

Evaluation of Continuous Peripheral Nerve Block in Total Knee Arthroplasty Post-Operative Pain Management

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Abstract: Total knee arthroplasty (TKA) can contribute to significant pain for the patient. Continuous peripheral nerve blocks (CPNBs) have been shown to be efficacious in treating post-surgical pain. The objective of this study is to determine the efficacy of a bupivacaine 0.2% solution administered via CPNB plus standard of care (SOC) compared to SOC alone. SOC for this institution includes the use of opioid analgesics, non-opioid analgesics, regional anesthesia, and other adjuncts. The primary outcome is the overall use of post-operative pain medication. Secondary outcomes include the average length of stay and average pain scores. Methods: A data surveillance system was used to retrospectively identify all patients who underwent TKA with and without the use of CPNB. To be included, patients must have been male or female ≥ 18 years of age who underwent TKA from September 2016 through September 2017. And 70 patients were included in both the CPNB and SOC groups. A retrospective chart review determined the following data: The types and amounts of pain medications used, the length of stay, and patient-reported pain scores. Results: There was an increase in the amount of as needed pain medication use in the CPNB + SOC vs. SOC group with 12.97 administrations vs. 12.67 administrations respectively. Length of stay was increased in the CPNB + SOC vs. SOC group with 3.65 days in the CPNB + SOC group vs. 3.5 days in the SOC group. Pain scores were increased in the CPNB + SOC group with a patient average pain score of 4.5 vs. the SOC groups average pain score of 4.4. Conclusions: The use of a 0.2% bupivacaine solution administered via CPNB in addition to SOC resulted in increased utilization of as needed pain medication administration, increased average length of stay, and increased average pain scores when compared to SOC alone.

Key words: CPNB, pain management, TKA.

1. Introduction

Total knee arthroplasty (TKA) is one of the most popular and most performed surgeries in the United States. According to the agency of Healthcare Research and Quality, roughly 600,000 TKAs are performed in the U.S. each year. By the year 2030, the demand for TKAs is expected to increase to more than three million per year [1]. One facet of TKA that has been studied, but not extensively, is post-operative pain control modalities and how it impacts the use of as needed pain medication, length of stay and pain scores. This study aims to focus on the use of a bupivacaine 0.2% solution administered via continuous peripheral

nerve blocks (CPNB) to determine if its use has any effect on the use of as needed pain medication, length of stay, and pain scores.

TKAs commonly contribute to significant pain in patients. Pain is a chief concern for patients undergoing total joint arthroplasty, and poorly controlled pain can drastically limit rehabilitation and recovery [2]. CPNBs are useful in patients who are expected to have prolonged need for analgesia. CPNBs work by delivering a continuous infusion of a local anesthetic through a percutaneously-placed catheter. The catheter is placed bordering the peripheral nerve providing prolonged analgesia. This technique may increase patient satisfaction by decreasing pain perception, opioid use, and side effects. In light of the opioid epidemic currently in our country, non-opioid pain

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management solutions may be more beneficial for patients. Current recommendations include the use of a multimodal approach to pain management [3]. This approach may include opioid analgesics, non-opioid analgesics, regional anesthesia, and other adjuncts which can be individualized based on the specific source and severity of pain in the patient [3]. The study institution refers to this treatment as the standard of care (SOC). Some institutions perform CPNB as part of this multimodal approach, and this study will evaluate if its use is warranted.

2. Materials and Methods

2.1 Materials

This study was a comparison between two groups of patients who underwent a TKA with one group using a 0.2% bupivacaine solution administered via CPNB + SOC and the other group using SOC alone as post-operative pain management options. The data was obtained retrospectively from a data surveillance system. The 0.2% bupivacaine solution was made up of 300 mL of normal saline and 200 mL of 0.5% bupivacaine solution. Inclusion criteria for this study were patients either male or female ≥ 18 years of age who underwent TKA from September 2016 through September 2017 at a community hospital located in the Midwest. Pregnant women, the mentally challenged, and prisoners were excluded from this study. Data collection included patient age, weight, surgical site, provider, pain scores, length of stay, and frequency of as needed pain medication use.

A total of 140 patients were included in this study. And 70 patients were included in both the SOC and CPNB + SOC groups. Baseline characteristics among the two groups were similar (see Table 1). A retrospective chart review determined: The types and amounts of pain medications used, the length of stay, and patient-reported pain scores measured. The use of as needed pain medications was determined by

obtaining the average number of as needed administrations for each group. Length of stay and pain score assessments were also obtained by use of averages. This study was reviewed and approved by the Institutional Review Board.

2.2 Statistic Analysis

This study contains two groups, the CPNB + SOC group and the SOC group. To obtain the average number of as needed administrations, each administered as needed pain medication was added together for each group and then divided by the number of patients in each group. Average length of stay was found by adding the length of stay for each group and then dividing the sum by the number of patients in each group. Average pain scores were obtained by adding the pain scores of each group and then dividing the sum by the number of patients in each group.

3. Results

There was an increase in the primary outcome of the amount of as needed pain medications in the CPNB + SOC vs. SOC group with 12.97 administrations vs. 12.67 administrations respectively (see Fig.1). Drug class frequency of use in the CPNB + SOC group vs. SOC group was further broken down into opioids (85% in both groups), muscle relaxers (7% in both groups), NSAIDS (6% vs. 5%) and acetaminophen (2% vs. 3%) (see Table 2).

Secondary outcomes were also increased in the CPNB + SOC group. Length of stay was increased in the CPNB + SOC vs. SOC group with 3.65 days in the CPNB + SOC group vs. 3.5 days in the SOC group (see Fig. 2). This is a 3.6-hour increase in the length of stay for the CPNB + SOC group. Average pain scores were increased in the CPNB + SOC group with a patient average pain score of 4.5 vs. the SOC groups average pain score of 4.4 (see Fig.3).

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Table 1 Baseline characteristics.

	CPNB + SOC (n = 70)	SOC (n = 70)
Average age (years)	65.5	66
Average weight (kg)	94.1	95.1
Right knee (%)	51	59

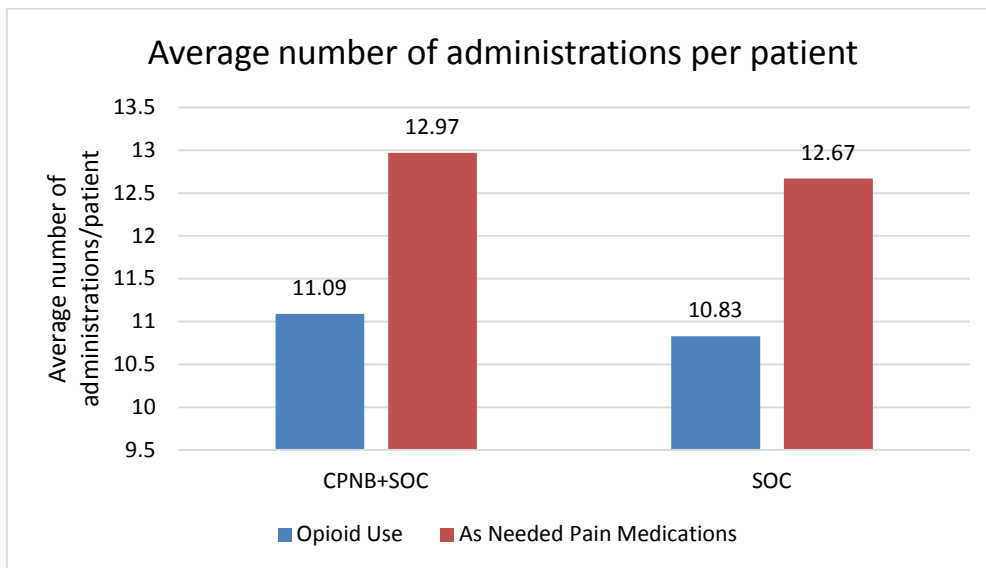


Fig. 1 Average number of administrations per patient.

Table 2 Frequency of use in CPNB + SOC and SOC alone.

	CPNB + SOC	SOC
Opioids	85%	85%
Muscle relaxants	7%	7%
NSAIDs	6%	5%
APAP	2%	3%

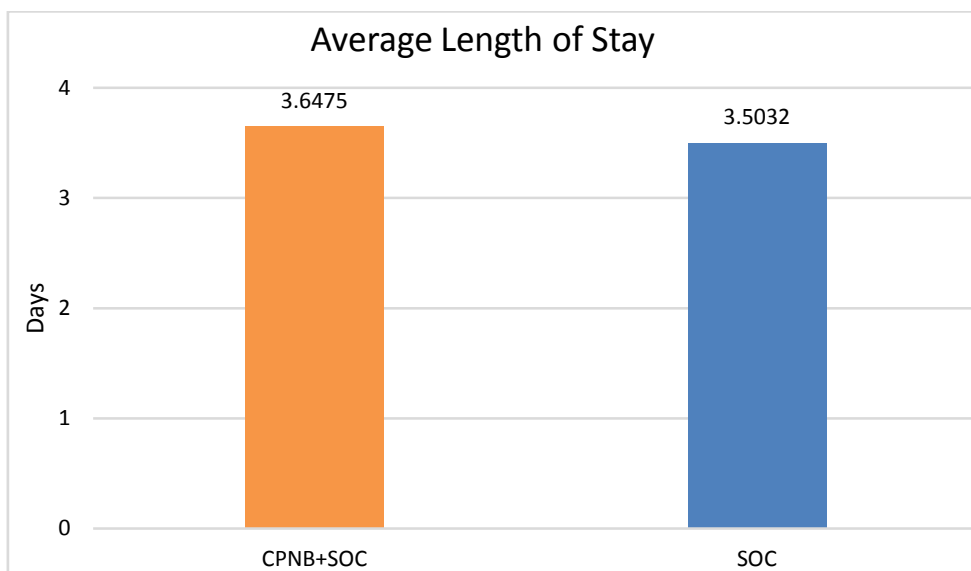


Fig. 2 Average length of stay.

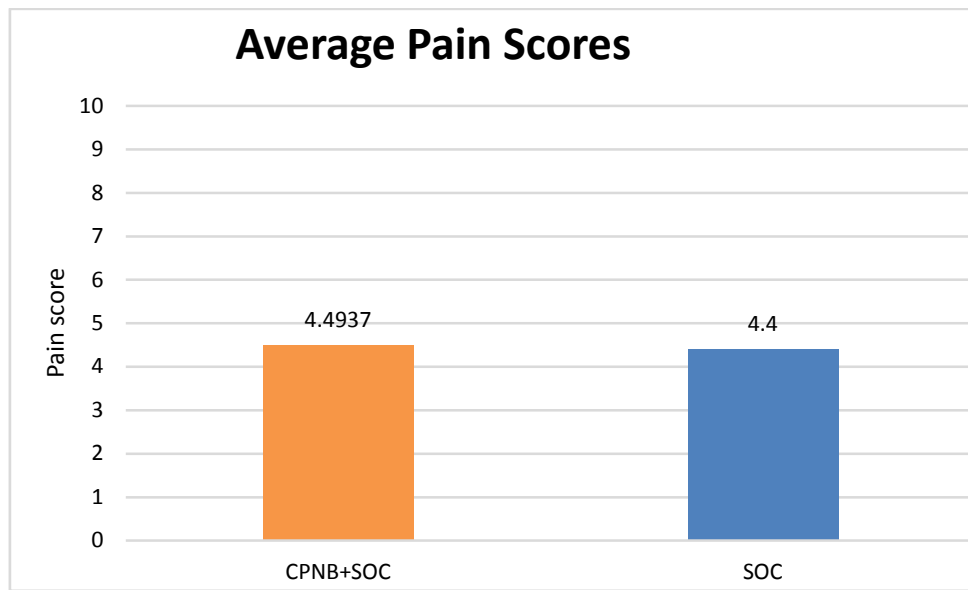


Fig. 3 Average pain scores.

4. Discussion

The data collected shows that the use of a 0.2% bupivacaine solution administered via a CPNB did not lower the use of as needed pain medication, length of stay, and pain scores at this study institution. In a recent article in the Journal of Orthopaedics, by O’Neil et al [4], the average length of stay was also increased in patients using a CPNB. A possible theory as to why there is an increase in the length of stay is that the use of a CPNB may numb the leg thus decreasing ambulation post-operatively. Patients may not be accustomed to the sensation a CPNB brings about. This numbness may perturb patients from ambulation. Although not proven, the observed increase in length of stay could stem from decreased ambulation in the CPNB + SOC group.

This study was not completed without limitations. This study did not look into the pain scores based on the patients’ gender. Other studies have shown that males require more pain medications after a TKA than females [4]. If there was a significant number of males requiring more pain medications in either arm, the data could be skewed. Every pain score recorded was used in this study regardless of time. Some patients had many pain scores of zero recorded late at night.

Whether the zeros were entered because the patient verbalized their score was a zero, or because they were sleeping, is unknown. A standardization of time for pain score collection could have solved this confounding variable.

Opioid medications were not converted into morphine equivalents in this study. This would be a limitation because one dose of hydrocodone or hydromorphone was counted as one administration, even though hydromorphone is more potent when converted into morphine equivalents. This study also did not take into account scheduled pain medications. It is possible that patients with less as needed pain medication administrations required less because they had more scheduled pain medications. Furthermore, increased use of pain medications may have been seen in the CPNB + SOC group because the length of stay was larger for that group, leading to increased administrations of medications.

5. Conclusions

In conclusion, more robust data from randomized controlled trials would be needed before recommending the discontinuation of the CPNB. The data showed no benefit regarding frequency of as needed pain medication use, length of stay, and average

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pain scores. The use of a CPNB may be useful in select patients that cannot tolerate opioid medications, but further studies are warranted to make that claim. I would recommend the study institution continues to utilize SOC for pain management in patients undergoing a TKA while increasing multimodal pain management through the use of opioids, NSAIDs, muscle relaxants, and acetaminophen.

References

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