

Evidenced-Based Practice Guideline Development: Selection of Local Anesthetics and the Additive Dexamethasone in Brachial Plexus Blocks

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Introduction

Brachial plexus blocks (BPB) are a type of regional anesthesia where a local anesthetic (LA) is injected near a group of nerves in the neck called the brachial plexus, to provide motor and/or sensory inhibition from hours to days (Kukreja et al., 2019). Efficacy of a BPB depends on the type and dose of LA, as well as use of any additive agent. Additive agents are medications, such as dexamethasone, which are added with LA to prolong the duration of analgesia (Bindal et al., 2018).

Clinical Problem

Despite evidence demonstrating best practices and benefits of LA and additive use with BPB, recent chart audit reports revealed a wide variability of clinical practice in the use of LA and additives in BPB among the anesthesia providers at the large Level 1 trauma center. Further complicating this issue, the hospital lacked a standardized evidence-based practice (EBP) guideline for the choice of LA and additives for BPB, which may have also contributed to the current state of inconsistent practice among providers.

Project Purpose

The purpose of this project was to develop and provide the hospital with a practice guideline using the best evidence from the literature. The final guideline will not be implemented at the hospital, due to time constraints related to guideline implementation and the duration of the Doctor of Nursing Practice (DNP) academic length. The goal of the guideline was to provide leadership with evidenced-based recommendations that can be used to help streamline and improve the quality and consistency of future anesthesia delivery of BPB.

Project Goals

- Synthesize the evidence around the use of LA and the additive dexamethasone with BPB
- Develop a guideline based on the evidence
- Present the guideline to the Clinical Process Improvement Team (CPIT)

Project Implementation

The Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) Model, as shown in Figure 1, is a clinical problem solving and decision-making model. It helps to address clinical needs using practice questions, evidence, and translation (PET) with a hope to quickly incorporate latest findings in patient care (Newhouse et al., 2017). The project will follow the JHNEBP Model through Step 3 “Best Practices”.

Step 1: Inquiry

The practice issue at the hospital was a lack of evidence-based clinical guidelines for LA and the additive dexamethasone used in BPB. The issue was identified after several meetings with key stakeholders in anesthesia and pharmacy departments, by auditing providers' preference lists, and systematically analyzing high level currently published evidence. See the Inquiry Findings table below.

Step 2: Practice Learning

Practice Question: In patients who received BPB (P) how does the use of 30 ml 0.5% ropivacaine and the additive agent dexamethasone (I) compared to BPB with varied LA types or volumes without an additive agent (C) affect postoperative patient outcomes?

Evidence: A literature search was completed. The published studies were appraised using the Johns Hopkins Nursing Evidence-Based Practice Synthesis and Recommendations Tool. See Review of Literature below.

Translation: It was evident that practice is not adopted based on current evidence.

- Identified key stakeholders from the pharmacy and anesthesia departments to help develop clinical practice guideline on LA and additive agent use in BPB.
- Presented an overview of the problem and need for clinical practice change using the SWOT briefing format to all stakeholders and policy approving CPIT committee members. See SWOT analysis below)

Step 3: Best Practices

- Guideline was created from the data compiled through a systematic review and local/national/standard clinical practice guidelines.
- Submitted the evidenced-based clinical practice guideline to the anesthesia and pharmacy departments for further review and approval.

Step 4: Practice Improvements

- The project team was unable to implement the guideline due to the nature of the DNP program's academic/curricular timeline.
- The EBP guideline was communicated to the anesthesia and pharmacy departments for potential future implementation.

Project Evaluation

- Evaluation involved the ability to:
 - Collect and appraise data through systematic review and local/national/standard clinical practice guidelines.
 - Develop a EBP guideline and submit for initial committee review.
- The findings of this scholarly project can also serve as a beginning point for a greater understanding of the importance of evidence-based best practices, clinical knowledge, policy, and anesthesia practice impacts on postoperative patient outcomes.

Limitations

- Due to the nature of DNP project's limited time, it was not possible for the current members to implement the guideline.
- The project timeline was impacted by the ongoing COVID-19 pandemic
 - The first scheduled CPIT meeting had to be rescheduled due to hospital mandates.
- The project's findings were based on a literature review, so findings might differ if a trial is performed at the selected hospital.

Conclusion

BPB are a type of regional anesthesia that inhibits the sensory and motor function of the upper extremity. The literature review suggested that 30 ml of 0.5% ropivacaine with dexamethasone 4 mg is the most appropriate dose to provide optimal patient outcomes. The project developed practice guidelines based on the selection of LA and the additive dexamethasone in BPB to address the clinical practice gap identified at the hospital.

The goal of the guideline was to provide leadership with evidence-based recommendations that can be used to help streamline and improve the quality and consistency of future anesthesia delivery of BPB. The consistent use of 30 ml of 0.5% ropivacaine with dexamethasone 4 mg for BPB may lead to improvements in patient outcomes as a result.

Guideline

- GUIDELINE**
- I. Local Anesthetic Selection**
- A. Type:**
1. Ropivacaine is the recommended type of local anesthetic:
 - a. Rationale for recommending Ropivacaine:
 - 1) Ropivacaine has faster a sensory and motor onset
 - 2) Ropivacaine showed stronger effects with the additive dexamethasone compared to Bupivacaine
 2. Other local anesthetics that can be used:
 - a. Bupivacaine
 - 1) Bupivacaine has demonstrated an enhanced motor blockade, but also demonstrated more cardiac toxic effects
 - b. Lidocaine and Ropivacaine
 - 1) No statistical differences between varied doses of LA combinations
 - 2) Higher lidocaine volume can cause more negative side effects, such as lower pulse oximetry levels and local anesthetic toxicity
- B. Dose:**
1. 30 ml of 0.5% Ropivacaine is the recommended dose
 2. Other local anesthetics doses that can be used:
 - a. 30 ml of 0.5% of Bupivacaine
 - b. 10 ml 1% Lidocaine and 20 ml 0.75% Ropivacaine
 3. Volume may vary depending on UNB location
- C. Recommended criteria:**
1. Common inclusion criteria:
 - a. ASA physical status I-III, 18-65 years old, upper extremity surgery
 2. Common exclusion criteria:
 - a. Allergy to amide LA, short duration of blockade
- II. Dexamethasone Selection**
- A. Route:**
1. Perineural dexamethasone is the recommended route
 2. Intravenous dexamethasone can also be used
- B. Dose:**
1. 4 mg of perineural dexamethasone is the recommended dose:
 - a. Studies showed 10 mg of dexamethasone had same effects as 4 mg
 - b. Higher doses (> 4 mg) were associated with perineal pruritus, paresthesia, transient increase in blood sugar level, and increased risk of infections
 2. < 4 mg of dexamethasone can also be used
 - a. 1 mg dexamethasone is better for pain management than not using dexamethasone
- C. Recommended criteria:**
1. Common inclusion criteria:
 - a. ASA physical status I-III; 18-65 years old; elective ambulatory surgery
 2. Common exclusion criteria:
 - a. Allergy to dexamethasone; long-term steroid therapy; immunocompromised patients; uncontrolled diabetes mellitus

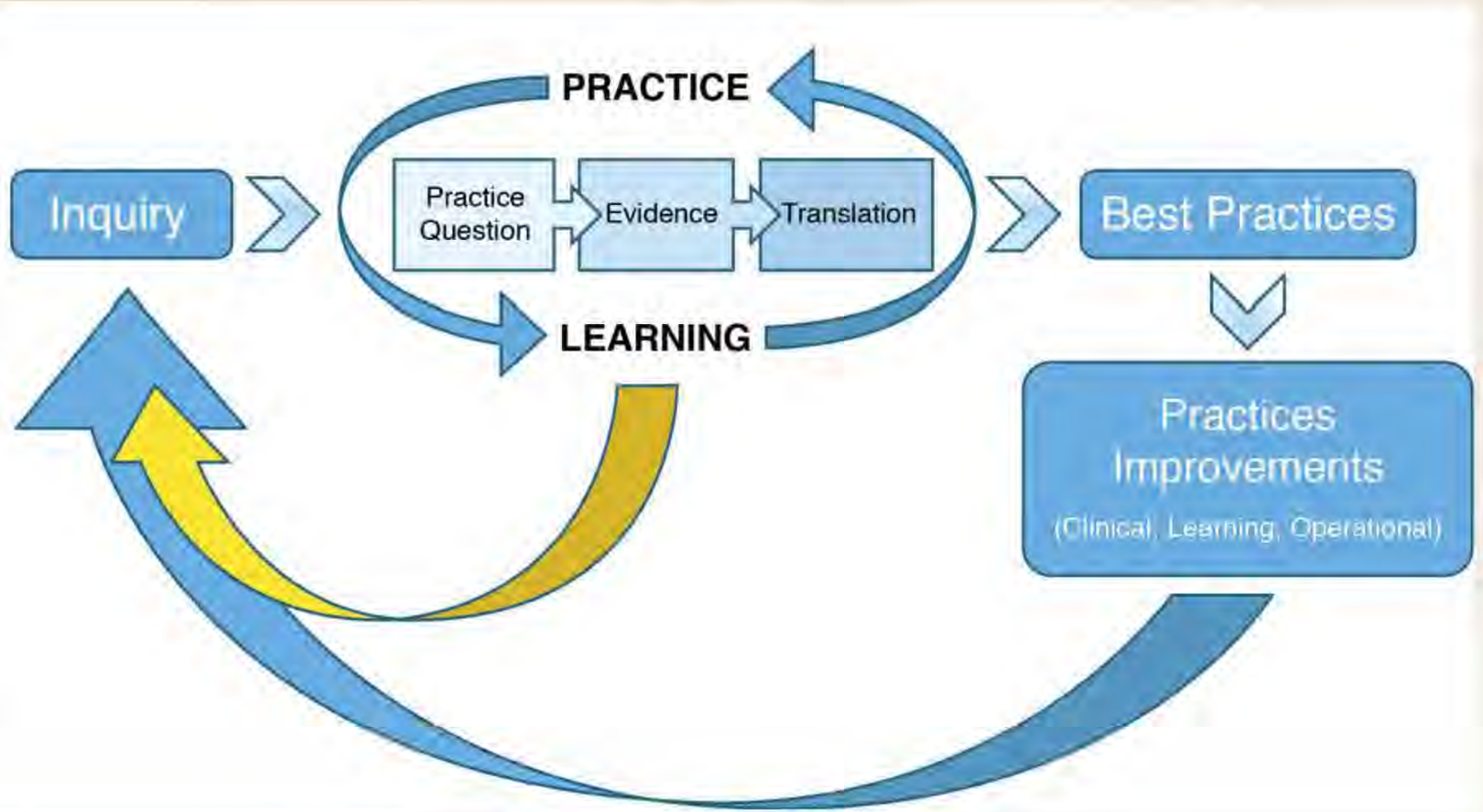


Figure 1. JHEBP Model (Newhouse et al., 2017).

Inquiry Findings

Paper list of individual preferences for 25 providers on LA and additive combinations

Majority of providers use 30 ml of 0.5% ropivacaine

46.4% of providers use the additive dexamethasone

No department guidelines/protocols related to the utilization of LA and additives in BPB

Literature Review Tables



Review of Literature

- Key search terms were derived from the practice question.
- **Limits:** literature less than five years old, academic journals, and study type.
- Rapid critical appraisal checklist specific to each study design was performed (Melnyk & Fineout-Overholt, 2019).
- John Hopkins Nursing EBP: Evidence Level and Quality Guide was used to analyze the level of evidence for 22 selected studies.
 - 11 high quality literature
 - 8 good quality literature
 - 3 low quality literature
- Various studies showed that 30 ml of 0.5% ropivacaine is a useful agent for BPB with a rapid onset and prolonged pain relief effect (Bindal et al., 2018 & Nakayama et al., 2017)
- Dexamethasone prolonged the duration of analgesia, motor, and sensory blocks (ASRA, 2019).
- Most of the studies suggested 30 ml 0.5% ropivacaine with dexamethasone 4 mg is most appropriate dose to provide optimal patient outcomes.

SWOT Analysis

Strengths:	Weakness:
<ul style="list-style-type: none">- 46.4% of providers were utilizing additives- The most used additive was dexamethasone- The most used LA was ropivacaine- Additive helped with better pain management and sensory block	<ul style="list-style-type: none">- Lack of LA & additive guidelines- Lack of pre-set orders- Lack of individual variation consideration while administering additives
Opportunities:	Threats:
<ul style="list-style-type: none">- Improved block process and time- Improved block duration of action- Improved postoperative patient outcomes	<ul style="list-style-type: none">- Providers reluctant to change- Lack of preferred additives- Individual experience

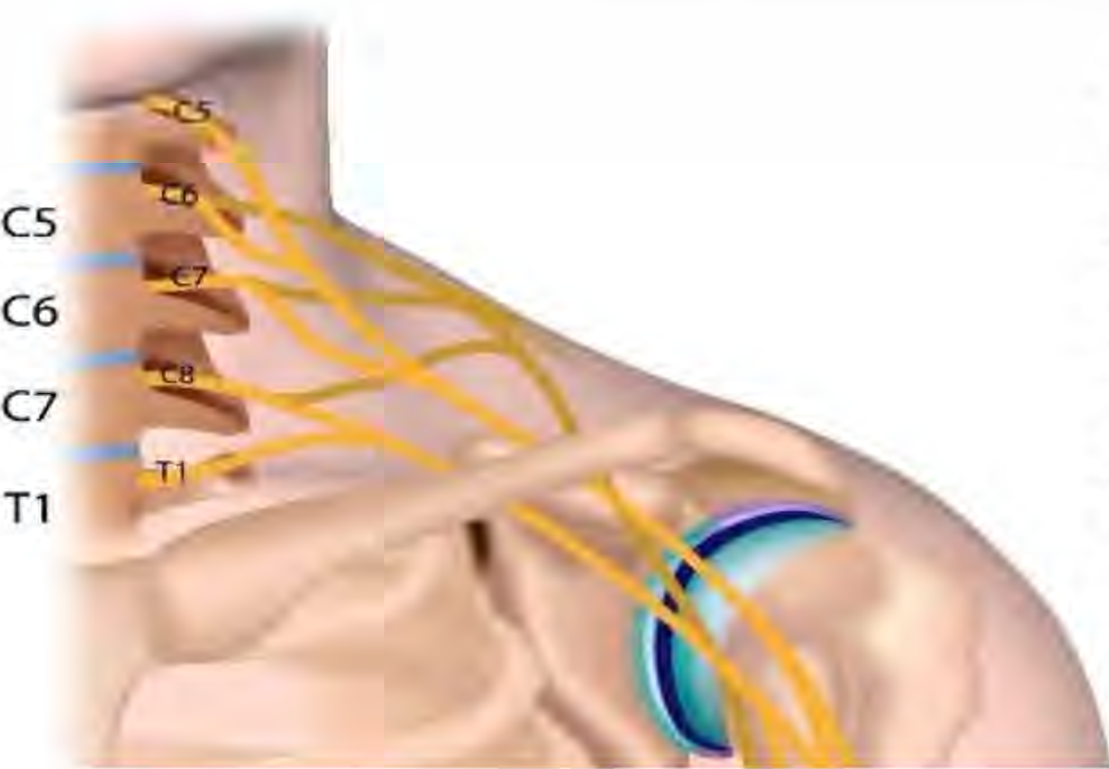


Figure 2. Brachial Plexus (Christopher & Dana Reeve Foundation, (2022)).

References



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