Clinical Neurophysiology Practice 6 (2021) 170–171

Contents lists available at ScienceDirect

Clinical Neurophysiology Practice

journal homepage: www.elsevier.com/locate/cnp

Letter to the Editor

Topical lidocaine hydrochloride 4% spray on pain perception during the needle electromyography: A prospective study

The needle electromyography (EMG) is an essential tool in establishing an accurate diagnosis of various neuromuscular diseases (Slack et al., 2009). It measures the electrical activity in the muscles via the insertion of the needle electrode. It can be painful, especially during skin puncture, resulting in early termination (Slack et al., 2009; Moon et al., 2013).

In our study, we sought to determine, if there was any difference in pain perception with needle EMG as measured by numerical rating scale (NRS) between the group who received topical anesthetic lidocaine HCl 4% spray versus no lidocaine. Forty-two patients were recruited at our Electromyography (EMG) lab at the University of Missouri, Columbia, over three months, from January to March 2017. They were randomly assigned into two groups, one who received topical anesthetic lidocaine HCl 4% spray and the other without any. Both groups were age-matched and matched to the muscles and their frequency of testing.

When the nerve conduction study was over, the physician (RG) proceeded to the needle EMG examination. All patients in the study were educated and watched an American Association of Neuromuscular and Electrodiagnostic Medicine-AANEM video about the procedure. NRS is a numerical single-item scale that has been used for the measurement of pain intensity. It is mostly displayed as a scale where "no pain"(score of 0), moderate pain (score of 5) and "worst imaginable pain" (score of 10). After educating the patients in the Lidocaine group, the physician (RG) cleaned the site using an alcohol gauze, followed by Lidocaine Hydrochloride 4% spray, from three inches distance for fifteen seconds, which were then allowed to dry. In the control group, the patient was only educated about the procedure. Then the patient was asked to relax the muscle before inserting a concentric needle electrode. After checking the insertional and spontaneous activity, the motor unit potentials were recorded by instructing the patient to contract the muscle of interest against the resistance, with the needle still in place. Once the needle was removed, the pressure was applied at the site of needle insertion for a variable amount of time depending on the patient body habitus, and the site was inspected for hemostasis. The NRS was obtained at the end of the procedure by the technician.

Patient demographics and clinical data were analyzed using the SAS 9.4 system. Continuous and categorical data summarized with descriptive statistics, including median, mean with standard deviation, ranges, and frequencies. The two groups were compared using a *t*-test. $P < 0.05$ was considered statistically significant. The study was approved by the University of Missouri institutional review board, and informed consent was obtained from each participant.

Forty-two patients were recruited with a mean age of 57.9 ± 5.05 years. 95% Caucasians, and 5% African Americans. Among them, 55% were men and 45% women. 17 different muscles (254 times) were tested, and they were matched in both groups. We used a standardized muscle testing protocol for common conditions such as radiculopathy, neuropathy, and many patients got similar muscles tested. The demographics, NRS scores of the two study groups are described in Table 1, and the muscles tested, and their frequencies are depicted in Fig. 1.

The indications of the needle EMG among all the patients are Lumbosacral radiculopathy. (33.3%), Polyneuropathy (35.7%), ulnar mononeuropathy (2.5%), carpal tunnel syndrome (11.9%), and cervical radiculopathy (16.6%). The calculated mean ± SD of the NRS score in the lidocaine spray group is 5.7 ± 0.75, and the non-lidocaine group is 5.9 ± 0.85. There was no statistically significant difference between the two groups ($P = 0.609$).

A study determining various predictors in the pain perception associated with EMG reported that information about the procedure would reduce the anxiety associated with the procedures (Khoshbin et al., 1987). Providing detailed information about the procedure, in other terms educating the patient, can alleviate the pain perception (Richardson et al., 1994). In our study, all the patients were educated about the procedure to reduce pain perception. Other factors like the physician's skill performing the needle EMG and the type of electrode used (monopolar vs. concentric) can influence the pain score (Strommen and Daube, 2001). While we used a concentric needle in our study, the same physician (RG) performed the testing (results are operator dependent) (Menkes and Pierce, 2019). The type of muscle also influences the pain perception tested; for instance, it is well known that testing abductor pollicis brevis is reported to be very painful (London et al., 2014). Appropriate measures were taken to match the type of muscles tested in both the groups of our study.

Various studies reported the role of topical anesthetic agents in minimizing the pain due to needle EMG. A study utilized a Eutectic mixture of local anesthetic [EMLA] cream and placebo, but they were applied to the same hand at the forearm and thenar surface sites.

Application of EMLA cream resulted in partial relief of EMG pain (Lamarche et al., 1992). Another study reported that the application of vapocoolant spray prior to the needle EMG procedure was superior to the EMLA cream and placebo (Moon et al., 2013). However, only one muscle (gastrocnemius) was tested in this study.

In a randomized control trial, determining the effect of lidocaine iontophoresis in the needle EMG, the pain was found to be less, but not statistically significant. The pain relief was rather attributed to the iontophoresis procedure itself rather than lidocaine (Annaswamy and Morchower, 2011).

Lidocaine hydrochloride (HCl) 4% spray is extensively used as a local anesthetic, and our study is unique as we sought to determine

https://doi.org/10.1016/j.cnp.2021.04.001

Table 1
Patient demographics and NRS scores in two groups.

	Lidocaine group (n = 22)	No lidocaine group (n = 20)
Age (mean)	57.5 years	58.4 years
Gender (male: female)	63%: 37%	45%: 55%
Race (Caucasian: African American)	95%: 5%	95%: 5%
NRS score (mean ± SD) [p-value = 0.609]	5.7 ± 0.75	5.9 ± 0.85

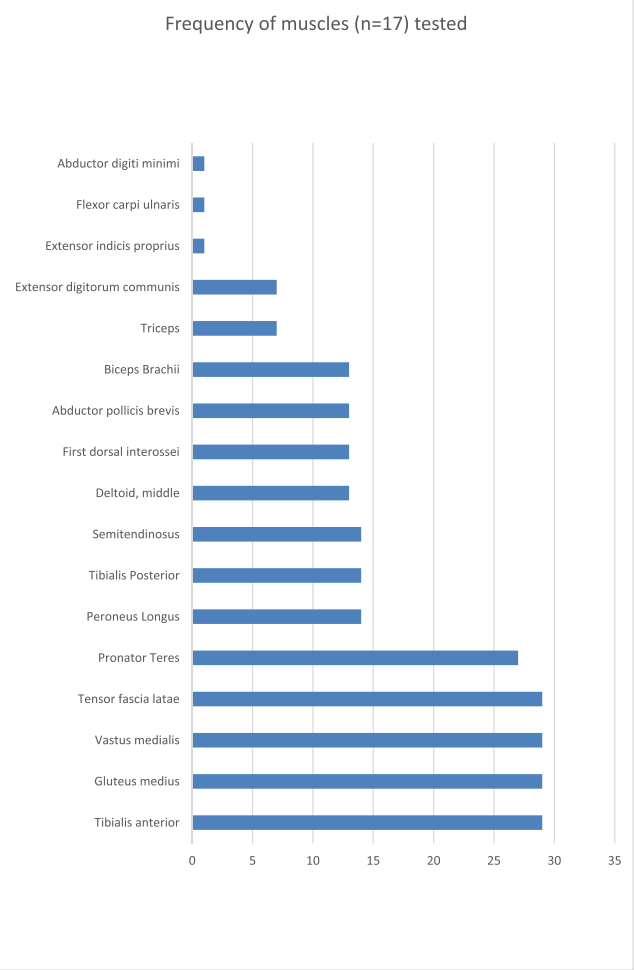

Fig. 1. Muscles tested and their frequencies.

the analgesic effects of lidocaine spray in the needle EMG pain on various muscles in both upper and lower limbs in a clinical setting.

The lack of difference can also be attributed to the minimal cutaneous absorption of Lidocaine HCl spray and the lack of its impact on the nociceptive receptors in the muscle (Derry et al., 2014). However, our study is not devoid of limitations like lack of blinding, age match in the lidocaine group, and small sample size.

We found no effect of topical anesthetic lidocaine HCl 4% spray on patient's perception of pain with needle EMG measured by NRS.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Received 7 January 2021
Received in revised form 24 March 2021
Accepted 26 April 2021

Available online 11 May 2021