http:// ijp.mums.ac.ir
Original Article (Pages: 15060-15066)

The Analgesic Effects of Oral Acetaminophen vs. Ibuprofen in Children with Supracondylar Fractures: A Triple-blind Randomized Clinical Trial

Morteza Talebi Doluee[1], Somaye Begherian[1], Rezvani Kakhki[2], Alireza Mousavian[3], Hamid Heidarian Miri[4], *Elnaz Vafadar Moradi[5]

[1] Department of Emergency Medicine, Faculty of Medicine, Mashhad University of Medical Science, Mashhad, Iran
[2] Department of Emergency Medicine, Faculty of Medicine, Mashhad University of Medical Science, Mashhad, Iran
[3] Orthopedic Research center, Mashhad university of Medical Sciences, Mashhad, Iran
[4] Department of Epidemiology and Biostatistics, Social Determinants of Health Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[5] Department of Emergency Medicine, Faculty of Medicine, Mashhad University of Medical Science, Mashhad, Iran

Abstract

Background: Supracondylar fractures are common in children with the average age of is 5-8 years. It is especially important to pay attention to pain control in these children because of the severe pain they experience. This study was designed to compare the analgesic effects of oral ibuprofen with those of the acetaminophen in children with supracondylar fractures undergoing a non-surgical treatment.

Methods: This triple-blind clinical trial was conducted on children with supracondylar fracture referred to the Emergency Department of Imam Reza and Hasheminejad Hospital. Children's pain was assessed 2, 4 and 12 hours after taking the drug by VAS (Visual Analog Scale) criteria, which was explained by the researcher to their parents.

Results: In this study, 64 children with a mean age of 5.7±1.7 years were studied. 31 children in the acetaminophen group and 33 children in the ibuprofen group were evaluated. The mean score of pain reduction within 12 hours of drug administration showed no difference between the two groups (P = 0.710). After 12 hours of drug administration, 5 and 7 children became painless in the acetaminophen and ibuprofen, respectively, with no difference between the two groups.

Conclusion: During the 12 hours after ibuprofen and acetaminophen, all children, similarly, felt analgesia and there was no significant difference between the two drugs in terms of pain relief and side effects; thus, both drugs are safe and effective for pain-control in children.

Key Words: Acetaminophen, Ibuprofen, Fractures, Humeral, Pain.

* Please cite this article as: Talebi Doluee M, Bagherian S, Rezvani kakhki B, Mousavian A, Heidariam Miri H, Vafadar Moradi E The Analgesic Effects of Oral Acetaminophen vs. Ibuprofen in Children with Supracondylar ractures: A Triple-blind Randomized Clinical Trial. Int J Pediatr 2021; 9 (12):15060-15066. DOI: **10.22038/IJP.2021.58555.4576**

**** Corresponding Author:***

Elnaz Vafadar Moradi, Department of Emergency Medicine, Faculty of Medicine, Mashhad University of Medical Science, Mashhad, Iran. Email: Vafadarme@mums.ac.ir

Received date: Jun.24,2021; Accepted date:Sep.11,2021

1- INTRODUCTION

Supracondylar fractures are common in children and are most often caused by indirect blows to the elbow during a fall on outstretched elbow (1). The mean average age of patients is 5-8 years and the incidence decreases up to 15 years. The goal of treatment is to heal the fracture in the desired position to return to the normal function (2). Depending on the type of fracture and the amount of displacement, surgical or non-surgical treatment is used (3).

The Cartland classification is the most common classification used for this fracture today (4). According to this classification, which is based on radiological manifestations of displaced parts, there are three types of fracture in this part: Type I. No displacement, Type II. There is a fracture but the posterior periosteum is intact, Type III. Complete displaced fracture. Type I is treated with splinting, but the treatment of Type II is controversial, splint or closed-reduction in K-wire fixation is used, and Type III is treated with closed reduction and percutaneous K-wire fixation (5).

These children have a lot of pain therefore it is especially important to pay attention to pain control. Several pharmacological and non-pharmacological methods such as Ice packing or elevation are used to control pain (6, 7). Various analgesic drugs are used among pharmacological methods, among which nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen are widely used to control pain in children (8). Ibuprofen is one of these NSAIDs, which is used for mild pain and is more tolerable than other drugs in this group (9). Acetaminophen is also an available drug without side effects in normal doses (10, 11).

This study was designed to compare the analgesic effects of oral ibuprofen and acetaminophen in children with supracondylar fractures undergoing a non-surgical treatment.

2- MATERIAL & METHODS

2.1. Method

This triple-blind clinical trial was conducted on children with supracondylar fracture referred to the Emergency Department of Imam Reza and Hasheminejad Hospital in 2016-2017. Inclusion criteria encompass all children with supracondylar fractures who are candidates for non-surgical treatment (Splinting). Exclusion criteria include history of bleeding or ulceration in the gastrointestinal tract, coagulopathy, platelet dysfunction, kidney disease, allergies to acetaminophen or ibuprofen or taking an analgesic other than this medications and reluctance to participate in the study.

2.2. Sample size

Sample size was calculated based on the previous studies for acetaminophen P1 = 0.35 and for oral Ibuprofen P2 = 0.61. Considering the study power of 80% and the significance level of 95%, the sample size calculated using the following formula was equal to 30 samples for each group in total equal to 60 samples.

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \left[P_1(1-P_1) + P_2(1-P_{2)}\right]}{(P_1 - P_2)^2}$$

2.3. Data collection and processing

In this study, we evaluated children who referred to the Emergency Department of Imam Reza and Hasheminejad hospitals with complaints of upper extremity trauma. After performing standard X-rays and diagnosing supracondylar fractures, those children who were candidates for splinting were included in this study. Distal humerus fracture line, the posterior

fat-pad sign or anterior humeral line displacement led us to the diagnosis of supracondylar fracture. Informed consent from the parents/legal guardian was obtained; and the sixty children were divided into two groups, based on a random table. All patients were recommended non-pharmacological methods of pain relief such as limb elevation and the use of cold compresses. The drug was randomly administered with a dose of 10 mg / kg for the two groups and the coding method was used to triple-blind the study. A nurse researcher colleague, gave the drug to the child's parents based on the coding and explained the required dose to them, based on the child's weight (**Figure 1**). The researcher explained the VAS criteria to the child's parents and gave them a brochure with full explanations. Then, the patients' pain levels were evaluated 2, 4 and 12 hours after taking the drug; and the parents declared them to the researcher, by telephone and based on the brochure. At the end of the study, the methodologist colleague performed the design based on the statistical analysis code, and after opening the coding box, the researcher found out which drug each patient had taken.

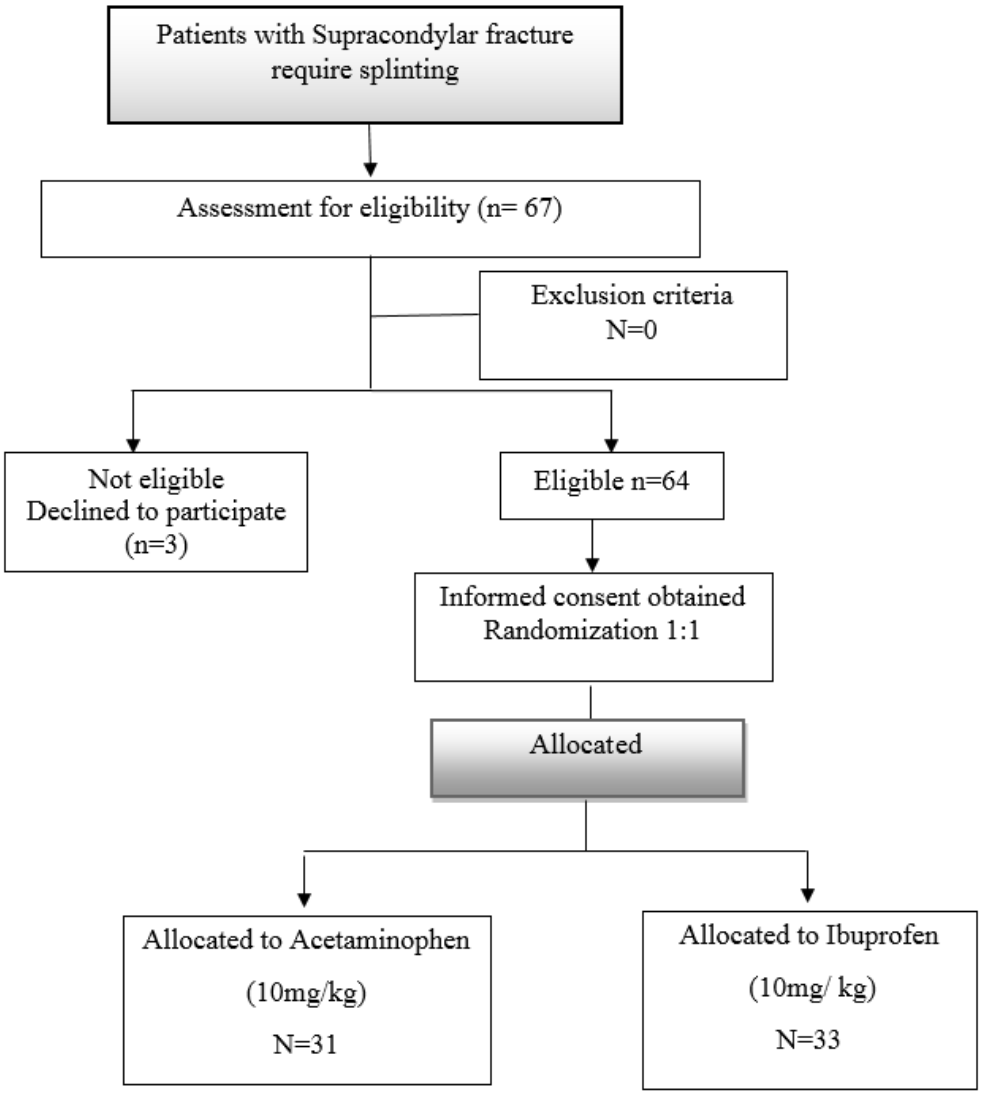

Fig. 1: Study Protocol

2.4. Ethical consideration

The Ethics Committee of Mashhad University of Medical Science (IR.MUMS.fm.REC.1395.237) approved this study and its clinical trial registration code is IRCT2016100811956N7. The names and surnames of the participants were not in the checklist, the information was classified based on numbers, and all information obtained from the study population was confidential.

2.5. Data Analysis

The data includes the demographic characteristics of these patients, clinical symptoms, the type of drug taken to reduce pain, duration of pain relief, side effects of the medication such as nausea, vomiting and pruritus of each patient were collected and analyzed by SPSS22. The $\chi 2$ test was used to analyze the qualitative variables and, if necessary, the Fisher's exact test was implemented. P value less than 0.05 was considered as the significance level in all tests.

3- RESULTS

In this study, 64 children with a mean age of 5.7±1.7 years were studied. 31 children in the acetaminophen group and 33 children in the ibuprofen group were evaluated, among whom 24 (37.5%) in the acetaminophen group and 24 (37.5%) in the ibuprofen group were boys. Patients' pain scores were measured before drug administration in the acetaminophen and ibuprofen groups as 8.5 ± 1.1 and 8.2 ± 1.9, respectively; the groups did not show any significant difference (P = 0.585). The pain scores after 2 hours of acetaminophen and ibuprofen administration were 8.5 ± 1.1 and 9.1 ± 2.1, respectively, the difference of which was not significant, and did not change compared to before drug administration (p = 0.471). The mean pain scores after 4 hours of acetaminophen and ibuprofen administration were 5.8 ± 1.2 and 5.3 ± 1.4, respectively, which showed no significant difference between the two groups using Mann-Whitney. After 12 hours, the pain mean score decreased in both groups, acetaminophen group was 1.4 ± 0.8 and ibuprofen group was 1 ± 0.7; however, the difference between the two groups was not significant (P = 0.065) (**Table 1**).

The reduction of the mean pain score within 12 hours of drug administration was compared between the two groups using Mann-Whitney; and no significant difference was observed between the two groups (P = 0.710) (**Figure 2**). After 12 hours of drug administration, 5 and 7 children were painless in the acetaminophen and ibuprofen groups, respectively, with no significant difference between the two groups (P = 0.6.3).

Table-1. Demographic data, and pain score means of the two groups

	Acetaminophen	Ibuprofen	P value
A. Demographic variables			
Age(Years Old)	6.1±1.8	5.4±1.5	0.099
Male	24	24	0.665
B. Average pain Score			
Before drug administration	8.5±1.1	8.2±1.9	0.585
2 Hours after administration	8.5±1.1	9.1±2.1	0.471
4 Hours after administration	5.8±1.2	5.3±1.4	0.193
12 Hours after administration	1.4±0.8	1±0.7	0.065

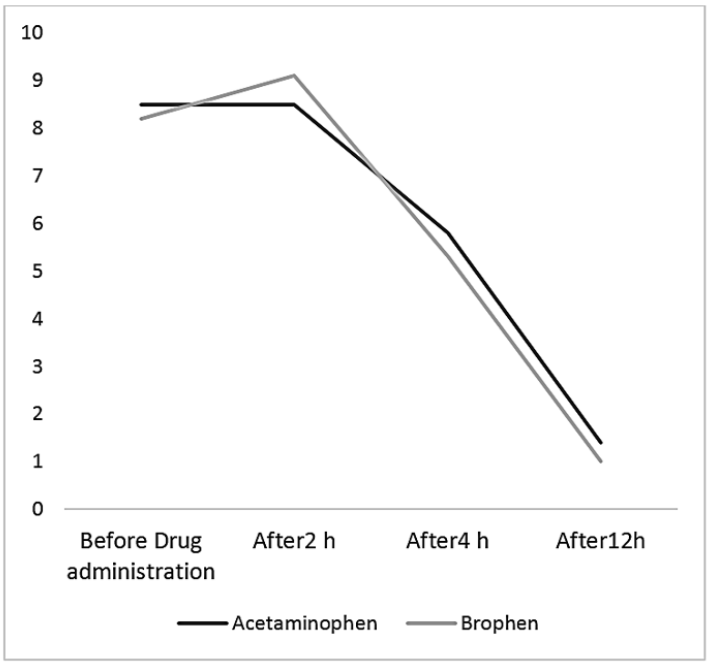

Fig. 2- The reduction of the pain score means within 12 hours of drug administration in the two groups

4- DISCUSSION

In this study, 64 children with supracondylar fractures who were candidates for treatment with posterior splint were evaluated with the purpose of comparative study of pain relief with acetaminophen and ibuprofen. From among the 64 children, 48 were boys, consistent with literature showing the higher prevalence of this fracture in boys. The mean age of the patients was 5.7 years, which is in accordance with the previous studies, and it is reasonable because at this age, children's outdoor activities and games increase, and the risk of trauma is also increased.

Numerous studies have been performed on the efficacy and side effects of acetaminophen and ibuprofen in children. Despite the fact that supracondylar fractures are common in children, there are not many studies performed on pain control in this fracture; and the present study is one of the first comparative studies on the effects of acetaminophen and ibuprofen on controlling the pain of these children. In 2020, Perrott et al. conducted a systematic review on the efficacy and safety of acetaminophen compared to ibuprofen in the treatment of fever and pain in children (12). They examined seventeen double-blind clinical trials in patients under 18 years of age who had used these two drugs for pain or fever. In this study, they concluded that single-dose acetaminophen and ibuprofen have similar analgesic effects and side effects are similar in both drugs, but that the antipyretic effect of ibuprofen after 2, 4 and 6 hours is greater than that of acetaminophen. The results of this systematic review are in line with the results of our study, although they also compared the antipyretic effects of the two drugs. Nonetheless, our study investigated the effect of these two drugs on pain control of supracondylar fracture, which is one of the most common childhood fractures that was not studied in Perrott's study (12).

Swanson et al. examined the effects of acetaminophen and morphine on the mean

pain of children with supracondylar fractures after surgery. In this retrospective study, they studied patients in two groups receiving non-narcotics and narcotics (morphine), in which acetaminophen group had an average pain of 1.2 and morphine group 2.4. They concluded that acetaminophen had a morphine-equivalent pain-controlling effect with fewer side effects and could be used as a safe analgesic after supracondylar fracture surgery (5). This study was similar to our study in terms of the type of injury, which was a supra-condylar fracture, but in this study, children undergoing surgery were studied and the effect of acetaminophen was compared with morphine. In 2004, Nosrati et al. compared the analgesic effects of acetaminophen and ibuprofen after extracting the lower first molar teeth. In this study, ibuprofen was slightly more effective than acetaminophen in reducing pain on the first and second days after ingestion, but on the third day, the two drugs were not different. In general, there was no significant difference between the effects of these two drugs on pain after tooth extraction (13). In this study, similar to ours, the analgesic effect of acetaminophen and ibuprofen was compared; but their study was on patients whose teeth were extracted and the study period was longer. Yet, the results reported by Nosrati et al. were similar to those of our study.

In 2020, Rokni et al. compared the pain-reducing effects of paracetamol and pethidine in children after fracture surgery. After the operation, they first assessed the severity of the children's pain using VAS; then after 6 hours of surgery, they Prescribe pethidine for the first group and paracetamol for the second group. They concluded that paracetamol has a greater pain-reducing effect than pethidine (14). Their study group, like ours, had orthopedic injuries, but their study was on patients after surgery, while we evaluated patients who were candidates for non-surgical treatment. While we compared acetaminophen and ibuprofen, Rokni et al. evaluated paracetamol and pethidine. Overall, a review of studies shows the need to use safe drugs with low side effects along with a suitable analgesic effect in children.

Limitations

One of the limitations our study was the incorrect estimation of the patients' pain by parents, and the other one was the impossibility of evaluating the patients by the researcher.

5- CONCLUSION

During the 12 hours after ibuprofen and acetaminophen, children had similar analgesia and there was no significant difference between the two drugs in terms of pain relief and side effects; both drugs are, then, safe and effective for pain-control in children.

6- ACKNOWLEDGEMENT

This study is a based on Dr. Bagherian’s postgraduate thesis and supervised by Dr. Talebi Deluee. The Vice Chancellor for Research of Mashhad University of Medical Sciences has supported this study.

7- REFERENCES

1. Holt JB, Glass NA, Shah AS. Understanding the epidemiology of pediatric supracondylar humeral fractures in the United States: identifying opportunities for intervention. J Pediatr Orthop. 2018; 38(5):e245 – e251. DOI: 10. 1097 / BPO.0000000000001154.

2. Ramesh P, Avadhani A, Shetty AP, Dheenadhayalan J, Rajasekaran S. Management of acute 'pink pulseless' hand in pediatric supracondylar fractures of the humerus. J Pediatr Orthop B. 2011 May; 20(3):124-8. DOI: 10.1097 /BPB. 0b013e328342733e. PMID: 21164361.

3. Friday JH, Kanegaye JT, McCaslin I, Zheng A, Harley JR. Ibuprofen provides analgesia equivalent to acetaminophen-codeine in the treatment of acute pain in children with extremity injuries: a randomized clinical trial. Acad Emerg Med. 2009 Aug; 16(8):711-6. DOI: 10.1111/j.1553-2712.2009.00471.x. Epub 2009 Jul 14. PMID: 19624576.

4. Canale ST. Fractures and Dislocations in Children. In Canale ST, Beaty JH (eds): Campbell's Operative Orthopaedics, 11th ed. Philadelphia: Mosby. 2008. pp1524-1531.

5. Swanson CE, Chang K, Schleyer E, Pizzutillo PD, Herman MJ. Postoperative pain control after supracondylar humerus fracture fixation. J Pediatr Orthop. 2012 Jul-Aug; 32(5):452-5. DOI: 10. 1097/ BPO. 0b013e318259f85a. PMID: 22706458.

6. Porter RN, Chafe R, Mugford G, Newhook L, Furey A. Poor access to timely pain reduction interventions for pediatric patients with supracondylar humerus fracture. Pediatr Emerg Care. 2013 Jul; 29(7):796-800. DOI: 10.1097/PEC.0b013e31829838b2. PMID: 23823256.

7. Clark E, Plint AC, Correll R, Gaboury I, Passi B. A randomized, controlled trial of acetaminophen, ibuprofen, and codeine for acute pain relief in children with musculoskeletal trauma. Pediatrics. 2007 Mar; 119(3):460-7. DOI: 10.1542/ peds.2006-1347. Erratum in: Pediatrics. 2007 Jun; 119(6):1271. PMID: 17332198.

8. Friday JH, Kanegaye JT, McCaslin I, Zheng A, Harley JR. Ibuprofen provides analgesia equivalent to acetaminophen-codeine in the treatment of acute pain in children with extremity injuries: a randomized clinical trial. Acad Emerg Med. 2009 Aug; 16(8):711-6. DOI: 10.1111/j.1553-2712.2009.00471.x. Epub 2009 Jul 14. PMID: 19624576.

9. Drendel AL, Gorelick MH, Weisman SJ, Lyon R, Brousseau DC, Kim MK. A randomized clinical trial of ibuprofen versus acetaminophen with codeine for acute pediatric arm fracture pain. Ann Emerg Med. 2009 Oct; 54(4):553-60. DOI: 10.1016/j.annemergmed.2009.06.005. Epub 2009 Aug 19. PMID: 19692147.

10. Lim KB, Tan SS, Abdullah SN, Ong LL, Wong ML, Allen JC. Percutaneous pin removal in the outpatient clinic--do children require analgesia? a randomized controlled trial. J Bone Joint Surg Am. 2014 Apr 2; 96(7):597-602. DOI: 10.2106/JBJS.M.00806. PMID: 24695927.

11. Nazari Dashlibrun Y, Ramezanian M, Ebrahimi Saravi M, Arabi M. Comparing the Efficacy of Celecoxib, Ibuprofen and Acetaminophen Codeine in Pain Relief after Impacted Lower Third Molar Surgery. J Mazandaran Univ Med Sci. 2015; 24 (121):94-102 URL: http://jmums.mazums.ac.ir/article-1-5304-en.html

12. Perrott DA, Piira T, Goodenough B, Champion GD. Efficacy and safety of acetaminophen vs ibuprofen for treating children's pain or fever: a meta-analysis. Arch Pediatr Adolesc Med. 2004 Jun; 158(6):521-6. DOI: 10.1001/ archpedi.158.6.521. PMID: 15184213.

13. Nosrati K, Baradaran M, Habibi Savadkoohi M. Analgesic effect of Acetaminophen and Ibuprofen in pain relief after extraction of mandibular first molar. JBUMS. 2004; 6 (5):35-39. http://jbums.org/article-1-2724-en.html

14. Rokni, A., Sezavar, M., Eslahtalab, A., Mirimoghaddam, M., Behzadfar, S., Jalalpour, M., Pour Amiri, A. Comparison of Postoperative Pain in Two Groups of Children with Bone Fractures Receiving Pethidine and Paracetamol in Kerman Bahonar Hospital: A Clinical Trial Study. International Journal of Pediatrics, 2020; 8(10): 12213-12221. DOI: 10.22038 /ijp. 2020.51516.4094