INTRA VENOUS DEXAMETHASONE IN COMBINATION WITH CAUDAL BLOCK PROLONGS POSTOPERATIVE ANALGESIA IN PEDIATRIC DAYCARE SURGERY

MURNI SARI AHMAD ARBI*, AZARINAH IZAHAM**, ESA KAMARUZAMAN*, KHAIRULAMIR ZAINUDDIN***, HAMIDAH ISMAIL** and NORSIDAH ABDUL MANAP****

Abstract

Background: This study was conducted to determine if intravenous dexamethasone combined with caudal block was able to prolong post-operative analgesia in pediatric daycare surgeries.

Methods: Sixty four ASA I or II children aged 3 to 10 year old scheduled for daycare open unilateral herniotomy received general anesthesia and caudal block using 0.25% levobupivacaine 0.75 mg.kg⁻¹ with suppository paracetamol 30 mg.kg⁻¹. After anesthesia induction, they were randomized to receive either intravenous dexamethasone 0.5 mg.kg⁻¹ (Group I) or same volume intravenous normal saline (Group II). Postoperatively, pain scores were assessed using Wong-Baker faces scale. At home, their parents assessed and recorded the pain scores, time to first oral paracetamol served and frequency of paracetamol given in two consecutive days post surgery. On the third postoperative day, these information were gathered from the parents via a phone call.

Results: There were statistically significant differences between Group I and Group II in the median time to first paracetamol (800 vs 520 min, p = 0.01), mean pain scores postoperative day 1 (1.9 ± 2.0 vs 3.5 ± 2.2, p = 0.05), mean pain score postoperative day 2 (0.8 ± 1.6 vs 2.3 ± 2.0, p = 0.03) and mean frequencies of paracetamol given on postoperative day 2 (0.3 ± 0.8 vs 1.1 ± 1.0, p = 0.02).

Conclusion: A single intravenous dexamethasone dose when combined with caudal block reduces postoperative pain, decreases paracetamol requirement and prolongs analgesic duration in children after open herniotomy.

Keywords: dexamethasone, postoperative, analgesia, pediatric, daycare.

* MD (USM), MMed (Anaesth) UKM.
** MD (UKM), MMed (Anaesth) UKM.
*** MBChB (Otago), MMed (Anaesth) UKM.
**** MBBS (Sydney), MMed (Anaesth) UKM.

Department of Anaesthesiology& Intensive Care, Universiti Kebangsaan Malaysia (UKM) Medical Centre, Kuala Lumpur, Malaysia.
Department of Anaesthesiology& Intensive Care, Hospital Kuala Lumpur, Kuala Lumpur, Malaysia.

Address for correspondence: Azarinah Izaham, Department of Anaesthesiology& Intensive Care, Universiti Kebangsaan Malaysia Medical Centre, Jalan Yaacob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia. Tel: +603 91455797, Fax: +603 91456585, E-mail: azaizaham@yahoo.com
Introduction

Pediatric daycare surgeries now form a large part of pediatric anesthetic practice. In the United States of America, 2.3 million pediatric surgeries were performed on a daycare basis in 2006. Children are candidates for daycare surgeries as they are usually healthy, free of systemic disease and typically require straightforward, minor or intermediate surgical procedures.

An audit of pediatric daycare surgeries in a district general hospital in the UK by Jolliffe et al. (1997) found that postoperatively, pain was more of a problem than nausea and vomiting. Most studies of analgesia in pediatric daycare surgeries have focused on the immediate postoperative course, and largely ignored the potential for moderate or severe pain after discharge home, when it then becomes the responsibility of the parents.

Studies have been conducted to find the appropriate method to improve postoperative pain in pediatric daycare setting. The use of local anesthetic infiltration, oral non-steroidal anti-inflammatory drugs or tramadol, intravenous or caudal clonidine and ketamine have been shown to improve the postoperative analgesia and to reduce the postoperative pain. However, the use of these drugs has been limited by unacceptable adverse effects in children undergoing daycare surgery.

Dexamethasone is a potent synthetic glucocorticoid which has a powerful anti-inflammatory action. Preoperative administration of dexamethasone has been shown to reduce pain and swelling after oral, spinal and laparoscopic surgeries. Despite the exact mechanism by which dexamethasone exerts its analgesic effect is not fully understood, a reduction in pain by steroids has been supported by many studies.

This study was conducted to determine if a single intravenous dexamethasone dose when combined with caudal block was able to reduce post-operative pain and prolong post-operative analgesia in pediatric daycare herniotomies.

Methods

This was a prospective, randomized, controlled and double blind study conducted at Hospital Kuala Lumpur, Malaysia following approval from the Medical Research Committee of Universiti Kebangsaan Malaysia Medical Centre and the National Medical Research and Ethics Committee Malaysia. A total of 64 ASA I or II children aged between 3 to 10 years old, scheduled for daycare open unilateral herniotomy were included in the study.

Children who have contraindication to caudal block, have allergy to any drugs used in the study, who developed complications intraoperatively and required admission postoperatively were excluded from the study.

In the morning of surgery, parents were informed regarding the study at the daycare ward and written informed consents were obtained. Both parents and their children were taught regarding the usage of Wong-Baker faces scale for pain scoring after discharge. They were given a diary to record the pain score when their children complained of pain and frequency of paracetamol given at home. The children were kept fasting according to the daycare protocol. They were randomized using computer generated random number into two groups, Group I received intravenous dexamethasone 0.5 mg.kg\(^{-1}\) (maximum of 10 mg) and Group II who were given the same volume of intravenous saline after induction of anesthesia.

In the operating theatre, the children were induced by inhalational technique with sevoflurane 8% in 100% oxygen. Standard monitoring of non-invasive blood pressure, electrocardiogram and pulse oximeter were applied. After securing intravenous access, the children received intravenous fentanyl 1 µg.kg\(^{-1}\). An appropriate sized Proseal laryngeal mask airway (LMA) was inserted accordingly. The end tidal concentration of sevoflurane was adjusted to deliver a minimum alveolar anesthetic concentration (MAC) of 1.0. The patients then received either intravenous dexamethasone or normal saline according to their group allocation.
Caudal block was performed on all children using a 5 cm short beveled 22 G needle in the lateral decubitus position. After identifying the space with loss of resistance technique, the children received 0.75 ml.kg⁻¹ levobupivacaine 0.25% (maximum 20 ml). Suppository paracetamol 30 mg.kg⁻¹ was given after completion of caudal block.

Surgery was allowed to begin 10 minutes after performing the block. Children with an increase in heart rate of more than 20% from baseline indicating failed caudal block were given intravenous morphine and were discontinued from the study.

Postoperatively, patients were monitored in the post-anesthesia care unit (PACU). Intravenous fentanyl 0.5 µg.kg⁻¹ was administered as rescue analgesia if the pain score was 4 and above. These children were then transferred to day care ward where their pain scores were monitored at hourly intervals till discharge. Oral paracetamol 15 mg.kg⁻¹ was given if any of these children had a pain score 4 and above. At home, their parents would monitor the pain score as previously instructed.

The time to first supplemental oral paracetamol (first paracetamol time) is defined as the time from the end of surgery to the first administration of oral paracetamol. The time of first paracetamol given, frequency of paracetamol given in the two consecutive postoperative days and associated pain scores were recorded by parents in the respective diaries given earlier upon discharge. On the third postoperative day, these information were collected through phone calls.

**Statistical Analysis**

The study was designed with type I error of α = 0.05, type II error of β = 0.2 and power of 80%. Calculated sample size was 64 including 20% dropout rate. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS version 19.0 IBM Corp, Armonk, NY) software. Chi-square test was used to compare categorical demographic data and pain score between the two groups. Independent Student’s t-test was used to compare mean frequency of paracetamol given and survival analysis Kaplan Meier...
Fig. 2
Postoperative pain scores using Wong-Baker faces scale.
Data expressed as mean ± SD

Fig. 3
Frequency of oral paracetamol given postoperatively-Data expressed as numbers, n

* # p < 0.05
was used to demonstrate the time to first paracetamol between groups. A p value of < 0.05 was considered statistically significant.

Results

A total of sixty four patients were recruited to the study but only 57 patients had reliable data. Seven patients were excluded from the study: 2 parents were uncontactable after discharge, 3 patients were readmitted to the ward on postoperative day 1 due to surgical complications and 2 mothers had violated the protocol postoperatively. There were no statistically significant difference between the two groups with regard to their age, weight, gender and races (Table I). There was no failure of caudal blocks in any patients.

None of the children in both groups required rescue fentanyl in the PACU or rescue oral paracetamol in the daycare ward. The time to first oral paracetamol administration was significantly longer in Group I (800 minutes) compared with Group II (520 minutes), (p = 0.011) (Figure 1).

Pain scores assessed using Wong-Baker faces scale showed that the pain was less in Group I compared to Group II in the first (1.9 ± 2.0 vs 3.5 ± 2.2, p <0.05) and second postoperative days (0.8 ± 1.6 vs 2.3 ± 2.0, p <0.05) as shown in Figure 2. None of these children experienced pain in PACU or daycare ward.

There was no statistically significant difference in paracetamol administration during day 1 postoperatively although 14 children in Group I did not require any paracetamol as compared to 7 children in Group II. There was, however, significant difference in paracetamol administration on day 2 postoperatively where the frequency of paracetamol administration was less in Group I compared to Group II (0.3 ± 0.8 vs 1.1 ± 1.0, p = 0.022). It was noted that on day 2, 22 children in Group I did not require paracetamol for pain relief compared to only 12 children in Group II. This reduction in paracetamol requirement reflected an improved quality of pain relief in Group I (Figure 3).

Discussion

Daycare surgery is a modern, effective and economical way to treat patients while maintaining the same level of quality of patient care. Daycare surgery has been reported to be safe and effective for a large proportion of infants and children requiring operation in many pediatric hospitals. It is gaining considerable acceptance and many parents have expressed satisfaction with this approach18. Inguinal hernia repair is one of the frequently performed surgical procedures in children whereby it is frequently performed as daycare surgery19. A study by Obalum et al (2008) reported that postoperative pain was the most common complication of daycare inguinal herniotomy and herniorrhaphy20. Adequate postoperative pain relief is one of the most fundamental issues for successful pediatric outpatient surgery, but unfortunately this is not always the case despite the various analgesic treatment options that are available21.

We demonstrated that a single dose of intravenous dexamethasone in combination with a caudal block prolongs the postoperative pain relief significantly. This finding is comparable to a study done by Hong et al (2010) which reported that a single dose of intravenous dexamethasone 0.5 mg.kg⁻¹ combined with caudal block prolongs postoperative pain relief in pediatric orchidopexy23. These results may be due to the onset of dexamethasone which has been shown to have a long duration of action of 36 to 54 hours11. The exact mechanism by which dexamethasone may exert an analgesic effect is not fully understood. It has been postulated that systemic administration of steroids has been found to suppress tissue levels of bradykinin and the release of neuropeptides from nerve endings, both of which can enhance nociception in inflamed tissue. The established reduction in prostaglandin production may further contribute to analgesia by inhibiting the synthesis of cyclooxynegenase isofrom-2 in peripheral tissues and in the central nervous system. They also inhibit other mediators of inflammatory hyperalgesia, for example, tumour necrosis factor-α, interleukin-17β and interleukin-623.

This study also showed that dexamethasone improved the quality of pain relief. This may be due to the action of dexamethasone as an anti-inflammatory
agent which reduces local edema and swelling\textsuperscript{24}. The above finding is comparable to a study done by Mohamed et al (2009) where the combination of both intravenous dexamethasone 0.5 mg.kg\textsuperscript{-1} and bilateral glossopharyngeal nerve block reduces visual analogue score significantly at 8 and 12 hours postoperatively compared to either intravenous dexamethasone or glossopharyngeal nerve block alone\textsuperscript{25}.

We demonstrated in this study that there was no significant difference in paracetamol administration on day 1 post-operation. However on day 2 post-operation, there was significantly less frequency of paracetamol administration when caudal block combine with intravenous dexamethasone. This finding correlates with its prolong duration of action and is comparable to a study done by Gomez-Hernandez et al (2010) which reported that postoperative ketorolac were required more in patients of the control group than in the dexamethasone group in breast cancer patients undergoing mastectomy\textsuperscript{14}.

In our study, none of the children experienced any postoperative nausea and vomiting. All the children were able to tolerate oral intake well before being discharged home. This may be due to minimal usage of intraoperative opioids, good pain relief by caudal block and effect of dexamethasone. The exact mechanism of action is unknown but dexamethasone may exert an antiemetic action via prostaglandin antagonism, serotonin inhibition in the gut and release of endorphins\textsuperscript{21}. This is similar to a study done by Samarkandi et al (2004) which demonstrated intravenous dexamethasone reduces postoperative vomiting and pain in pediatric tonsillectomy procedures\textsuperscript{16}.

There were several limitations to this study. We did not study the side effects of dexamethasone such as aggression, agitation, anxiety and blurred vision. Furthermore, there was no report of adverse effects in a single dose of dexamethasone in pediatric or adult surgery in previous studies\textsuperscript{12,17,23,25,26}. Our study is limited to only two postoperative days as the parents needed to resume back to their daily activities. The pain score was assessed by the parents at home and this may be subjected to bias as the parents were the sole assessors.

**Acknowledgements**

We would like to thank Dr. Azrin Azidin for his help in the data collections and manuscript for this study.
Dexamethasone improves caudal block analgesia

References

BRIDION—**for optimal neuromuscular blockade management** and improved recovery

### Predictable and complete reversal

- 98% of BRIDION patients recovered to a TOF® ratio of 0.9 from reappearance of T₂ within 5 minutes²
- 97% of BRIDION patients recovered to a TOF® ratio of 0.9 from 1 to 2 PTCs † within 5 minutes³

### Rapid reversal

- BRIDION rapidly reversed patients from reappearance of T₂ † in 1.4 minutes²
- BRIDION rapidly reversed patients from 1 to 2 PTCs † in 2.7 minutes³

BRIDION is indicated for the reversal of neuromuscular blockade induced by rocuronium or vecuronium. In children and adolescents (aged 2-17 years), BRIDION is only recommended for routine reversal of moderate rocuronium-induced neuromuscular blockade.

**Important safety information**

BRIDION is not recommended in patients with severe renal impairment. Studies in patients with hepatic impairment have not been conducted and, therefore, patients with severe hepatic impairment should be treated with great caution. Cautions should be exercised when administering BRIDION to pregnant women as no clinical data on exposed pregnancies are available.

BRIDION has not been investigated in patients receiving rocuronium or vecuronium in the Intensive Care Unit (ICU) setting.

If neuromuscular blockade is required within 24 hours of BRIDION administration, a nondepolarizing neuromuscular blocking agent should be used instead of rocuronium or vecuronium. The most commonly reported adverse reactions were dysgeusia (metal or bitter taste) and anesthetic complications (movement, coughing, grimacing, or sucking on the endotracheal tube). In patients treated with BRIDION, a few cases of awareness were reported. The relation to BRIDION was uncertain. In a few individuals, allergic-like reactions (i.e., flushing, erythematous rash) following BRIDION were reported. Clinicians should be prepared for the possibility of allergic reactions and take the necessary precautions. In a trial of patients with a history of pulmonary complications, bronchospasm was reported in 2 patients and a causal relationship could not be fully excluded.

Volunteer studies have demonstrated a slight (17%-22%) and transient (<30 minutes) prolongation of the prothrombin time/activated partial thromboplastin time (PT/ aPTT) with BRIDION; however, clinical studies have demonstrated no clinically relevant effect on peri- or postoperative bleeding complications with BRIDION alone or in combination with anticoagulants. As BRIDION has demonstrated an in vitro pharmacodynamic interaction with anticoagulants, caution should be exercised in patients on anticoagulation for a pre-existing or concomitant condition. This pharmacodynamic interaction is not clinically relevant for patients receiving routine postoperative prophylactic anticoagulation. Although formal interaction studies have not been conducted, no drug interactions were observed in clinical trials. Preclinical data suggest that clinically significant drug interactions are unlikely with the possible exceptions of toremifene, fusidic acid, and hormonal contraceptives.

† Train-of-four
‡ Post-tetanic count
§ Second twitch

**REFERENCES:**
1. BRIDION Summary of Product Characteristics (SPC).

Please see summary of product characteristics for full prescribing information.
Pioneering Medical Technology

TAP Block And InfihtraLong
For Effective Treatment
Of Long And Deep Incisions

Sono Cannulas
For Single Shot UltraSound
Guided Nerve Blocks

SonoSystem And SonoLong Curl
For UltraSound Guided Nerve Blocks

Sprotte® 2.G
The New Generation
Dura Puncture In Minimum Time

SonoEye Ophthalmic Block
For Peribulbar And Retrobulbar
Blocks Under Ultrasonic Monitoring

www.mediline-lb.com  Tel:+961 1 697500
**Intrafix® SafeSet**  
The first IV administration set with AirStop and PrimeStop

Gives every ward that extra measure of safety while providing higher efficiency.

Thanks to AirStop in the drip chamber - the sight of a container running empty is no longer cause for alarm and no reason for energy and time to be wasted rushing around because the patient gets upset.

When the container is empty, AirStop maintains a constant fluid level. No air can get through to the patient.

Thanks to the PrimeStop at the patient connector - you can now prepare several infusions at once, quicker and more hygienic than ever before. Right away your hands are free to prepare the next infusion.

For more information about Intrafix® SafeSet and Safe Infusion Therapy:
Question.
Your patient requires urgent pain medication. How can you administer this less invasively?

Answer.

References: