

Is pain perception different in pediatric and adult patients undergoing stone crushing procedure after the application of multimodal analgesia?

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Abstract

Aim: Extracorporeal shock wave lithotripsy (ESWL) is an important modality in the treatment of urinary system stone disease in children and adults. However, ESWL may be painful and stressful procedure. We aimed to examine the differences between pain perception felt during ESWL in pediatric and adult patients after the application of multimodal analgesia.

Material and methods: Patients who underwent the stone crushing procedure under multimodal analgesia at the ESWL unit of Mersin University Hospital Urology Clinic between May 2010 and December 2010, were divided into two groups as pediatric and adult. Using the VAS (Visual Analog Scale) form, the adult patients' and pediatric patients' pain perception felt during ESWL, were scored and compared.

Results: The success rate for ESWL was calculated as 83.3% for the pediatric group and 80% for the adult group. The first, second and third ESWL sessions mean VAS scores were 4.54 ± 1.13 , 4.55 ± 1.11 , 4.53 ± 1.14 for pediatric group and 3.58 ± 1.18 , 3.56 ± 1.20 , 3.57 ± 1.19 for the adult group. There was no statistically significant difference between the 1st ESWL session, 2nd ESWL session and 3rd ESWL session mean VAS scores in the pediatric group or adult group ($p > 0.05$). But the 1st ESWL session, 2nd ESWL session and 3rd ESWL session mean VAS scores of the pediatric group were found to be statistically significantly higher than the adult group ($p < 0.05$).

Conclusion: ESWL is a painful procedure. Our ESWL success rate is compatible with the literature. The pediatric and adult patients successfully completed the ESWL procedure with multimodal analgesia. ESWL sessions have no effect on each other for the pain perception felt during ESWL but the pain perception felt during ESWL score was higher in pediatric cases.

Key words: extracorporeal shock wave lithotripsy, pain perception, Visual Analog Scale, multimodal analgesia

Introduction

The incidence of renal stone disease varies between 1-20%, and countries where it reaches up to 37% are followed [1, 2]. Pediatric stone disease accounts for 2-3% of all stone disease cases and it is most common in children of both sexes, equally between the ages of 5 and 7 years [3].

Symptoms of renal stone-related flank pain, abdominal pain, urinary infection and hematuria can be seen. If the treatment of renal stone is not performed at the appropriate time, secondary diseases due to pain, urosepsis, renal dysfunction and end-stage renal failure may also be observed [4]. Medical and interventional treatment procedures are available for the treatment of renal stone

disease. ESWL is highly preferred in the interventional treatment procedure [4].

Extracorporeal shock wave lithotripsy (ESWL), which has been successfully applied for many years, is an important modality in the treatment of pediatric and adult urinary system stone disease [5]. Compared to minimally invasive and invasive methods, ESWL has many advantages in the treatment of kidney stones, such as fast recovery, less side effects, low kidney injury rate, and ease of re-treatment [6].

During the ESWL procedure, as a subjective feeling that is difficult to define, pain is sometimes described by patients with an intensity that may require general

anesthesia in addition to the application of analgesic and sedo-analgesic agents [7]. It is known that anxiety before ESWL increases and continues during the procedure has an effect on this pain. In order for the stone to crush easily during ESWL, the fact that the patient is cooperated and does not feel pain is important in increasing the effectiveness of ESWL [7].

The pain related to ESWL is complex acute pain. Multimodal analgesia is recommended in complex acute pain management. Pharmacological agents, regional anesthesia, rehabilitation, cognitive behavioral therapy, increasing morale, and non-pharmacological methods are recommended for this treatment [8, 9]. Failure to prevent or minimize treatable procedural pain in children is now considered both inappropriate and unethical [10]. Visual Analog Scale (VAS) has been widely used in studies to evaluate acute pain severity. The VAS form has proven itself for a long time and is a test that has been accepted in the world literature. It is safe, easy to apply [11].

In our retrospective study, we aimed to evaluate the pain perception felt during ESWL with recording VAS scores in children and adult patients after the application of multimodal analgesia and also to compare the both group's pain perception felt during ESWL .

Material and methods

Child and adult patients who applied to Mersin University Hospital Urology Clinic, were diagnosed with urinary system stone disease as a result of the tests and underwent ESWL for one to three sessions with ten days intervals were included in the study. All patients had symptoms related to an average of 1-2 cm renal stones without urinary infection. All the stones were radio-opaque. The patients were divided into two groups as pediatric (n: 18) and adult (n: 20). ESWL was applied to 38 renal units. After a physical examination and before ESWL, urine analysis and urine culture, serum urea, creatinine and electrolyte level, complete blood count, prothrombin (PTT) and aPTT level measurements were undertaken in all patients. ESWL was performed after successful antibiotic therapy in the patients that were found to have a urinary infection. ESWL contraindications (pregnancy, bleeding diathesis, severe skeletal system malformation, and obesity that would not allow the procedure) were also used as exclusion criteria. Previous ESWL treatment and psychiatric illness diseases were also an exclusion criteria.

Application of multimodal analgesia and ESWL: 40 minutes before the procedure intramuscular diclofenac sodium (0,5-2 mg/kg for pediatric patient) was administered to patients, and then the assistant physician responsible for the ESWL unit had told how to perform the procedure with the device to the patient and the procedure was followed at the time of another patient's treatment. A Multimed classic device (Elmed, 2010, Turkey) was used for ESWL. For the procedure, the pediatric patients received an average of 1,700 waves (1,500-2,000) and a maximum of 15Kv while the adults were applied 2,300 waves (1,500-2,500) and a maximum of 18Kv. The processing time was 40 minutes. At the 20th minute of the procedure, the VAS score that the patient felt was written by the assistant physician. There is a 10 cm ruler in the VAS form with painlessness on one end and the most severe pain on the other. The place marked by the patient on the ruler indicates his/her own pain. It is a one-dimensional method of measuring pain [8]. After the procedure, the patients were kept under observation for two hours.

At the end of the first week, the patients were evaluated with urinalysis, direct urinary tract radiography, and urinary

ultrasonography. In cases where the stones were not fragmented, or fragmentation was not sufficient, the patients were called for a further ESWL session.

The mean VAS scores of the first, second and third ESWL sessions were calculated for the pediatric and adult groups. The mean VAS scores of the same ESWL sessions of both groups were compared, and the mean VAS scores of each group due to three different ESWL sessions were compared within their own groups. By analyzing VAS scores related to ESWL sessions, we aimed to examine the differences between pain perception felt during ESWL in pediatric and adult patients after the application of multimodal analgesia.

IBM SPSS Statistics 22.0 program was used for statistical analysis. While evaluating the study data, in addition to descriptive statistical methods (Mean, Standard deviation), Friedman's S test was used for the analysis of variance between repeated measurements of quantitative data that did not show normal distribution, and Wilcoxon Signed Ranks test was used for the analysis of the difference between repetitions. Significance was evaluated at the $p < 0.05$ level.

Results

Pediatric group included 10 boys and eight girls, with a mean age of 12.94 ± 2.63 years and adult group included 14 males and six females, with a mean age of 46 ± 9.25 years. Body mass index (BMI) was 25.68 ± 4.63 in the adult group and it was 23.34 ± 27 in the pediatric group. In the pediatric group, eighteen patients completed first ESWL session, ten patients completed second ESWL sessions and four patients completed third ESWL session. In the adult group, twenty patients completed first ESWL session, fourteen patients completed second ESWL sessions and six patients completed third ESWL session. The success rate was calculated as 83.3% for the pediatric group and 80% for the adult group.

Table 1 presents the comparison of the VAS Scores related to ESWL Sessions between and within the Pediatric Group and Adult Group.

Table 1

Comparison of the VAS Scores related to ESWL Sessions between and within the Pediatric Group and Adult Group

VAS Score	Pediatric Group	Adult Group	1p
	Mean \pm SD	Mean \pm SD	
1st ESWL	4.54 \pm 1.13	3.58 \pm 1.18	0.001**
2nd ESWL	4.55 \pm 1.11	3.56 \pm 1.20	0.001**
3hd ESWL	4.53 \pm 1.14	3.57 \pm 1.19	0.001**
2p	1.000	1.000	
3p 1st ESWL- 2nd ESWL	1.000	1.000	
3p 1st ESWL- 3hd ESWL	1.000	1.000	
3p 2nd ESWL-3hd ESWL	1.000	1.000	

For comparison of the same ESWL session's mean VAS score between the groups: The first ESWL session mean VAS score of the pediatric group was found to be statistically significantly higher than the adult group ($p < 0.05$). The second ESWL session mean VAS score of the pediatric group was found to be statistically significantly higher than the adult group ($p < 0.05$). The third ESWL session mean VAS score of the pediatric group was found to be statistically significantly higher than the adult group ($p < 0.05$).

Figure 1 - The chart of the mean VAS scores of the pediatric and adult patient groups.



For comparison of the different ESWL sessions' mean VAS scores within the same group: In the pediatric group; There was no statistically significant difference between the mean VAS 1st ESWL session, 2nd ESWL session and 3rd ESWL session scores ($p>0.05$). In the adult group; There was no statistically significant difference between the mean VAS 1st ESWL session, 2nd ESWL session and 3rd ESWL session scores ($p>0.05$).

Discussion

In children, ESWL has high efficiency and reliability with a high success rate [12]. It is also applied with a high success rate in adult patients [13]. While the success rate is affected by stone size, density and localization in pediatric patients, in adult cases, in addition to these factors, body mass index and skin-stone distance are also effective [12,14]. In our retrospective study, the success rate of ESWL for 1-2 cm sizes radio-opaque renal stones without in pediatric and adult groups were followed in accordance with the literature and also no abnormality were observed in the BMI ratios of both groups.

In health interventions, exposure to severe pain without adequate pain management may lead to long-term negative consequences, such as morbidity and mortality, as well as fear and avoidance of future medical procedures [15]. Therefore, adequate pain management is essential for pediatric patients aged 0 to 17 years [16]. Different methods of analgesia, especially sedo-analgesia, have been applied in pediatric patients during ESWL in order to reduce the morbidity related to the procedure and ensure patient compliance. Fentanyl or midazolam is used for sedation and ketamine for analgesia [17]. General anesthesia may also be required for pediatric cases with pain intolerance. ESWL has been successfully performed with intramuscular analgesics (diclofenac sodium) in children over 12 years of age [18]. In a study by Gönener et al. [19], it was observed that giving descriptive and introductory information about the procedure to school children increased their pain threshold and decreased their fear in relation to the procedure. In our study the mean age of pediatric patients was 12.98. The patients completed the ESWL procedure after the application of multimodal analgesia (descriptive and introductory information + intramuscular diclofenac sodium). There was no need for sedo-analgesia or general anesthesia in any of the cases.

Some studies showed that informing adult patients undergoing ESWL about the procedure played an important role in reducing their pain score, as well as increasing their level of understanding about the process [20,21]. Thus, the anxiety intensity of adult patients decreases [22,23]. There are also studies investigating the primary preference of non-steroid anti-

inflammatory drugs (NSAIDs) during ESWL. In a meta-analysis comparing NSAIDs and opioids, the two groups of drugs were observed to equally relieve pain during ESWL [24]. In another study conducted by Özkan et al., it was reported that lornoxicam (an NSAID) administered before ESWL had a better analgesic effect than paracetamol and tramadol [25]. In addition, in a study on renal colic pain treatment, NSAIDs were concluded to be stronger analgesics with fewer side effects compared to opioids [26]. In our study, the adult patients completed the ESWL procedure after the application of multimodal analgesia (descriptive and introductory information + intramuscular diclofenac sodium).

The VAS form is accepted as a safe, valid and usable measurement tool for repeated measurements. There was no significant difference in the responses given after the test's short intervals and repetitions [27]. In studies conducted for the treatment of experienced pain due to ESWL, no significant difference was detected in the VAS scores measured more than once [20,22]. De Sio et al evaluated the pain tolerability in ESWL sessions with a relatively newer machine, and nearly half of the cases scored their pain on a VAS as 4 or 5 [28]. In our study, since the desired scores were answered with in a certain short period of time, we received only one answer in the tests we repeated. The first, second and third ESWL sessions mean VAS scores were 4.54 ± 1.13 , 4.55 ± 1.11 , 4.53 ± 1.14 for pediatric group and 3.58 ± 1.18 , 3.56 ± 1.20 , 3.57 ± 1.19 for the adult group. There was no statistically significant difference between the 1st ESWL session, 2nd ESWL session and 3rd ESWL session mean VAS scores in the pediatric group or adult group ($p>0.05$).

The child is physiologically and cognitively immature, but a developing creature, not a miniature of the adult. The physical, cognitive and emotional reactions to the disease vary according to the developmental period, and everything that affects the family as a system also affects the child [29]. Anatomical differences, physiological differences and behavior patterns towards the disease between children and adults affect an important role in the pain perception [30]. Hasanpoura found that pain perception decreased with increasing age in his research with children aged 5-12 years [31]. In another study, they argued that pain perception decreased as a result of the development of pain control methods with increasing age [32,33]. In our study all the same ESWL sessions mean VAS scores of the pediatric group were found to be statistically significantly higher than the adult group ($p<0.05$).

Conclusion

ESWL is a painful procedure. In our study, Our ESWL success rate is compatible with the literature. Pediatric and adult patients successfully completed the ESWL procedure with multimodal analgesia. ESWL sessions have no effect on each other for the pain perception felt during ESWL but the pain perception felt during ESWL was higher in the pediatric group.

Ethics committee approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/ or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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