PEDIATRIC ULTRA-SOUND GUIDED NERVE BLOCK IN ANAESTHESIA AND PAIN MANAGEMENT

Essay

Submitted for Partial Fulfillment
of Master Degree of Anesthesia

By

AlHassan Abd-ElMegeed Sayed Morsy
(M.B.,B. Ch.)

Supervision by

Prof. Dr. Zakaria Abd-ElAziz Mostafa
Professor of Anesthesiology and intensive care medicine
Faculty of Medicine - Ain Shams University

Prof. Dr. Adel Mikhail Fahmy
Professor of Anesthesiology and intensive care medicine
Faculty of Medicine - Ain Shams University

Dr. Ashraf Nabil Saleh Mostafa
Lecturer of Anesthesiology and intensive care medicine
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
2016

I would like to begin by thanking **ALLAH** for his guidance and protection, may this blessing always guide us.

Moreover I would like to express my sincere and profound gratitude to ***Prof. Dr. Zakaria Abd-ElAziz Mostafa,*** Professor of Anesthesiology and intensive care medicine, Faculty of Medicine - Ain Shams University, for his meticulous supervision, loyal encouragement and valuable advises throughout the work.

I wish to express deep appreciation to ***Prof. Dr. Adel Mikhail Fahmy,*** Professor of Anesthesiology and intensive care medicine, Faculty of Medicine - Ain Shams University, for his continuous guidance, unique supervision and kind care.

I am also grateful to ***Dr. Ashraf Nabil Saleh Mostafa,*** Lecturer of Anesthesiology and intensive care medicine, Faculty of Medicine - Ain Shams University, for his kind effort, assistance he offered me throughout the performance of this work.

Dr. AlHassan Abd-ElMegeed Sayed Morsy

Dedications

To my dear Father and Mother

who supported me in my whole life

To my faithfull Wife and dear Kids
who encouraged me to achieve my aims

✍. AlHassan Abd-ElMegeed Sayed Morsy


وأنزل الله عليك
الكتاب والحكمة
وعلَّمَكَ مَا لَمْ تَكُن
تَعْلَمُ وكَانَ فَضْلُ
اللَّهِ عَلَيْكَ عَظِيماً
صدق الله العظيم
سورة النساء الآية (١١٣)

List of Contents

List of Abbreviations

LAST	Local anesthetic systemic toxicity
VDSS	Volume distribution steady state
CPNBs	Continuous peripheral nerve block
IL/IH	Ilioinguinal;iliohypogastric
TAP	Transversus abdominis plane
CRPS	Complex regional pain syndrome
PVBs	Paravertebral block
USG	Ultrasonografy
VAS	Visual analogue scale
CHEOPS	Children hospital of lastern Ontario pain scale
ON	Occipital nerve
OCI	Obliqus capitis inferior
TENS	Transcutaneous electrical nerve stimulation
ITB	Intrathecal baclofen
IAS	International association for the study of pain

List of Tables

List of Figures

INTRODUCTION

Increased use of regional anaesthesia in infants, children, and adolescents has significantly improved the scope of pediatric pain management. Regional anaesthesia is generally accepted as an integral component of postoperative pain relief in pediatric patients **(Johr, 2013).**

Several regional anaesthetic techniques are also playing emerging roles in managing chronic pediatric pain syndromes. Performance of regional anaesthesia can be safely and effectively applied to pediatric patients, and these techniques are becoming increasingly popular **(Ecoffey, 2005).**

Large prospective databases and expert opinion have demonstrated the ability to safely perform regional anaesthesia in children with minimal risk of neurological damage **(Giaufre et al., 1996).**

Safe dosing guidelines and age-related trends in local anaesthetic pharmacokinetics and pharmacodynamics have been characterized and have facilitated expansion of pediatric regional anaesthesia practice **(Mazoit, 2012).**

Most regional anaesthetic techniques in adults are performed awake or with mild sedation, allowing patients to report paresthesias or pain during block placement, symptoms of

local anaesthetic systemic toxicity (LAST), and progression of sensory or motor block after injection. **(Berde et al., 2012).**

Although several authors have criticized the practice of performing major neuraxial or peripheral nerve blocks in adults under deep sedation or general anaesthesia, this is commonly utilized in infants and children to facilitate patient cooperation while performing the block **(Bernards et al., 2008).**

ONE of the most exciting recent advances in technology in pediatric regional anesthesia has been the introduction of anatomically based ultrasound imaging for facilitating nerve localization. This is because regional anesthesia techniques in children have been considered challenging due to targeting neural structures that often course very close to critical structures (*e.g.*, nerves of the brachial plexus run close to the pleura as they traverse the supraclavicular region). **(Tsui et al, 2010).**

The pre-requisite for sedation or general anesthesia masking potential warning signs (paresthesia), and the need for limiting the volume of local anesthetic solution below toxic levels. With the possibility of visualizing the target structures, ultrasound technology may encourage many anesthesiologists who had previously abandoned regional techniques to resume or increase their use of regional anesthesia in children **(Mariano et al., 2008).**

Age-appropriate pain assessment and management is vital in the care of children with acute pain. Assessment should happen regularly and should be documented clearly; pain should be treated and routinely reassessed. There are both short- and long-term consequences if pain is poorly treated in the acute and postoperative setting.**(Macintyre et al 2010).**

Continuous peripheral nerve blockade (CPNB) can provide excellent postoperative analgesia. Many adult studies report the effectiveness of CPNB. Although not as widely adopted in pediatrics, several studies support its use. Its niche lies in provision of analgesia after major unilateral limb surgery with severe postoperative pain expected for 48 to 72 hours **(Rochette et al., 2009).**

Acute exacerbation of an ongoing chronic pain can be a diagnostic and clinical dilemma. Chronic pain in children requires an interdisciplinary approach to assessment and treatment. Further, the child must commit to taking an active role in therapy **(Lauder et al 2010).**

Pediatric regional anesthesia is commonly used in adjunction with general anesthesia and plays a key role in the multimodal approach of pain management in surgical and nonsurgical pediatric patients and provides excellent postoperative analgesia. The development of needles and

catheters for pediatric patients has made the use of these techniques easier and safer. Large retrospective and prospective studies confirm the infrequent rate of complications and no major sequelae with regional anesthesia in children, especially with peripheral nerve blocks. The use of long-acting local anesthetics with less cardiotoxicity, as well as ropivacaine or levobupivacaine, increases the safety of these procedures in children. Virtually all techniques of nerve blockade have been evaluated in pediatrics, thus allowing precise definition of their indications, contraindications, and adverse effects **(Nolting et al., 1998).**

Continuous peripheral nerve blocks are one of the most recent developments in regional anesthesia in children. Local anesthetics in a single-shot procedure have a limited duration of action, sufficient for some pediatric surgeries but insufficient in many cases of major surgery. Major pediatric orthopedic surgery causes significant and prolonged postoperative pain, making continuous peripheral nerve blocks very important **(Nolting et al., 1998).**

Ultrasound imaging techniques represent the second transformation in regional anesthesia. The advantage of ultrasonography is to make visible spread of the local anesthetic. Without doubt, ultrasonographic guidance improves the quality

of regional anesthesia blockade, allowing both the adjustment of needle positioning in case of inappropriate spread and the reduction of local anesthetic dose in children **(Nolting et al., 1998).**

AIM OF THE ESSAY

The aim of this essay is to focus on the safety and efficacy of regional anaethesia in pediatric and its uses in anaethesia and pain management using ultra-sound.

PHARMACOLOGY AND TOXICITY OF LOCAL ANESTHETICS IN INFANT AND CHILDREN

Safe dosing guidelines and age-related trends in local anaesthetic pharmacokinetics and pharmacodynamics have been characterized and have facilitated expansion of paediatric regional anaesthesia practice. **(Mazoit JX, 2012).**

Neurologic or cardiac toxicity related to excessive local anaesthetic blood concentration is more likely to occur in infants than in adults because of low protein binding and decreased intrinsic clearance. **(Di Gregorio G.et al., 2010).**

Resuscitation measures must be initiated immediately after local anaethetic systemic toxicity (LAST). Neurotoxicity (seizures) can be treated with barbiturates, benzodiazapines or propopfol. Recent evidence indicates that the most successful treatment for LAST-related cardiotoxicity is the administration of a lipid emulsion, which is now considered first line therapy **(Weinberg G, 2006).**

An emerging number of case reports demonstrate that rapid bolus injections of lipid emulsion reverse the toxic effects of local anaesthetics in paediatric patients. **(Weinberg GL, 2010)**.