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The Use of Liposomal Bupivacaine Intraoperatively Through a Superficial Cervical Plexus Blockade for Postoperative Pain Management for Carotid Endarterectomy: a Case Report

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Abstract

Currently, bupivacaine liposome injectable suspension (Exparel™, PACIRA BIOSCIENCES, INC., Tampa, Florida, USA) has approval by the Food and Drug Administration for the management of postoperative pain in various surgical patients. In this case report, we suggest the addition of introducing its use in surgical procedures involving the neck, specifically, patients undergoing carotid endarterectomy. The infiltration of liposomal bupivacaine into the superficial cervical plexus has proved to provide adequate pain relief for approximately 72 hours postoperatively discarding the use of other analgesics. Despite the findings, this calls for a larger study comparing the efficacy of different postoperative pain management protocols.

Keywords: Liposomal Bupivacaine, Regional Anesthesia, Endarterectomy, Pain Management.

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1. Introduction

Local anaesthetics have shown to provide acceptable pain management via regional anaesthesia, yet opioides currently represent the gold standard in pain control despite their correlation with potentially severe side effects. Recently, nanotechnology has provided an alternative form of pain control lasting 2-4 hours (Moradkhani, et al., 2018). In 2011, bupivacaine liposome injectable suspension (Exparel™) was approved for postoperative analgesia through a single-dose block in a variety of cases, leading to increased comfort and effective analgesia up to 4 days (Moradkhani, et al., 2018).

The superficial cervical plexus block is used in surgical and pain management procedures pertaining to the neck, but the most common indication continues to be for carotid endarterectomy (CEA) (Stoneham, et al., 2015). Regional anaesthesia for CEA in the United States and United Kingdom alike have utilised 1.5% mepivacaine, 2% lidocaine, 0.25% bupivacaine, or 0.5% ropivacaine, providing approximately 3 – 10 hours of relief (Leoni, et al., 2000). Moreover, a combination approach with fentanyl in addition to ropivacaine have yielded 10 hours of relief, but 70-90% of these patients reported adverse effects related to opioid derivatives (Goma and Aref, 2014). In addition, we continue to find pain control after 10 hours replaced with 3.8 +/- 2.0 mg of morphine administered every 4 hours, increasing the risk of constipation, drowsiness, nausea, vomiting, and possibly developing addiction after long-term use (Goma and Aref, 2014).

New studies suggest that Exparel™ provides an alternative form of postoperative pain control. Double-blind studies performed confirmed the efficacy of Exparel™ reporting a 45 - 78% decrease in opioide consumption in the first postoperative 48 hours. Despite de latter, studies have yielded questionable results in postoperative pain management predominantly in knee and ankle procedures (Discepola, et al., 2020 and Surdam, et al., 2015). However, there is wide success using Exparel™ in the brachial plexus block for patients undergoing major shoulder surgery (Patel, et al., 2020). We believe using Exparel™ intraoperatively via a superficial cervical plexus block in patients undergoing CEA provides superior pain relief nullifying the use of opioid derivatives.

2. Case Report

A 53-year-old female with a history of “tunnel vision” is admitted for elective right carotid endarterectomy, previous work up with CT (Computed Tomography) Neck Angiogram reporting bilateral carotid stenosis (85% stenosis of the right internal carotid and 80% stenosis of the left internal carotid). Past medical history is significant for multiple coronary artery disease, aortic valve stenosis, hypertension, and diabetes mellitus type 2. The patient also reported a past surgical history of coronary angioplasty and multiple abdominal surgical procedures, with no reported complications associated to anaesthesia. Physical exam on admission found no neurologic deficits, carotid bruit bilaterally, systolic ejection murmur associated with aortic valve stenosis, a blood pressure of 170/70 mmHg, heart rate of 76 beat

per minute, and respiratory rate of 16 breaths per minute with an oxygen saturation on room air of 96%. According to the anaesthesia assessment, the patient was identified as ASA Class II. Dr. Gonzalez went over the anaesthetic plan and possible complications, risks associated to bupivacaine liposome injectable suspension (Exparel™) and consented the patient.

Anaesthetic plan is to provide general anaesthesia with an intraoperative placement of superficial cervical plexus block with 266 mg of bupivacaine liposome injectable suspension (Exparel™). The patient was transferred to the surgical operating room and was induced with 200 mg of propofol and 100 mcg of fentanyl. Muscle paralysis was obtained with 10 mg rocuronium as a prefasiculating dose followed by 100 mg of succinylcholine for placement of transoral intubation. Intubation was performed with Macintosh blade and size 7.5 mm diameter tracheal tube with ease on first attempt, no complications were reported. Thereafter, general anaesthesia was achieved through inhalation anaesthetic, sevoflurane with an expired concentration of 1.1 – 1.8%. Moderate arterial hypotension was observed on several occasions, phenylephrine was administered to maintain systolic blood pressure above 130 mmHg. Adequate anaesthesia was provided; no redose of narcotic was necessary. Prior to surgical incision closure anaesthesia instructed surgical team to localize the superficial cervical plexus and inject 266 mg of bupivacaine liposome injectable suspension (Exparel™) around the plexus in a fan-like technique, concluding surgical procedure. Reported duration of surgical procedure was 165 minutes. Patient was extubated in operating room, no complications were reported, and following protocol the patient was transferred to the recovery room for continuous monitoring.

On postoperative exam the patient was neurologically intact and following commands, pain score was 0/10, assessment was done with numeric rating scale, no narcotics were administered, with the following vital signs: blood pressure 122/76 mmHg, heart rate 81 beats per minute, respiratory rate 16 breaths per minute, oxygen saturation 98%. Within the next 24 hours, Dr Gonzalez followed up on pain control at 10:45 hours military time, patient was referring pain score 0/10 despite no administration of narcotics with numbness over the area innervated by the superficial cervical plexus, vital signs were reported stable. In the next 48 hours patient was discharged from the cardiovascular intensive care unit due to significant clinical improvement and to continue follow-up with treating physician externally. Dr Gonzalez followed up with the patient at 72 hours post-endarterectomy, confirming satisfactory results of pain control with no supplemental pain control needed. The entirety of this report adheres to CARE guidelines previously stipulated in the CARE Checklist 2013 edition.

3. Discussion

In the present case, the patient under general anaesthesia is administered a superficial cervical plexus block, prior to the closure of the surgical wound, by the cardiovascular surgeon under the guidance of Dr Gonzalez. Our reports indicate that

there was maintained satisfactory pain control, discarding the need for supplementary opioid analgesics within the next 24, 48, and 72 hours. Furthermore, any adverse events encountered during and after this case were reported to the manufacturer and United States Food and Drug Administration for further investigation.

The use of bupivacaine liposome injectable suspension lowers the use of supplemental opioid pain medications more effectively than previously established management. Currently, the most commonly utilised drug for the superficial cervical plexus block is 0.5% ropivacaine, which only provides 10 hours maximum of pain relief. Previously reported, 78% of patients were prescribed postoperatively: hydrocodone (28%), oxycodone (27%), hydromorphone (25%), and tramadol (4%); of which 70% of patients report continued use of opioid prescribed pain medications at home (Colton, et al., 2019). The inadequate control of pain leads to concerns of prolonged hospitalisation and increased risk of opioid related complications.

Compton and Valentino reported, opioid dependency is increasing at a greater margin, inadvertently leading to a public health crisis of substance abuse nationwide and exceeding 500,000 deaths due to opioid overdose (Compton, et al., 2021). Data in 2017, an estimated $500 billion were spent due to the misuse of opioids, which calls for further investigations for alternative pain management options (Compton, et al., 2021). Investigating alternatives for pain management would improve patient experience and drastically improve the public health issues that we are facing today.

After the release of liposomal bupivacaine, there is reported success using liposomal bupivacaine in an interscalene brachial plexus block in patients undergoing major shoulder surgery (Patel, et al., 2020). In this study, liposomal bupivacaine was associated with significantly reduced postoperative opioid administration ($P<0.0001$) and prolonged pain control through 48 hours ($P<0.0001$) (Patel, et al., 2020). However, the duration of effects can vary between different procedures and location of the administered block.

Moreover, physicians should be aware of the risk factors when performing a superficial, deep, or complete cervical plexus block and the intravascular toxicity of local anaesthetics. The following are known risk factors: infection, wound hematoma, phrenic nerve block, intravascular toxicity, nerve injury, and inadvertent subarachnoid or epidural anaesthesia. Yet, Pandit, Satya-Krishna, and Gration concluded that a superficial lone approach had zero complications when administering the block compared to a 0.25% incidence in the deep approach, with a P-value of 0.006 (Pandit, et al., 2007). Additionally, there was a reported 0.39% conversion to general anaesthesia in the superficial group compared with a 2.08% in the deep block group, with $P<0.0001$ (Pandit, et al., 2007). Of these conversions, it specifies the most common reasons to convert to general anaesthesia in both groups was due to block failure and patient anxiety/lack of co-operation (Pandit, et al., 2007).

In conclusion, these findings not only support and reiterate the safety of using a lone superficial block approach, but also represent an analysis of 2500 cases and 30 years of publications where there was no single instance of serious complications related

to a superficial cervical plexus block (Pandit, et al., 2007). While the use of liposomal bupivacaine has been successful in brachial plexus block procedures, its effectiveness for pain control in patients that have undergone carotid endarterectomies is underreported. Moreover, our success in maintaining pain control with Exparel™ through a superficial cervical plexus block and the lack of research pertaining to this approach suggests the need for further investigation. Therefore, we recommended that more research should be done to expand the use of Exparel™ in a superficial cervical plexus block on patients undergoing any type of neck procedure, and in this case specifically carotid endarterectomies. We also recommend that physicians review this medication before applying this medication on patients, to be informed on possible adverse effects and treat accordingly.

4. Advantages

No advantages were present before, during, and after the procedure and submission of the case report.

4.1.1 Cost

The author(s) received no financial support or endured additional costs for the research, authorship, and/or publication of this article.

4.1.2 Conflicts of Interest

The author(s) declared no potential conflicts of interest with respect to the research, external funding, or competing interests.

4.1.3 Disclosures

The following drug, bupivacaine liposome injectable suspension (Exparel™, PACIRA BIOSCIENCES, INC., Tampa, Florida, USA), used in this case report for regional anaesthesia through a superficial cervical plexus block is considered an "off-label" use because it is not specified as one of its indications.

5. Conclusion

More extensive research must be done using the superficial/deep cervical plexus blockade in combination with Exparel™ to compare the advantages and effectiveness of this new alternative with other commonly used methods.

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