Southern California CSU DNP Consortium

California State University, Fullerton
California State University, Long Beach
California State University, Los Angeles

PREVENTING WRONG-SITE REGIONAL BLOCKS:
AN INTEGRATIVE REVIEW

A DOCTORAL PROJECT

Submitted in Partial Fulfillment of the Requirements

For the degree of

DOCTOR OF NURSING PRACTICE

By

Haik Topadzhikyan

Doctoral Project Committee Approval:

John Nagelhout, PhD, CRNA, Project Chair
Dana Rutledge, PhD, RN, Committee Member
Michael Boytim, EdD, CRNA, Committee Member

May 2014
ABSTRACT

Wrong-site peripheral nerve blocks may occur in patients undergoing surgical procedures and a system to prevent these errors is needed. The purpose of this paper is to present a literature review pertaining to wrong site anesthesia and to evaluate the effectiveness of the time-out method and pre-anesthetic verification. A systematic search was conducted in PubMed, the Cochrane Library, and CINAHL for literature published from 2005 through 2013. Articles were included that related to (a) wrong-site anesthesia block and (b) studies of the issue, including cases in which the problem has occurred and possible solutions. Articles were reviewed to determine key factors associated with wrong-site anesthesia blocks, and nine articles were used in this review. Of these, six were case reports, two were retrospective database analyses, and one was an analysis of a physician insurance database. The review revealed that wrong-site anesthesia administration is often associated with a lack of an organizational policy for prevention. No study evaluating the effect of a time-out or site verification policy was found. The success of policies involving time-out verification depends on the successful execution by the anesthesia providers. As shown in this literature review, wrong-site regional blocks are multifactorial in origin and may be prevented if a system of checks is in place. Suggestions are given to avoid this preventable negative anesthetic event.
TABLE OF CONTENTS

ABSTRACT .................................................................................................................. iii

LIST OF TABLES ........................................................................................................ vi

LIST OF FIGURES ..................................................................................................... vii

ACKNOWLEDGMENTS ............................................................................................. viii

BACKGROUND ......................................................................................................... 1

Problem Statement .................................................................................................... 1
Supporting Framework ............................................................................................... 4
Project Goals/Objectives .......................................................................................... 6

RESULTS: REVIEW OF LITERATURE ....................................................................... 7

Methods ...................................................................................................................... 7
Results ......................................................................................................................... 7
Synthesis of Literature ............................................................................................... 8
Aim 1 ......................................................................................................................... 8
Aim 2 ......................................................................................................................... 11
Summary .................................................................................................................... 12

DISCUSSION AND RECOMMENDATIONS ............................................................ 14

REFERENCES ........................................................................................................... 17
APPENDIX A:  AUTHOR PERMISSION ................................................................. 20

APPENDIX B:  PRE-ANESTHETIC SITE VERIFICATION FOR REGIONAL BLOCKS ................................................................. 22

APPENDIX C:  WRONG-SITE ANESTHESIA BLOCK ASSESSMENT TOOL .... 25

APPENDIX D:  TABLE OF EVIDENCE FOR WRONG-SITE REGIONAL AND LOCAL ANESTHESIA BLOCKS ......................................................... 27
<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Modified framework for patient safety research related to wrong-site anesthesia</td>
<td>5</td>
</tr>
<tr>
<td>2. Modified integrative model to translate evidence into practice related to wrong-site anesthesia</td>
<td>10</td>
</tr>
<tr>
<td>Figure</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>1. Percentage of wrong-site surgery reports that describe wrong-site anesthesia blocks</td>
<td>3</td>
</tr>
<tr>
<td>2. Factors contributing to wrong-site nerve block</td>
<td>5</td>
</tr>
</tbody>
</table>
ACKNOWLEDGMENTS

I would like to express my special appreciation and thanks to my committee chair John Nagelhout, PhD, CRNA, you have been a tremendous mentor for me. I would like to thank you for encouraging me to continue my educational endeavors and allowing me to grow as a clinician. I would also like to thank my committee members, Michael Boytim, EdD, CRNA, and professor Dana Rutledge, PhD, RN, for serving as my committee members. I would like to offer my special thanks to Dr. Rutledge for her patient guidance, enthusiastic encouragement, and useful critiques of this doctoral project.

My special thanks are extended to my colleagues at Kaiser Los Angeles Medical Center Anesthesia Department for their continued support in reaching my educational goals. I wish to thank Dr. Charles Lee, anesthesiologist, for his professional guidance and valuable support, and Debra Withem, CRNA, for making it feasible to complete my degree while working full-time. My completion of this project could not have been accomplished without the support of my classmates: Becky Ashlock, CRNA, Tim Stacy, ACNP, and Jennifer Thompson, CRNA.

Finally, to my caring, loving, and supportive parents and family who have been by my side throughout my educational endeavors and for all the sacrifices that they have made on my behalf. I would also like to thank all of my friends who supported me and encouraged me to strive towards my goal.
BACKGROUND

Wrong-site peripheral nerve blocks occur in patients undergoing surgical procedures. There have been repeated occurrences of wrong-site regional and local peripheral blocks therefore; developing a system to prevent this event is warranted. Therefore, this Doctor of Nursing Practice project will review literature pertaining to wrong site anesthesia, including case reports of wrong-site anesthesia, reports through which providers take precautions in order to prevent wrong-site regional or local peripheral blocks, and reports of evaluations of such programs. The effectiveness of the time-out method and pre-anesthetic verification will be determined.

Problem Statement

The Institute of Medicine report To Err is Human called on all clinicians and health care organizations to make improving patient-safety a national priority (Institute of Medicine [IOM], 1999). Wrong-site surgery or peripheral nerve block can have undesirable effects for the patient. These “Never Events” are serious, but preventable patient safety incidents that should not occur when preventative measures have been developed and instituted in department policy. Wrong-site surgery is a devastating problem that affects all those who are involved including the patient, surgeon, anesthesia provider, and ancillary staff. Despite adoption of the mandatory Joint Commission’s Universal Protocol (since July 2004) along with other patient safety measures, wrong-site surgeries and related problems continue to occur. The Universal Protocol is based on incorporating a pre-procedure verification process, site marking, and a “time-out” with all clinicians before a procedure starts. It was developed to prevent wrong person, wrong site, and wrong procedure surgery. Wrong-site surgery has gained considerable national
attention and policies have been adopted and implemented to reduce its incidence (Cohen et al., 2010).

According to Stahel et al. (2010), strict adherence to the Universal Protocol must be expanded to nonsurgical specialties such as anesthesia providers to achieve a zero-tolerance philosophy for preventable incidents. Researchers analyzed a comprehensive, prospective database of 27,370 self-reported adverse occurrences logged by the nearly 6,000 policyholders (31.7% surgeons) of a Colorado professional liability insurance company from January 1, 2002 through June 1, 2008. Seventy-eight wrong-site surgical occurrences were reported. For wrong-site errors, the most frequent specialties involved were orthopedic surgery, which accounted for 22.4%, general surgery at 16.8%, and followed by anesthesiology at 12.1% (Stahel et al., 2010). Additionally, Makary (2010) suggests that the incidence may be substantially higher because errors are self-reported and not anonymous, which may lead to under reporting.

The Pennsylvania Patient Safety Authority (PSA) reports that wrong-site local and regional anesthesia blocks represent a major portion of wrong-site operating room procedures. In a 3-month period during 2009, there were 14 wrong site reports made in Pennsylvania; of those, seven (50%) were wrong-site local or regional anesthetic blocks performed by anesthesia providers. During the same period, PSA also found that wrong-site anesthetic blocks represented 29% of all reports of wrong-site procedures in the operating room. It is the largest type of wrong-site procedures within a single specialty. As depicted in Figure 1 reported by the PSA, wrong-site anesthetic blocks increased from less than 27% of all reports during third quarter 2004 to 50% during fourth quarter 2009 ($p < 0.05$). These data signify that despite the implementation of the
Universal Protocol to prevent wrong-site procedures, prevention of wrong-site blocks was a major problem. Clarke (2010) reports that the proportion of wrong-site anesthesia blocks is more notable given that only a fraction of surgical patients are vulnerable to wrong-site surgery from receipt of anesthesia in the form of regional blocks.

![Figure 1](image-url)  
*Figure 1*. Percentage of wrong-site surgery reports that describe wrong-site anesthesia blocks. Reprinted with permission from Clarke, 2010.

Thus, although measures such as the Universal Protocol have been implemented to improve patient safety, accidental wrong-sided peripheral nerve blocks still occur (Makary, 2010). This preventable or “Never Event” can lead to delay and cancellation of or continuation to wrong site surgery (Edmonds, Liguori, & Stanton, 2005; Malinovsky, 2010). Joseph Talarico, MD, president of the Pennsylvania Society of Anesthesiologists, posited that the increase in anesthesia-related wrong-site events may be related to an increase in regional nerve blocks (as cited in Agres, 2011). Or, it may reflect systems problems that affect patient safety resulting from poor preoperative planning, lack of
institutional controls, failure to exercise due diligence and care, or mistakes in communication between patient and providers (Al-Nasser, 2011; Edmonds et al., 2005; Rupp, 2008; Stanton, Tong-Ngork, Liguori & Edmonds, 2008). Anesthesia providers are responsible for a growing share of these “Never Events” involving wrong-site regional nerve blocks.

**Supporting Framework**

The supporting framework of the integrative review for wrong-site regional or local anesthesia blocks is the “Framework for Patient Safety Research and Improvement” (Pronovost et al., 2009). In the current health care environment, quality and safety-related activities have been growing but still demonstrate minimal empiric evidence (Pronovost et al., 2009). The authors devised this framework based on their own experiences, the Institute of Medicine’s suggested strategies for improvement, and current literature related to the transfer of knowledge and the diffusion of innovation (Pronovost et al., 2009).

The “Framework for Patient Safety Research and Improvement” contains five specific domains (Table 1), which are as follows: (1) evaluating progress in patient safety, (2) translating evidence into practice, (3) assessing and improving culture, (4) identifying and mitigating hazards, and (5) evaluating associations between organizational characteristics and outcomes (Pronovost et al., 2009). As shown in Table 1, this model assists clinicians in evaluating quality issues related to wrong-site anesthesia, a safety issue in operating rooms. In this application, following identification of the clinical problem, an evidence search for findings related to preventive strategies is
done, along with applicable organizational changes related to operating room safety in
general, and tracking information specific to wrong-site anesthesia.

Table 1

<table>
<thead>
<tr>
<th>Domain</th>
<th>Description</th>
<th>Application to Wrong-Site Anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluating progress in patient safety</td>
<td>Develop valid and feasible measures to evaluate progress to improve patient safety</td>
<td>Wrong-site anesthesia is defined as the performance of a regional or local anesthetic procedure on the wrong part of the body.</td>
</tr>
<tr>
<td>Translating evidence into practice</td>
<td>Develop and evaluate interventions that increase the extent to which patients receive evidence-based medicine</td>
<td>There is currently no list of generally accepted recommended strategies (clinical practice guidelines) specific to prevention of wrong-site anesthesia. Elements from prevention strategies for wrong-site surgeries may or may not be applicable.</td>
</tr>
<tr>
<td>Assessing and improving culture</td>
<td>Strategies and interventions to improve safety culture and communication</td>
<td>General strategies and interventions to improve safety culture and communication should be applicable.</td>
</tr>
<tr>
<td>Identifying and mitigating hazards</td>
<td>Use of retrospective and prospective analyses to identify and mitigate safety hazards at the microscopic level (unit or department, in-depth evaluation) and macroscopic (institutional, country) levels</td>
<td>Due to small numbers of errors per organization, case reports should be analyzed across multiple sources to identify factors associated with wrong-site anesthesia. These may fit under previously identified categories (O’Neill et al., 2010): physician, patient, procedural, and other.</td>
</tr>
<tr>
<td>Evaluating associations between organizational characteristics and outcomes</td>
<td>Evaluate organizational characteristics that help or hinder research efforts or patient safety practices</td>
<td>Organizational characteristics may be identified from the case report analysis that can help patient safety related to prevention of wrong-site anesthesia.</td>
</tr>
</tbody>
</table>

Note. This framework was modified from that developed by Pronovost et al. (2009).

In a framework such as patient safety, for a valid and more systematic cross-organizational learning, one assesses the conditions that may have been important for success elsewhere so as to replicate the essential conditions for adaptation at the institutional and departmental level. By outlining the four steps in the “Integrative Model to Translate Evidence into Practice” as depicted in Table 2 (Pronovost et al., 2009), this model aims to assist an organization to improve patient safety by focusing on healthcare systems, engagement of interdisciplinary teams in following evidence-based
recommendations, and creation of a collaborative culture amongst clinicians to sustain patient safety results.

Table 2

*Modified Model to Translate Evidence into Practice related to Wrong-Site Anesthesia*

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Actions</th>
<th>Application to Wrong-Site Anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summarize the science</td>
<td>Identify interventions associated with outcome; Select interventions with strongest evidence and lowest barriers to use; Convert interventions to behaviors</td>
<td>Identify best of tested strategies to prevent wrong-site anesthesia; incorporate strategies into policy or procedures</td>
</tr>
<tr>
<td>Measure performance</td>
<td>Select measures (either process or outcome); Develop and pilot test measures; Measure baseline performance</td>
<td>Implement new policy, measure wrong-site anesthesia events over 1 year period, compare to earlier reports</td>
</tr>
<tr>
<td>Understand the current process ad context of work</td>
<td>Walk the process to identify breakdown in the process; Research the context of current work to identify barriers in providing the intervention</td>
<td>Identify mitigating factors in any reported wrong-site anesthesia reports: physician, anesthetic, procedural, patient, other</td>
</tr>
<tr>
<td>Ensure all patients reliably receive the intervention</td>
<td>Approach engages, educates, executes; involves hospital leaders, interdisciplinary team leaders, and frontline staff</td>
<td>Staff involvement and evaluation: anesthesia provider, nursing staff, surgical team</td>
</tr>
</tbody>
</table>

*Note.* This model was modified from that developed by Pronovost et al. (2009).

**Project Goals/Objectives**

The main project objective is to review the literature on wrong site regional and local anesthetic nerve blocks. The two project aims are to:

1) Analyze the case reports to determine key factors at play in wrong-site regional or local anesthesia blocks.

2) Evaluate the potential utility of strategies found in the literature aimed at ameliorating wrong-site anesthesia.
RESULTS: REVIEW OF LITERATURE

Methods

Literature was sought from scholarly journals via articles pertaining to wrong-site regional and local anesthesia blocks. A systematic search was conducted in PubMed, the Cochrane Library, and CINAHL for literature published from 2005 through 2013. Results were limited to humans and to articles published in English. The inclusion criteria for articles included those relating to (a) wrong-site anesthesia block and (b) studies of the issue, including cases in which the problem has occurred and possible solutions.

Reference list of key articles were also systematically checked. The following key words were used: “wrong-site regional anesthesia,” “wrong-site anesthesia,” “laterality,” “site verification,” “peripheral nerve block,” “wrong sided block,” “incorrect side nerve blocks,” “erroneous side regional block,” “wrong side procedures,” “regional anesthesia block policy,” and “pre-anesthetic site verification.” The literature search reporting on wrong-site anesthesia, local and peripheral blocks yielded 51 articles. From these potential articles or reports, 19 were selected to undergo full text review. After full text review, 10 additional exclusions were made because of repetitive data.

Results

The review of the articles and their relevance to the issue at hand caused the total number of articles actually used to be limited to nine. Of the selected articles, six are case reports, two reports are retrospective database analyses, and one is an analysis of a prospective physician insurance database. Arguments for the implementation of a time-out policy to prevent wrong-site anesthesia and studies on how likely the problem is to occur and its impacts on both patients and healthcare providers were also evaluated.
Given that most evidence found consisted of case reports and analyses of existing reports, the overall strength of the evidence is low, and any estimate of effect of preventive interventions is uncertain. The evidence to establish the efficacy of a preoperative time-out or site verification policy including checklists for preventing wrong-site blocks is limited to expert opinion. Appendix D includes a table that summarizes the published evidence found on the concept.

**Synthesis of Literature**

**Aim 1**

O’Neill et al. (2010) stratify risk factors into four categories (1) physician factors, (2) patient factors, (3) procedural factors, and (4) anonymous (no consistent checking procedures in place, and missing information or incomplete patient record). For physician factors, these authors list high workload, time pressures, poor team communication, failure to clearly mark the correct site preoperatively, and diffusion of authority or lack of accountability. Patient factors included sedation, lack of consulting or inability to engage patient, language deficits and abnormal anatomy. Procedural factors were identified as unanticipated changes in schedule, wrong-site prepped, multiple procedures on same patient, and change in position. Lastly, O’Neill et al. define anonymous factors as missing or incomplete patient information and no consistent verification or lack of policy (O’Neill et al., 2010).

The synthesis of the current evidence revealed that wrong-site anesthesia administration is often associated with a lack of an organizational policy for prevention, a factor categorized as “other” in a diagram seen in Figure 2 (Al-Nasser, 2011; Clarke, 2010; Cohen et al., 2010; Edmonds et al., 2005; Nixon & Wheeler, 2011; O’Neill et al.,
When present, a time-out policy mandates that anesthesia providers verify and follow a checklist to ensure that there is no misunderstanding between the healthcare professionals and the patient (Al-Nasser, 2011; Edmonds et al., 2005; Nixon & Wheeler, 2011; Stanton et al., 2008). The pre-anesthetic check reviews for all providers (including anesthetists) that the proper site is marked and the correct patient is identified (Nixon & Wheeler, 2011).

As seen in Figure 2, the evidence appraised also shows that these occurrences are commonly due to distractions of the anesthesia providers, or to a lack of communication or understanding between providers and the patient (Al-Nasser, 2011; Clarke, 2010; Cohen et al., 2010; Edmonds et al., 2005; Nixon & Wheeler, 2011; O’Neill et al., 2010; Stahel et al., 2010; Stanton et al., 2008).

According to the American Society of Anesthesiologists (ASA) Committee on Quality Management and Departmental Administration, there was an exponential increase in wrong side peripheral nerve blocks than previously reported between 1995 and 2006 (Rupp, 2008). Sentinel Event statistics reported by the ASA showed that anesthesia as a specialty contributed to the increased frequency of wrong-site procedures (as cited in Bierstein, 2007). From 1995 until 2005, anesthesia providers reported 2% of wrong-site procedure errors. In 2006 alone, the figure had risen to 16% (Bierstein, 2007). Investigators compared a root cause analyses for 20 wrong-site blocks to those for 44 wrong-site surgical procedures in a 3-year period. A significant decrease was noted in wrong-side anesthetic blocks that occurred (a) in the presence of a surgical mark (physician factor in Figure 2), (b) before a surgical time-out (other factor in Figure 2),
and (c) when nurses were included in any pre-anesthetic verification time-out (other factor in Figure 2) (Clarke et al., 2011).

Published case studies of wrong-site blocks indicate causation may indeed be multifactorial, and can be influenced by the work environment (Harris & Torlot, 2009; Nixon & Wheeler, 2011; Rupp, 2008). Harris and Torlot (2009) identified that surgical site marking may often be distant from the nerve block insertion site, which is a potential contributing factor to cases of incorrect side block. Rupp (2008) hypothesizes that several reasons exist for the increased reports of unintentional wrong-sided peripheral nerve

Figure 2. Factors contributing to wrong-site nerve block. *Case Reports: Al-Nasser, 2011; Clarke, Atkins, Munn, Finley, & Minetti, 2011; Cohen et al., 2010; Edmonds et al., 2005; Nixon & Wheeler, 2011; O’Neill et al., 2010; Stanton et al., 2008). **Editorials: (Harris & Torlot, 2009; Malinovsky, 2010; Rupp, 2008). ***Prospective Analyses: (Clarke, 2010; Cohen et al., 2010; Stahel et al., 2010).
blocks: (a) complexity of the system; (b) the variation in practice from provider to provider; (c) the apprentice-like nature of resident training and subsequent practice; (d) issues of physician autonomy; (e) lack of evidence-based medicine in anesthesia; and (f) breaks in the supply chain (Rupp, 2008). Rupp (2008) lists other hindering factors such as the additional time required for performance of new safety steps (e.g., time-out procedures) and reliance on memory for new safety systems are difficult to incorporate into the work flow.

**Aim 2**

No study evaluating the effect of a time-out or site verification policy was found, although many case study authors concluded that lack of such policy was contributory to a wrong-site anesthetic event.

Although the Universal Protocol (surgical time-out) is intended to achieve the goal of preventing wrong site, wrong procedure, and wrong surgery, errors still occur (Bierstein, 2007). The case reports reviewed bring attention to the importance of adhering to policies and the importance of site verification prior to administering a peripheral nerve block. The common themes throughout the literature and analysis are two-fold. First, the success of policies and time-out verification depends on the execution by the anesthesia providers. Second, once the pre-anesthetic site verification is performed, if there is a time delay before the actual block is done, errors can occur (Edmonds et al., 2005; Stanton et al., 2008). Also, according to Rupp (2008), 100% compliance is not easily achievable despite the vigilance of the providers.
Currently, one of the biggest problems, based upon the evidence reviewed, is that healthcare providers try to save time, and this causes an increase in the numbers of mistakes. The Pennsylvania Patient Authority (PSA) posits that instituting a time-out protocol (separate from the surgical time-out) before an anesthetic block could potentially eliminate approximately 27% (92 of 337) of wrong site errors in the surgical suite (Clarke, 2010). Furthermore, the American Association of Nurse Anesthetists (AANA, 2012) argues that “structured transfers of care, and encouraging a culture of open communication among all healthcare members to foster safe surgical and anesthesia care for patients” (p. 3) is a way in which wrong-site blockage can be prevented. The research suggests that wrong-site blockage should be considered a “Never Event,” which will deem it an inadmissible error for anesthesia providers.

Summary

The importance of taking steps designed to eliminate wrong-site peripheral nerve blocks is consistently highlighted in efforts to ensure patient safety. The body of evidence addresses the incidence and potential harm associated with wrong-site anesthesia, as well as the processes and effectiveness of those processes to assure correct site in the surgical patient population. Synthesis of the literature posits that variation from provider to provider, issues of provider autonomy, lack of an organizational site verification policy, and breaks in communication lead to wrong-site blocks. The case reports that evaluate wrong-site peripheral blocks consistently affirm the low incidence of these events; however, it is difficult to estimate their incidence. None of the reviewed cases suggest that efforts to reduce these undesirable events have no value. However, there is
inconsistency in estimating the degree to which interventions influence the rate of unintentional wrong-site peripheral blocks. The literature suggests a net benefit of implementing processes for preventing wrong-site events, though no policy intervention has been universally accepted.
DISCUSSION AND RECOMMENDATIONS

Recommendations to date for preventing wrong site blocks have not taken into account published cases and trends found in large databases. The PSA completed one of the largest evaluations of wrong site blocks and based recommendations upon their own findings (Clark, 2010). To minimize the risk of error, this group recommends that the anesthesia provider independently validate the site with the patient’s understanding and all supporting documents (Clarke, 2010). Specifically, the PSA “strongly advises that a formal time-out be done with the anesthesia provider just before any anesthetic block and that another time-out be done with the surgeon just before the incision” (Clarke, 2010, p. 28). The rationale for performing two time-outs comes because the regional block procedure may be done outside of the surgical suite.

In light of this review of the literature and consultation of experts in anesthesia, the following recommendations may be instituted to prevent and minimize wrong-site anesthesia blocks:

1) Pre-anesthetic site verification for regional blocks with two providers (anesthesiologist, certified registered nurse anesthetist, registered nurse, or surgeon).

2) Administration of block to occur immediately after pre-anesthetic verification with no time lapse from site verification to start of block procedure.

Historically, the anesthesia provider in the hospital or ambulatory setting has performed regional blocks. Developing and implementing a procedural model for safe clinical practice is warranted when a policy does not exist. A set of critical elements for providers to follow for regional blocks should include: (1) validation from the patient and
appropriate documents that the block site is accurate; (2) site verification to verify correct laterality and site; (3) confirmation that all medications are labeled; and (4) provision of continuous monitoring of the patient during the block and surgical procedure. In Appendix B is found a suggested policy for site verification with recommended steps for implementation and follow-up.

Administration of peripheral nerve blocks has become popular with the increased use of ultra sound technology and patient experience of reduced postoperative pain. The incidence of wrong-site blocks is relatively low. However, incidents of wrong-site regional blocks do occur, and may be more common than the literature indicates due to under reporting. The low reported incidence and dearth of documented case characteristics leads to difficulty in characterizing their actual incidence and contributing factors. Even more problematic is the lack of evidence about the efficacy of site verification procedures, one of the major proposed preventative measures. Increased patient and clinician awareness combined with evidence-based protocols and standardization of site verification procedures will enhance patient safety. The key to achieving this goal is promoting a culture of safety and strengthening communication among health care providers and patients.

Anesthesia providers have been proponents and advocates for patient safety. As the phenomenon of wrong-site regional blocks becomes widely recognized, the goal of results of this integrative review of literature will lead to change in the attitudes, and practices of clinicians in the anesthesia community. Developing and implementing a feasible site verification policy before regional block administration will be instrumental in prevention of wrong-site procedures. This patient safety practice should help reduce
the probability of wrong-site block with its potential association with wrong site surgery. As shown in this literature review, wrong-site regional blocks are multifactorial in origin and may be prevented if a system of checks is in place. Universal application of the recommendations presented in Appendices B and C can be adapted to fit various models of anesthesia care delivery where peripheral nerve blocks are routinely given. Evaluation of the impact of implementation of a site verification policy is needed to assure our confidence on its effect.
REFERENCES


Harris, B., & Torlot, K. (2009). Site marking for peripheral nerve blockade to reduce the incidence of incorrect side regional anesthesia. *Anaesthesia, 64*, 1022-1023. doi:10.1111/j.1365-2044.2009.06037.x


APPENDIX A

AUTHOR PERMISSION

Permission to use Figure 3 (Clarke, 2010)

Cal State Fullerton Mail - Permission Request: Wrong-site Surgery Project Data
Haik Topadzhikyan <haik@csu.fullerton.edu>

Permission Request: Wrong-site Surgery Project Data
2 messages
Haik Topadzhikyan <haik@csu.fullerton.edu> Sun, Sep 22, 2013 at 5:11 PM To:
patientsafetyauthority@pa.gov
Dear Pennsylvania Patient Safety Authority,
I am a current student and practicing Certified Registered Nurse Anesthetist in a Doctor
of Nursing Practice program at Cal State University, Fullerton in California, United
States. I am currently working on a project on wrong-site peripheral nerve blocks.
For this project, I am interested in exploring factors contributing to wrong-site peripheral
nerve blocks.
I am requesting your permission to use Figure 3: Percentage of Wrong-Site Surgery
Reports that Describe Wrong-Site Anesthesia Blocks in my project. If you would be so
kind as to grant me permission to use Figure 3 in (2010). Quarterly update on the
preventing wrong-site surgery project: Digging deeper. Pennsylvania Patient Safety
I look forward to hearing from you regarding this matter. I would like to thank you in advance for taking the time to review this email and provide a response.

Haik Topadzhikyan, CRNA, MSN Cell: 555-555-5555 Email: haik@csu.fullerton.edu

ST, Patient Safety Authority <patientsafetyauthority@pa.gov> Mon, Sep 23, 2013 at 6:50 AM To: Haik Topadzhikyan <haik@csu.fullerton.edu>
Yes, please feel free to use any information contained on our public website. We only ask that you do not change any of the information and that you attributed it to the Pennsylvania Patient Safety Authority.
Thanks
From: Haik Topadzhikyan [mailto:haik@csu.fullerton.edu] Sent: Sunday, September 22, 2013 8:11 PM To: ST, Patient Safety Authority Subject: Permission Request: Wrong-site Surgery Project Data
[Quoted text hidden]
APPENDIX B

PRE-ANESTHETIC SITE VERIFICATION FOR REGIONAL BLOCKS

Two providers (the anesthesia provider and a member of the clinical staff) should be present at the pre-anesthetic site-verification in order for them to have an opportunity to discuss the procedure and any anticipated safety concerns.

Two providers (anesthesia and clinical staff member) are involved in the pre-anesthetic site-verification but anyone in the team can lead it.

A record of having used a pre-anesthetic site-verification process should be entered in the communication tool for the patient as well as in clinical notes in the patient’s medical record.

Measurements of compliance (e.g., use of pre-anesthetic site-verification policy for each patient; measurement of outcome, accurate placement of block into correct site; and efficiency, no time delay between cases) can all be used.

Administration of anesthetic block site verification policy

1.1 Overview of the importance and role of the policy
Risk management and the Department of Anesthesia evaluate the process of reporting the occurrence of wrong-site anesthetic blocks. A list of reasons as to why wrong-site blocks occur is developed (e.g., distraction of anesthesia provider, lack of site verification time-out, and discrepancy between surgical consent and patient understanding), allowing for creation of a post-occurrence assessment tool (Appendix C).

1.2 Scope
Policy applies to all providers who administer regional anesthetic blocks before surgery or pain management.

1.3 Purpose
Policy attempts to address the key issues and is intended to supplement the existing Universal Protocol of pre-surgical time out. The aim of site verification is to minimize the risk and therefore the incidence of administration of wrong-site anesthetic block before surgery.
1.4 Implementation

Policy will be implemented [enter date]. Anesthesia providers as well as pre-operative nurses, circulating nurses, post-operative nurses and surgical staff will require training prior to implementation. This will jointly developed and delivered by the Perioperative Department Administrator and Anesthesia Department.

1.5 Process for Monitoring Compliance/Effectiveness

<table>
<thead>
<tr>
<th>Element of Policy to be monitored (as established by Anesthesia Department)</th>
<th>Lead</th>
<th>Tool/Method (e.g. audit, review of minutes, records, training)</th>
<th>Frequency</th>
<th>Analysis</th>
<th>Where results will be reported (e.g., anesthesia meetings, safety committee)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure Types</td>
<td>Anesthesia provider-Lead for anesthetic blocks</td>
<td>Audit – patient health records</td>
<td>Quarterly</td>
<td>Risk Management</td>
<td>Patient Safety Liaison</td>
</tr>
</tbody>
</table>

1.6 Review of Policy

Compliance of the pre-anesthetic site-verification policy would be monitored quarterly and the policy reviewed every 2 years.
Site Verification for Administration of Anesthetic Blocks

To minimize the risk of distraction:

- No one should enter procedure area between the time of pre-anesthetic verification and procedure administration.
- Pre-anesthetic site verification for regional blocks with two providers.
- Administration of block to occur immediately after pre-anesthetic verification with no time lapse from site verification to start of block procedure.

1. If surgical patient, anesthesia provider to check surgical site mark by surgeon.
2. Anesthesia provider to communicate with either patient or surrogate regarding site.

Procedure for the administration of anesthetic blocks

Anesthesia provider and 2nd provider take part in verification process

Administering anesthesia provider and 2nd provider confirm the site of the proposed anesthetic block; site verification is documented on patient flowsheet prior to administering sedating medication

Administering provider administers the anesthetic block and documents the procedure in the patient record or communication tool

Providers ensure minimal time delay between the pre-anesthetic site-verification of the proposed site of the anesthetic block and block administration

During the surgical time-out (Universal Protocol), anesthesia provider communicates with surgical staff that a successful block was administered
APPENDIX C

WRONG-SITE ANESTHESIA BLOCK ASSESSMENT TOOL

(For auditing purposes, used in case of a wrong-site block event)

Patient Name:

Medical Record Number:

Pre-anesthetic Verification Documented: Yes [ ] No [ ]

Date and Time of Event:

Anesthesia Provider Name:

Clinical Staff Provider Name:

Planned Surgical Procedure:

Planned Regional Block Procedure:

Surgical Consent Signed and in Medical Record: Yes [ ] No [ ]

Anesthesia Consent Signed and in Medical Record: Yes [ ] No [ ]

Documentation of a Surgical Site Mark pre-Site Verification: Yes [ ] No [ ]

Desired Block Site: Left [ ] Right [ ]

Regional Block Site: Left [ ] Right [ ]

Description of occurrence:
Indicators for wrong-site block found in case:

**Physician Factors**
- Time pressure
- Distractions
- Multiple # of providers
- Poor Communication
- Reliance upon surgical marking

**Procedural Factors**
- Sedation
- Inability to communicate
- Language barriers
- Abnormal Anatomy
- Knowledge/Understanding

**Patient Factors**
- Change in position
- Unanticipated changes
- Surgical site marking not visible
- Multiple procedures
- Schedule changes

**Other Factors**
- No consistent checking mechanism in place
- Documents/Records
- Time delay - verify/block
- Exclusion healthcare team
## APPENDIX D

### TABLE OF EVIDENCE FOR WRONG-SITE REGIONAL AND LOCAL ANESTHESIA BLOCKS

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Design</th>
<th>Setting &amp; Sample</th>
<th>Measures</th>
<th>Findings</th>
<th>Conclusions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draw attention to the potential wrong site error during peripheral nerve block</td>
<td>Case report</td>
<td>Single tertiary hospital in France; Identification of pt via continuous sciatic nerve block @ popliteal fossa, outpatient</td>
<td>WHO surgical safety checklist in preventing wrong side errors</td>
<td>Pt. in pre-anesthesia area, pre-anesthesia checklist was confirmed prior, provider left pt. for a difficult intubation instructing RN to set up ultrasound, prepare table, administer midazolam, provider returned after some time, pt. confirmed limb, block administered &amp; pt. taken to OR</td>
<td>Pt. confirmed wrong site before nerve block, sedation given, confusion both extremities involved &amp; unwillingness to interfere in the procedure, surgical time-out indicated wrong site block before incision after GA</td>
<td>Although initial checklist was confirmed, distraction and poor communication main indicators for wrong site block, bilateral limbs for surgery, different procedures, pt. unaware to stop provider</td>
</tr>
<tr>
<td>Identify correctable factors in wrong-site blocks</td>
<td>Case reports</td>
<td>Hospitals &amp; ambulatory surgical centers that perform blocks in Pennsylvania, 75 (23%) facilities of 332 responded, 8/1/07 through 1/15/10</td>
<td>Comparison of RCA of wrong-site blocks &amp; other wrong-site surgical procedures reported to PA-PSRS, using RCA form; comparison anesthesia department protocols from Pennsylvania facilities that did/did not report wrong-site blocks</td>
<td>16 (21%) facilities experienced wrong-site blocks; RCA 20 wrong-site blocks compared to 44 wrong-site surgical procedures; 20 blocks with RCAs represented 36% of wrong-site blocks, $p &lt; .05$ between wrong-site blocks and wrong-site surgical procedures</td>
<td>Anesthetic blocks more likely to be wrong-side errors; occur even though surgical mark present; occur prior to a time-out; less likely to include RNs in any anesthetic time-out</td>
<td>Results of studies support recommendation-s that providers verify pt documents, specify type &amp; location of anesthetic blocks on consents, refer to surgical site marking, perform formal time-outs with RNs before administration of block</td>
</tr>
<tr>
<td>Purpose</td>
<td>Design</td>
<td>Setting &amp; Sample</td>
<td>Measures</td>
<td>Findings</td>
<td>Conclusions</td>
<td>Notes</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Estimate relative incidence and determine causes of wrong-site pain management procedures</td>
<td>Retrospective database analysis</td>
<td>Four civilian academic teaching hospitals, two military teaching hospitals, one nonacademic military treatment facility &amp; three private practices; quality improvement records examined from 2007 to 2009; 48,941 procedures</td>
<td>Categorical clinical data during 6 months; incidence of wrong-site injections stratified by institutional classification, Fisher exact test used to evaluate difference between incidence rates among the three types of institutions</td>
<td>13 wrong-site procedures, lower percentage of at-risk procedures at military pain clinics (45%) than academic (56%) and private practices (55%), ( p &lt; .001 ); wrong-site procedures ranged from 0-2 at each facility; wrong-site blocks estimated 2.7 occurrences for every 10,000 procedures</td>
<td>RCA conducted to determine origin of each error, only one case involved use of universal protocol, three pts knew that wrong-site was being injected, multiple lapses in universal protocol identified, injections frequently performed in off-site or remote settings with fewer people</td>
<td>Wrong-site blocks occur more frequently than previously acknowledged, adaptation of universal protocol to nerve blocks may prevent wrong-site occurrences; despite adoption of universal protocol, number of wrong-site procedures had not significantly declined may be because of increased reporting</td>
</tr>
<tr>
<td>Develop a system to prevent laterality errors for peripheral nerve blocks</td>
<td>Case Reports</td>
<td>Hospital for Special Surgery in New York, elective orthopedic surgery facility; Identification of two pts via interscalene brachial plexus block &amp; combined spinal epidural with psoas block; 2003; 19,500 anesthetics performed each year; 44% consist of unilateral peripheral nerve blocks</td>
<td>JCAHO Universal Protocol for preventing wrong site, wrong procedure, wrong person surgery; Inclusions: pre-operative verification process, marking operative site, “time-out” immediately before making surgical incision</td>
<td>2 cases of peripheral nerve blocks on non-operative extremity; Case 1 disruption occurred in operating room anesthesiologist left room and returned, error in laterality discovered after completion ( \rightarrow ) GA; Case 2 scheduling error prior case cancelled, sedation given with pt unresponsive to verbal communication, surgical team</td>
<td>Both cases, correct site surgery performed; Errors justify importance of developing standardized process to prevent wrong-site regional anesthetic techniques; After hospital review verifications in policy occur after anesthetic block &amp; prior to skin incision; Policy did not account for 2 different processes requiring site and laterality verification</td>
<td>No policy for pre-anesthetic verification prior to administering regional block; contributing factors: last minute operating room changes and not adequately notifying these changes to support staff</td>
</tr>
</tbody>
</table>

Cohen et al. (2010)

Edmonds et al. (2005)
<p>| Purpose                                                                 | Design          | Setting &amp; Sample                                                                 | Measures                                                                                                                                                                                                                                                                                                                                                                           | Findings                                                                                                                                                                                                                                                                                                                                 | Conclusions                                                                                                                                                                                                                                                                                                                                 | Notes                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify multifactorial factors in wrong-side, wrong-site, wrong-procedure and wrong-pt adverse events | Case Report     | Surgical Center at University of Illinois Hospital; identification of pt via left infragluteal sciatic nerve block &amp; right femoral nerve block, outpatient | JCAHO Universal Protocol for preventing wrong site, wrong procedure, wrong person surgery; Inclusions: pre-operative verification process, marking operative site, “time-out” immediately before making surgical incision                                                                                     | Surgical service obtained all consents &amp; marked pts. left leg on anterior knee with surgeons initials; consent obtained for GA &amp; peripheral nerve block, time-out occurred involving pt., anesthesia resident &amp; attending confirming pt. name, birth date, surgical site &amp; laterality; pt. marked with initials on posterior aspect left leg by anesthesia team; RCA multifactorial findings | Left infragluteal sciatic nerve block performed, attending anesthesiologist received phone call and left block room, surgical service entered room and discussed with resident about another pt to be blocked, pt repositioned &amp; subsequently right leg prepped and blocked by resident prior to return of attending; error influenced by work environment | Training residents, multiple providers, distraction from other services; factors identified: (1) failure to mark all block sites; (2) failure to perform a 2nd time-out after change in position; (3) distraction during procedure |
| Identify factors that independently or synergistically challenge the integrity of an established site verification protocol | Case Report     | Hospital in France; Pre-operative clinic and site of surgery different locations; Identification of pt left-sided peribulbar block, inpatient | WHO surgical safety checklist in preventing wrong side errors                                                                                                                                                                                                                                                                                                                                           | Patient pre-medicated before transfer to operating room, identification was confirmed in anesthetic room, operative side verified with pt, ophthalmic surgeon’s report, signed surgical consent unavailable, left-sided peribulbar block performed, 40 minutes later; pt to operating room for | Pt confirmed wrong site after pre-medication given, poor medical record keeping, inadequate communication between anesthesiologist and surgeon, lack of access to surgical note, failure of surgeon to specify operative site in referral letter | Relying exclusively on pt to indicate operative site resulted wrong-site block, clinicians that prepped pt left eye not part of surgical team, unavailability of surgical consent before block administration, error discovered in operating room before surgical incision when applying “Time Out” protocol but after administration of |</p>
<table>
<thead>
<tr>
<th>Purpose</th>
<th>Design</th>
<th>Setting &amp; Sample</th>
<th>Measures</th>
<th>Findings</th>
<th>Conclusions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarterly update on preventing wrong-site surgery project Pennsylvania Patient Safety Authority, Clarke (2010)</td>
<td>Retrospective database analysis</td>
<td>Operating room and surgical procedure venues, 525 Pennsylvania hospitals and ambulatory surgical centers; 2009</td>
<td>Secure, web-based system; permits healthcare facilities to report serious events &amp; incidents; authority analyzes data to identify trends &amp; recommend changes in healthcare practices &amp; procedures to reduce unwarranted incidents, confidential</td>
<td>7 of 14 (50%) wrong-site regional or local anesthetic blocks; wrong-site blocks represent 29% of wrong-site procedure reports; wrong-site blocks increased from less than 20% of all reports from third quarter 2004 until fourth quarter 2009 to more than 40% ($p &lt; 0.05$)</td>
<td>Limited use of information/documents to confirm correct side; data signify that implementation of the Universal Protocol to prevent wrong-site blocks lags behind other efforts to prevent wrong-site surgery; formal time-out necessary immediately prior to performing regional or local anesthetic block</td>
<td>Inconsistent compliance with known best practices or variation in compliance with known best practices among facilities</td>
</tr>
<tr>
<td>Determine frequency, root cause, and outcome of wrong-site and wrong-patient procedures in the era of the Universal Protocol Stahel et al. (2010)</td>
<td>Analysis of prospective physician insurance database</td>
<td>Colorado, 6,000 physicians, database contained 27,370 physician self-reported adverse events, 1/1/02 to 6/1/08</td>
<td>Cases screened using predefined taxonomy filters; characteristics of reporting physicians, number of adverse events reported each year, &amp; RCA and occurrences related pt outcomes</td>
<td>Self-reported adverse occurrences logged by policyholders (31.7% surgeons); for wrong-site errors; most frequent: orthopedic surgery, 22.4%, general surgery 16.8%, anesthesiologists 12.1%; wrong-site occurrences related to errors in judgment</td>
<td>Strict adherence to the Universal Protocol must be expanded to nonsurgical specialties; nonsurgical specialties involved contributed equally with surgical disciplines to adverse outcomes related to wrong-site occurrences</td>
<td>Inadequate planning of procedures &amp; lack of adherence to “time-out” policies are determinants of unintended wrong-site occurrences’ Universal Protocol expanded to nonsurgical specialties to achieve preventable incidents of wrong-site procedures</td>
</tr>
<tr>
<td>Purpose</td>
<td>Design</td>
<td>Setting &amp; Sample</td>
<td>Measures</td>
<td>Findings</td>
<td>Conclusions</td>
<td>Notes</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td>-----------------</td>
<td>----------</td>
<td>----------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>Discuss importance of “pre-anesthetic site verification” and modifications to policy</td>
<td>Case Reports</td>
<td>Hospital for Special Surgery in New York, elective orthopedic surgery facility; Identification of two pts via combined spinal epidural and femoral nerve block &amp; combined spinal epidural with femoral nerve catheter</td>
<td>Written pre-anesthetic site verification performed by anesthesia independent of surgical site verification; anesthesia, circulating nurse, and pt visually confirm surgical site as documented on surgical consent prior to block placement</td>
<td>2 cases peripheral nerve block on non-operative extremity; Case 1 disruption in operating room, pre-anesthetic site verification not performed; Case 2 pre-anesthetic site verification performed in operating room, pt. talking about other extremity with anesthesiologist, block placed at other extremity</td>
<td>Success of policy depends on accurate execution of pre-anesthetic site verification by anesthesia team; delay between site verification and block performance can lead to wrong-site anesthesia; adaptations necessary to meet demands of operating room schedules and unanticipated events</td>
<td>Time pressures &amp; distractions lead to diverting attention away from pt &amp; reduce the time-out process; although policy was amended to prevent incidence of wrong-site nerve blocks, 100% compliance is difficult</td>
</tr>
</tbody>
</table>

*Note.* WHO = World Health Organization; pts. = patient(s); GA = general anesthesia; RN = Registered Nurse; PA-PSRS = Pennsylvania Patient Safety Reporting System; pt/pts = patient; RCA = root-cause analysis; JCAHO = Joint Commission on Accreditation of Healthcare Organization.