

A Retrospective Analysis of Trigger Point Injections in the Management of Post-surgical Pain in Patients who had Anterior Cervical Surgery

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ABSTRACT

Introduction: The opioid epidemic has launched the United States into a public health crisis, resulting in a greater emphasis on non-opioid multimodal pain control methods. At our institution, post-operative posterior neck stiffness and myofascial pain are a common concern after anterior cervical surgery (ACS), likely due to prolonged intraoperative positioning in neck extension. Studies have shown successful analgesic outcomes of trigger point (TP) injections with local anesthetic for generalized myofascial pain. This retrospective pilot study aimed to evaluate whether TP injections with bupivacaine decrease post-surgical pain compared with traditional therapies in patients undergoing ACS and thereby decrease the amount of opioid medication used. **Materials and Methods:** We retrospectively reviewed all ACS cases from January 2019 to March 2020 at a single university hospital. We identified patients who received TP injections versus standard care (SC). Patients were excluded if TP was performed >3 h from surgery, in recovery for opioid use disorder, underwent a posterior approach, staged surgery, or sustained cervical trauma. The primary outcomes were pain control through the visual analog scale (VAS) and calculated oral morphine equivalents (OME) taken at 6, 12, and 24 h postoperatively. Secondary outcomes included length of stay. **Results:** A total of 137 patients received ACS (100 SC, 37 TP), 62 were excluded. A total of 75 (47 SC, 28 TP) patients were included in this study. The average OME at 6 h significantly decreased when comparing SC versus TP (32 vs. 22, $P = 0.025$). There was no significant difference in average VAS at all time points and average OME at 12 and 24 h. About 50% of patients were discharged by 18 h. **Discussion:** Within 6 h of the post-operative period, TP injections with bupivacaine significantly reduce opioid consumption, without affecting overall pain level. There is an opportunity for TP injections to be included in opioid-sparing, multimodal pain regimens for post-operative myofascial neck pain, especially in consideration of the opioid crisis. Limitations of this retrospective study were the small number of study participants that many patients were discharged before 18 h and that some may have been on chronic pain therapy. **Conclusions:** In this retrospective study, trigger point injections are an effective alternative method of pain control for myofascial neck pain in the immediate post-operative period after ACS, leading to decreased opioid consumption.

Key words: Anterior cervical corpectomy with fusion, anterior cervical discectomy and fusion, myofascial pain, opioid crisis, post-operative pain, trigger point injection

BACKGROUND/INTRODUCTION

Cervical radiculopathy is a disabling form of spinal disease in the adult population. It arises from a compressive or neurodegenerative process causing

pain, numbness, and weakness in the neck and shoulders and upper extremities.^[1] While non-surgical management is typically effective, surgery is often indicated in patients who fail conservative management or develop worsening motor weakness, myelopathy, or myeloradiculopathy.^[1] In

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the United States, the number of cervical spine surgeries performed overall continues to increase very year.^[2]

There are two typical surgical approaches: Anterior and posterior. Anterior cervical discectomy and fusion surgery is the most common, making up at least half of all cervical spine surgeries.^[2,3] It has shown to be more cost effective, has improved outcomes and lower complication rates.^[4-6] Another effective anterior approach is anterior cervical corpectomy with fusion.^[7] A notable advantage of anterior cervical surgeries (ACS) is that the disc can be accessed without disruption to the spinal cord, spinal nerves, and posterior neck muscles.^[8] The literature thus far has reported successful reduction of neuropathic neck pain after surgery,^[9-11] however, there is no mention of new-onset cervical myofascial pain during the post-operative period. At our institution, post-operative posterior neck stiffness and pain are a common concern from our patients. Appropriate surgical exposure for an anterior approach requires patients to be positioned supine with the neck extended; therefore, their myofascial pain is likely a consequence of overuse or trauma, exacerbated in the setting of prolonged neck extension during surgery. The myofascial pain is localized to areas known as “trigger points (TP)” which are areas of muscle tension resulting in palpable tense bands. When compressed, TPs can cause local and referred pain.^[12]

TP injections with or without local anesthetic such as lidocaine have been shown to be effective treatment for myofascial pain in patients with chronic neck pain.^[13] The procedure involves administration of saline or anesthetic directly on the palpated TP.^[12] Several studies have compared TP injections with other treatments. When TP injections are combined with local anesthetic, it is more effective than placebo with saline,^[14] Botox injections or dry needling,^[13,15] and equivalent to physical therapy.^[16] Our institution has recently incorporated TP injections into a multimodal regimen for post-operative pain control. The aim of this study is to evaluate retrospectively whether TP injections with bupivacaine decreases post-surgical pain compared with traditional therapies in patients undergoing ACS and thereby decreases the amount of opioid pain medication used.

MATERIALS AND METHODS

IRB approval was granted for this study. We retrospectively chart reviewed all ACS cases from January 2019 to March 2020 at a single university hospital. We identified patients who voluntarily received TP injections (TP) versus standard care (SC). All patients received SC for pain control, which included pre-operative acetaminophen 1000 mg PO Q8h and various opioids for post-operative breakthrough pain (hydromorphone 0.5 mg IV PRN, fentanyl 50 mcg IV PRN, and/or oxycodone/paracetamol 5/325 mg PO PRN). Basic demographic information, such as age, gender, and ethnicity, was also collected. TP with 0.25% bupivacaine was administered in

aliquots of 2 ml into multiple locations along the bilateral trapezii and rhombi by an anesthesiologist. The total volume of local anesthetic used was 20 ml throughout these regions.

Patients were excluded if TP injection was performed >3 h from surgery, in recovery for opioid use disorder, underwent a posterior approach, had staged or multiple surgeries, or sustained cervical trauma.

The primary outcome measures were pain control described through the visual analog scale (VAS) and calculated oral morphine equivalents (OMEs) taken at 6, 12, and 24 h postoperatively. Secondary outcomes included length of stay. Statistical analysis was performed, and *P*-values were based on Welch's *t*-test.

RESULTS

A total of 137 patients received ACS (100 SC, 37 TP), 62 were excluded. A total of 75 (47 SC, 28 TP) patients were included in this study. The average age of patients was 56 years. The average OME at 6 h was significantly lower when comparing SC versus TP (32 vs. 22, *P* = 0.025). There was no significant difference in average VAS at all time points and average OME at 12 and 24 h [Table 1]. About 50% of patients were discharged by 18 h.

DISCUSSION

This study retrospectively evaluated the efficacy of TP injections versus opioid only to treat post-operative myofascial neck pain after ACS in reducing overall opioid use for pain control. Our results suggest that TP injections with bupivacaine significantly reduce opioid consumption within 6 h of the post-operative period, without increasing overall pain level. There is an opportunity for TP injections to be included

Table 1: Primary outcomes of anterior cervical surgery patients receiving postoperative standard pain control versus trigger point injection at multiple time points.

Outcome	Standard Care (n=47)	Trigger Point Injection (n=28)	p-value
OME	(mg)	(mg)	
6 hours	32±2.8 (n=47)	22±3.0 (n=28)	0.025*
12 hours	54±5.1 (n=29)	37±10.5 (n=9)	0.18
24 hours	78±7.1 (n=27)	58±18.9 (n=6)	0.35
VAS			
6 hours	3.4±0.4 (n=47)	3.3±0.4 (n=28)	0.78
12 hours	5.3±0.6 (n=29)	4.2±1.3 (n=9)	0.45
24 hours	5.4±0.6 (n=27)	3.2±1.5 (n=6)	0.21

Data presented as Mean±Standard Deviation, * p-value was <0.05
OME: Oral Morphine Equivalents, VAS: Visual Analog Scale

in non-opioid multimodal pain regimens for post-operative myofascial neck pain, especially during the opioid crisis. There are currently no studies in the literature assessing the effectiveness of alternative pain control methods in the post-operative period for myofascial pain. However, as summarized in the introduction, the previous studies have highlighted the successful analgesic outcomes of TP injections with local anesthetic for generalized myofascial pain.^[12-15]

These results have significant clinical implications for post-operative pain management. The opioid epidemic has launched the United States into a significant public health crisis. According to the CDC, almost 70% drug overdose deaths in 2018 were related to opioids. Although opioid-related death rates have been slowly decreasing since 2017, drug overdose deaths are still 4 times higher than in 1999.^[17] About 6% of new persistent opioid use in the American adult population result after major and minor surgical procedures.^[18] Current clinical guidelines recommend the use of multimodal analgesia for the treatment of post-operative pain.^[19] This makes sense as pain is an experience that is acquired through multiple mechanisms mediated through the spinal cord and processed in the cortex. These pathways have several locations where different modalities can intervene to alter this negative experience. The previous studies demonstrated that the inclusion of alternative analgesia such as nonsteroidal anti-inflammatory drugs and perioperative intravenous ketamine has been shown to augment pain relief effectively or decrease opioid consumption.^[20] Therefore, a multimodal analgesia regimen – starting with regional or local anesthesia followed by systemic non-opioid analgesics before administering systemic opioids – is crucial to reducing overall opioid consumption.^[21] This study suggests that TP injections with a local anesthetic are also an effective non-opioid intervention to incorporate into the pain control regimen to reduce post-operative opioid use further while maintaining appropriate analgesia.

Opioids have effective analgesic properties but are well known for their systemic side effect profile and potential for physiologic and psychological dependence. Common side effects include sedation, respiratory depression, constipation, nausea, vomiting, and dizziness. Typically, patients develop tolerance to both the analgesic and side effects except for constipation and nausea, which can be difficult to manage.^[22] On the other hand, in the current literature, the most commonly reported side effect of TP injections is temporary local discomfort from the site of injection, but most patients do not experience any.^[23,24] The reported post-injection soreness is described as distinctly different from myofascial pain.^[24]

We recognize that all procedures are not without risk. Potential complications of TPs include pain, bleeding, pneumothorax, infection, allergic reaction to the anesthetic, and hematoma.^[25] These have only been reported in rare

case reports in the literature.^[26,27] Pneumothorax reports have been isolated and were noted to be after a TP injection in cervicothoracic region.^[28] Otherwise, TP injections are generally low risk, well tolerated by patients and have a limited side effect profile. The overall benefit of TP injections ultimately outweighs the risks when compared with that of opioids for pain control.

The opioid epidemic also poses a significant economic burden on the health-care system. In the recent decade, research and government groups estimated that the total economic burden related to prescription opioids and the opioid crisis ranged between \$78.5 billion and \$504 billion.^[29,30] A significant proportion of these costs is related to overdoses. Adverse drug reactions from opioids also contribute to the excessive healthcare costs due to increased hospital length of stay and use of hospital resources to manage those adverse effects.^[31] Our study shows that alternative methods for pain control such as TP are effective, generally safe with a limited side effect profile, and can reduce overall opioid consumption. Therefore, fewer opioids are prescribed, decreasing frequency of adverse reactions, ultimately playing a role in reducing increasing costs to the health-care system and to the patient.

There are a few limitations in this study. As a retrospective study, it was difficult to control for different variables within our study population. For instance, patients were offered TP on a volunteer basis, thus introducing possible selection bias. Furthermore, there were only a limited number of patients who met our inclusion criteria and received TP leading to a small sample size. Many patients were also discharged before 18 h; thus, we were unable to assess the efficacy of TP beyond that time point. Some of our results could also have been affected in patients who have been on chronic pain therapy with methadone. In the comparison group of patients who received standard pain control, not every patient received standardized perioperative management including intraoperative ketamine and post-operative acetaminophen, nonsteroidal anti-inflammatory agents, and opioids for breakthrough pain. Therefore, some patients may be receiving varying amounts of pain control medications that may affect their level of reported pain through the VAS. As already mentioned, some processes were unable to be standardized. Therefore, TP was not administered within the same timeframe and would occasionally occur after post-operative narcotics were given in the post-anesthetic care unit.

Future research is to develop a prospective randomized controlled study to compare with this retrospective study. The study design will address the limitations previously stated. The prospective study will include placebo and control groups, as well as randomization and blinding of both the patients, medical team, and investigators. There is also an opportunity to standardize the overall procedure such as defining a short and specific time in which all groups

receive their assigned procedure. In addition, myofascial pain as a consequence of surgical position is not unique to ACS; therefore, future studies may focus on the effectiveness of TP injections across multiple surgical subspecialties.

CONCLUSIONS

In this retrospective study, TP injections are an effective alternative method of pain control for myofascial neck pain in the immediate post-operative period after ACS, leading to decreased overall opioid consumption. This is an important consideration for pain control management during the opioid epidemic. Further studies can continue to ascertain effectiveness while also assessing for safety and generalizability across other types of surgeries.

COMPETING INTEREST

Authors have no financial or non-financial competing interest to disclose.

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AUTHORS' CONTRIBUTIONS

- Vivien Pat – medical student who did data collection and literature review
- Ivy Benjenk – research coordinator, manuscript writing and editing
- Everett Chu – resident physician who did data collection and manuscript writing
- Geoffrey Ho – research assistant who did data analysis and manuscript editing
- Eric Heinz – attending physician who did project design and manuscript writing and editing
- Anita Vincent – attending physician, team leader, and manuscript composition.

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