

## INTRODUCTION

- Approximately 47,600 opioid-related deaths took place in the US in 2017, with 35% of these deaths linked to prescription abuse/misuse leading providers to be cautious with prescribing these medications.<sup>1</sup>
- Diseases of the musculoskeletal system comprise 8.3% of primary diagnoses by physicians, with 60% to 90% of patients in the Emergency Department (ED) reporting a chief complaint involving pain.<sup>2,3</sup>
- Non-steroidal anti-inflammatory drugs (NSAIDs) are prescribed as the initial treatment because of their analgesic and anti-inflammatory properties through COX-1 and COX-2 inhibition.
- In cases where NSAIDs like ibuprofen alone don't offer the intended effect, transdermal lidocaine may be given to promote analgesia by targeting and suppressing sodium ion channels, without resulting in the systemic side effects of NSAIDs.
- Studies show that NSAIDs and topical analgesics relieve musculoskeletal pain in a similar or better manner when compared to strong opioids.<sup>4,5</sup>
- Transdermal lidocaine has also been effective in treating post-herpetic neuralgia and postoperative cesarean surgery, with minimal side effects.<sup>6,7</sup>

## HYPOTHESIS

- The treatment of patients who present to the ED with a chief complaint of acute musculoskeletal pain with ibuprofen and a lidocaine patch will result in the greater improvement of their pain scores and fewer follow-up visits when compared to treatment with ibuprofen alone.

## MATERIALS & METHODS

- Patients who presented to the ED at Vidant Medical Center with a chief complaint of acute, isolated musculoskeletal pain ( $\leq 7$  days duration) and met inclusion/exclusion criteria (exclusions such as pregnancy, diabetes, and end-stage renal disease) were asked to participate.
- Participants were randomized into two treatment arms: 1) 800 mg ibuprofen or 2) 800 mg ibuprofen plus a 4% lidocaine patch (Lidocare Pain Relief Patch<sup>TM</sup>).
- Following the administration of medications, patients were observed for relief of symptoms for 1 hour in the ED.
- Using the 10-point Likert pain scale, patients circled a number corresponding to their pain at baseline (prior to the administration of medication) and at discharge.
- Patients were given a prescription for medication they were administered in the study for 3 days and were contacted in 48 to 72 hours to obtain follow-up data.
- Changes in pain ratings over time were analyzed using ANOVA, one sample t-test, and paired t-test.

## RESULTS

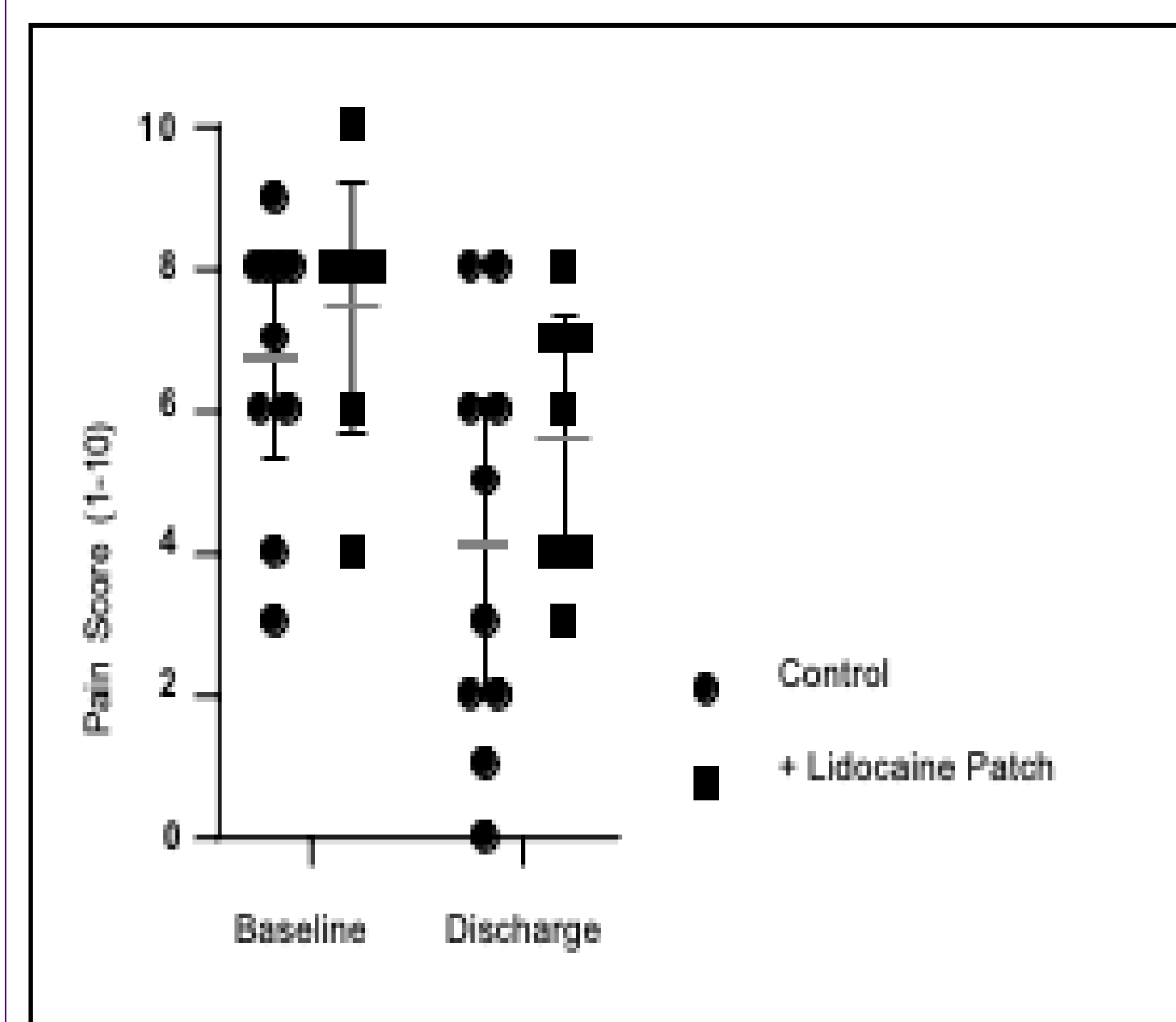
A total of 23 participants were enrolled in this study, with 17 patients used for final analysis. The 6 patients were removed since either the data collected on them was incomplete or they did not meet study protocol. Of the patients in the study, 10 patients were randomized into the control group and 7 patients in the lidocaine patch treatment group.

**Table 1: Pain Scores at Baseline and ED Discharge between Groups**

Group A: Ibuprofen			Group B: Ibuprofen and Lidocaine		
Patient	Pain Score (Initial)	Pain Score (Discharge)	Patient	Pain Score (Initial)	Pain Score (Discharge)
1	6	5	11	8	7
2	6	8	12	6	3
3	7	6	13	4	4
4	8	3	14	8	6
5	8	6	15	8	4
6	9	0	16	10	8
7	3	1	17	8	7
8	4	2			
9	8	8			
10	8	2			

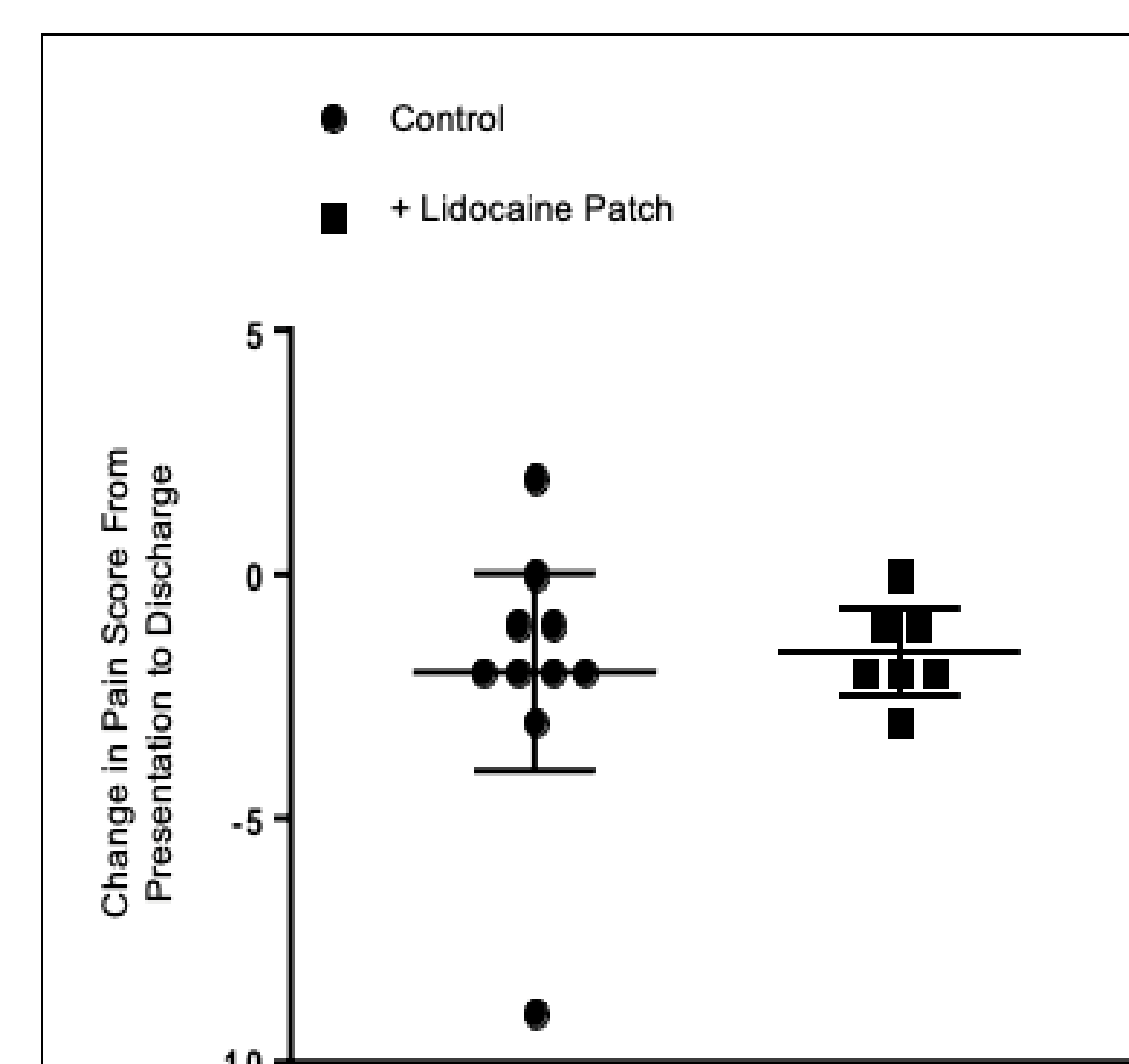
**Table 1.** A) Ibuprofen group with baseline pain score (average 6.7) and pain score at discharge (average 4.1). B) Ibuprofen + Transdermal Lidocaine group with baseline pain score (average 7.4) and pain score at discharge (average 5.6)

**Figure 1: Patient Pain Scores at Baseline and Discharge**



**Figure 1.** Patient pain scores, with thick lines representing means. Whiskers represent 95% CI.

**Figure 2: Comparison of the Change in Pain Scores Between Treatment Groups**



**Figure 2.** Change in pain scores from admission to discharge.

As depicted in Figure 1, there was no clinically significant difference in mean pain scores between the control group and the lidocaine group at baseline ( $6.7 \pm 1.9$  vs.  $7.4 \pm 1.9$ ;  $p=0.46$ ) or at discharge ( $4.1 \pm 2.9$  vs.  $5.6 \pm 1.9$ ;  $p=0.26$ ). There was a nearly 30% pain reduction to a pain score less than 5 in the control and treatment group. The median change in pain score was -2.0 in both groups, with a range of 2 to -9 in the control group and 0 to -3 in the lidocaine patch group as depicted in Figure 2.

## DISCUSSION

- Many patients in the ED do not have adequate pain control with NSAIDs, with studies showing how a 33% or more decrease in pain intensity serves as a good measure of clinical response.<sup>8</sup>
- In this study, there was a 2-point decrease in pain severity in the ibuprofen control group (20% reduction) and 1.6-point decrease in pain severity in the experimental group (16% reduction).
- In regard to the pain scale, both study groups achieved similar results for pain scores of  $< 5$  at ED discharge (50% for control and 42% for experimental group).
- Although the overall change in the pain scores is similar for both the control group and the treatment group, the lidocaine patch treatment group had much less variability as evidenced by a tighter 95% CI, which may be reflective of its consistency to be effective and reliable.<sup>9</sup>
- One of the advantages of transdermal patches is that they function through a more controlled, sustained delivery of medication, often with reduced variation in drug levels when compared to oral medications.<sup>9,10</sup>
- This study had limitations including a single center recruitment site and relatively low number of study patients.
- Future studies are needed to further examine the efficacy of transdermal lidocaine in treating acute musculoskeletal pain with consideration of its incorporation into multimodal treatment combinations.

## REFERENCES

- Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. Drug and Opioid-Involved Overdose Deaths - United States, 2013-2017 | MMWR. Centers for Disease Control and Prevention. [https://www.cdc.gov/mmwr/volumes/67/wr/mm675152e1.htm?s\\_cid=mm675152e1\\_w](https://www.cdc.gov/mmwr/volumes/67/wr/mm675152e1.htm?s_cid=mm675152e1_w). Published January 4, 2019.
- Rui P, Okeyode T. National Ambulatory Medical Care Survey: 2016 National Summary Tables. Pain Management in the Emergency Chain: The Use and Effectiveness of Pain Management in Patients with Acute Musculoskeletal Pain. *Pain Med.* 2015; 16 (5): 970-984. doi: 10.1111/pme.12668.
- Friedman BW, Dym AA, Davitt M, et al. Naproxen With Cyclobenzaprine, Oxycodone/Acetaminophen, or Placebo for Treating Acute Low Back Pain: A Randomized Clinical Trial. *JAMA.* 2015 Oct 20;314(15):1572-80. doi: 10.1001/jama.2015.13043.
- Berthelot JM, Darrieutort-Lafitte C, Le Goff B, Manguers Y. Strong opioids for noncancer pain due to musculoskeletal disease: Not more effective than acetaminophen or NSAIDs. *Joint Bone Spine.* 2015 Dec;82(6):363-367. doi: 10.1016/j.jbspin.2015.08.003.
- Vrooman B, Kapural L, Sarwar S, et al. Lidocaine 5% Patch for Treatment of Acute Pain After Robotic Cardiac Surgery and Prevention of Persistent Incisional Pain: A Randomized, Placebo-Controlled, Double-Blind Trial. *Pain Med.* 2015;16(8):1610-1621. doi:10.1111/pme.12721 [doi].
- McCarberg B, D'Arcy Y. Options in topical therapies in the management of patients with acute pain. *Postgrad Med.* 2013;125(4 Suppl 1):19-24. doi:10.1080/00325481.2013.1110567011 [doi].
- Farrar JT, Berlin JA, Strom BL. Clinically important changes in acute pain outcome measures: a validation study. *J Pain Symptom Manage.* 2003;25(5):406-411. doi:S0885392403001623 [pii].
- Nalamachu S, Gudini J. Characteristics of Analgesic Patch Formulations. *J Pain Res.* 2020;13:2343-2354. doi:10.2147/JPR.S270169 [doi].
- Rousseau V, Morelle M, Arriurbe C, et al. Efficacy and Tolerance of Lidocaine 5% Patches in Neuropathic Pain and Pain Related to Vaso-occlusive Sickle Cell Crises in Children: A Prospective Multicenter Clinical Study. *Pain Pract.* 2018;18(6):788-797. doi:10.1111/papr.12674 [doi].

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