Sonuç: *ESWL'de etkin ağrı yönetimi işlem süresini, süresini ve radyasyon dozunu azaltarak tedavinin başarısını artırmaktadır.*

Anahtar kelimeler: *ESWL; böbrek taşı; litotripsi*

Introduction

Urolithiasis is a common pathology and its highest incidence occurs between 30 and 40 years of age. Approximately 84% of renal calculus are calcium oxalate and phosphate calculus, but uric acid and infection calculus are rare[1]. Approximately 11.1% of urinary stones are encountered between the 10th and 70th decades[2].

Extracorporeal Shock Wave Lithotripsy *(ESWL)* is an effective method with low complication rate that is frequently used in the treatment of urolithiasis. However, since it is a painful procedure, it requires pain management. Inadequate pain control reduces the effectiveness of the procedure. In pain control, non-steroidal anti-inflammatory drugs *(NSAIDs),* analgesics or opioid agents can be administered locally, intravenously *(IV),* and orally. Opioid agents may not be the first choice because of longer follow-up, side effects such as nausea, hypotension, respiratory depression, and vomiting[3].

The power of the energy used in ESWL is important in breaking the urinary system stones. In the use of strong energy, the pain threshold of the patients should be increased with medication. This prevents patient movements and provides an effective treatment with high energy and in a short time[4].

In ESWL, patient-related variables can affect pain. Patients with younger age *(adolescents),* gender *(female),* depression and anxiety, and patients with low body mass index are more sensitive to pain. Extracorporeal Shock Wave Lithotripsy related

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variables can be listed as the type of shock wave, energy power, entry location, location and size of the stone[5].

Uninterrupted transmission of high energy is effective in the success of ESWL, and for this, the patient's immobility plays an important role. Intense analgesia reduces patient movement. It is also important that a new generation of lithotripsy devices that cause less pain have been developed[6]. This has led to the use of topical drugs and local anesthetics, oral and intravenous sedatives. In addition, transcutaneous electrical nerve stimulation, anesthetic local administration, intravenous administration, inhaled administration can be used.

Opioid agents may not be the first choice because of their side effects and costs. These agents can be preferred in selected patients. General or spinal anesthesia may be preferred in selected patients and children[4].

Despite developing technology, ESWL is still a painful treatment and requires adequate analgesia. The aim of this research is to manage effective pain; To investigate the effectiveness of ESWL through objective parameters such as radiation duration and dose, energy amount and duration, number of shocks, and procedure time.

Materials and Method

This study adhered to the tenets of Helsinki Declaration of the World Medical Association, and received full approval from Scientific Research Ethics Committee of Agri Ibrahim Cecen University (2022–73). A total of 202 patients with urinary system stones were included in the study. Two groups were created before ESWL application. In the first group, triple analgesia combination consisting of hyoscine N-butylbromide, metamizole and pethidine was applied for effective pain control. The second group was given diclofenac sodium for analgesia. Objective parameters *(ESWL duration, frequency, radiation dose, amount and duration of shock wave energy used)* of the procedures applied to the groups were recorded retrospectively.

Patients with known drug hypersensitivity, coagulation disorders or anticoagulants, uncontrolled hypertension, pregnant women, urinary system infection, abdominal aneurysm, distal ureteral stones, obesity and skeletal disorders were not included in the study. In addition, patients who left the ESWL procedure unfinished were also excluded from the study. Extracorporeal Shock Wave Lithotripsy procedure was performed by a single expert with a single device.

Data were analyzed with SPSS *(Statistical Package for the Social Sciences)* version 21.0 program. Mann Whitney U-Test and Chi-square Test for categorical variables were used for group comparisons. A value of $p<0.05$ was defined as statistical significance.

Results

There were 100 patients in the Group 1 that were given triple drug combination for effective analgesia. The Group 2 individuals were given only diclofenac sodium consisted of 102 patients. Half an hour before the ESWL procedure, pethidine was administered intramuscularly at a dose of 0.8 mg/kg. Diclofenac sodium was administered intramuscularly at a dose of 75 mg half an hour before the procedure. Other drugs were injected in hydrochloride saline (100 cc).

Demographic characteristics and objective parameters of the study patients are given in Table 1. There was no statistically significant difference between the two groups in terms of gender, age, location of urinary system stones and the size of the stones ($p>0.05$).

Considering the objective parametric data, treatment duration and period were shorter in Group 1 than in Group 2, and a statistically significant difference was found ($p=0.002$).

When we compared the frequency of shock waves used in ESWL, a statistically significant difference was found in Group 1 compared to Group 2 ($p<0.0001$).

Considering the applied energy doses, the applied energy dose in Group 1 was more effective than Group 2 and a statistically significant difference was found ($p<0.0001$).

The radiation range and dose used to locate the stones were also lower in Group 1 compared to Group 2, and a statistically significant difference was found ($p<0.0001$).

Discussion

General anesthesia was used for pain control in the early years of ESWL. With the development of lithotriptors, general anesthesia has been replaced by less invasive anesthetic methods today, except for selected patients. However, ESWL is still a painful procedure today. Shock waves can cause pain by various mechanisms as they pass through the skin, muscles, kidney capsule and deeper internal structures. Accompanying body movements with pain causes difficulties in focusing the stones[7,8].

Table 1. *The demographic and clinical features of patients*

		Total N=202	Grup 1 N=100	Grup 2 N=102	p-value
Gender (N (%))	Male	144 (71,3)	**63 (63,0)**	**81 (79,4)**	**0.013**
	Female	58 (28,7)	**37 (37,0)**	**21 (20,6)**	
Age (year, median and interquartile range (IQR*))		46 (34–57)	**43 (33–52)**	**47 (37–60)**	**0.026**
Localisation (N (%))	Right	78 (38,6)	36 (36,0)	42 (41,2)	0.497
	Left	124 (61,4)	64 (64,0)	60 (58,8)	0.719
Stone localisation (N (%))	Renal Upper Clayx	17 (8,4)	6 (6,0)	11 (10,8)	0.225
	Renal Medium Clayx	43 (21,3)	25 (25,0)	18 (17,6)	0.286
	Renal Pelvis	75 (37,1)	38 (38,0)	37 (36,3)	0.908
	Renal Lower Clayx	14 (6,9)	6 (6,0)	8 (7,8)	0.593
	Ureter Upper End	37 (18,3)	19 (19,0)	18 (17,6)	0.869
	Ureter Medium	16 (7,9)	6 (6,0)	10 (9,8)	0.317
Dimensions of stone (N (%))	5×10	95 (47,0)	40 (40,0)	55 (53,9)	0.124
	10×15	98 (48,5)	55 (55,0)	43 (42,2)	0.225
	15×20	9 (4,5)	5 (5,0)	4 (3,9)	0.739
Treatmenttime (minute, medianand IQR)		33 (30–36)	**32 (30–34)**	**34 (30–41)**	**0.002**
X-Ray Application (second, medyan median and IQR)		33 (24–46)	**29 (20–40)**	**37 (29–54)**	**<0.0001**
X-Ray Dose (cyG/cm^2, median and IQR)		116.57 (90,39–173,51)	**91.13 (58,81–102,76)**	**169.46 (133,95–251,86)**	**<0.0001**
ScWCount (medianand IQR)		2817 (2500–2965)	**2941 (2800–2988)**	**2548 (2334–2881)**	**<0.0001**
EW Frequency (P/minute, median and IQR)		120 (120–120)	120 (120–120)	120 (120–120)	1.000
EW Time (minute, median and IQR)		23 (21–25)	23 (21–25)	24 (21–25)	0.109
EW Energy (J., median and IQR)		87.07 (71,37–96,34)	**95.58 (85,98–103,63)**	**72.45 (51,12–87,71)**	**<0.0001**
M. Energy (J., median and IQR)		4.0 (3,0–4,7)	**4.5 (4,0–5,05)**	**3.2 (2,7–4,0)**	**<0.0001**
A. Energy (J., median and IQR)		2.0 (1,6–2,4)	**2.3 (2,0–2,6)**	**1.8 (1,3–2,0)**	**<0.0001**

* IQR: Interquartile Range.

Stone size is one of the most important factors determining the effectiveness of ESWL, and the best clinical results are achieved in calculus smaller than 2 cm. Considering the stone structures, cystine calculus are resistant to ESWL. Extracorporeal Shock Wave Lithotripsy is contraindicated in conditions such as pregnancy, uncontrolled hypertension, severe sepsis, obesity. Pain mechanisms in ESWL are not clear, nociceptor inductions by microbubbles can cause visceral and peritoneal pain. The pain threshold is personal, and the patient's compliance and perception of anxiety affect the success of ESWL[9].

Local anesthesia can be used in ESWL. The pain is felt on the skin surface and gives signs of erythema and petechiae[10]. Akçali et al.[11] compared paracetamol, lornoxicam and tramadol and found no significant difference in clinical efficacy, but reported that they provided adequate analgesia in ESWL. In another study; they found no significant difference between the efficacy of NSAIDs and opioids. However, opioids were reported to be effective in the first 10 minutes. It has been shown to provide adequate analgesia for both and the mean pain scores are similar[1].

Combination treatments of local anesthetics and parenteral drugs are preferred for pain control in ESWL[12]. Pentazosin + Lorazepam combination was found to be more effective in the comparison of pentazocine/morphine/lorazepam[13]. In another study, it was shown that intramuscular sodium diclofenac is more effective than local anesthetics and its combination has no superiority[14].

Effective analgesia provided positive benefits in all these parameters when the criteria for radiation duration, radiation dose, energy application time and amount, total number of shocks were evaluated according to the study plan. Extracorporeal Shock Wave

Lithotripsy period and frequency were significantly lower in effective analgesia. Significant results were also found in the applied energy doses. Maximum energy doses administered to patients in effective analgesia provided effective treatment. The radiation range and dose used during the ESWL procedure were also reduced with effective analgesia.

It is evident that pain management in ESWL is directly related to the success of the procedure as well as patient comfort. The lack of pain scoring in our study was a missing aspect of the study.

Conclusion

Effective analgesia management in ESWL reduces the procedure time, period and radiation dose. It is expected to increase the relative effectiveness of the treatment, as it facilitates the effective transfer of the energy used and the focusing process in the stone localization.

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