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Original Research Article

Analgesic effects of caudal versus intravenous dexamethasone on bupivacaine based caudal block for paediatric infraumbilical surgeries

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ABSTRACT

Background: Singleshot caudal block provides short lived postoperative analgesia necessitating continued exploration for adjuvants. Aim was to compare the analgesic efficacy between intravenous and caudal dexamethasone on bupivacaine based caudal block for paediatric infraumbilical surgeries.
Methods: Following ethical clearance and parental consent, 69 children aged 1-6 years, of American society of anesthesiologists (ASA) physical status classification I and II were randomized into groups A, B and C, of 23 each. All subjects underwent laryngeal mask airway (LMA) general anaesthesia induced with propofol and maintained with isoflurane in 100% oxygen, and had caudal block with 1 ml/kg bupivacaine 0.25%. Additionally, groups B and C received caudal 0.1mg/kg and intravenous preinduction 0.25 mg/kg dexamethasone, respectively. Pain was assessed using FLACC scale. The time to first analgesic request (TTFAR) was defined as the interval from caudal injection until pain score was ≥4; at this point, analgesic was given.
Results: All 69 children were completely studied. The mean TTFAR (in minutes) was longest in Group B (485.40±24.50) followed by C (459.60±36.40), and shortest in group A (253.63±71.55), p=0.001, 0.024 and 0.968 for A versus B, A versus C and B versus C respectively, with greatest 24 hours pethidine consumption in Group A relative to groups B and C, p=0.001 and 0.025.
Conclusions: Caudal 0.1 mg/kg or intravenous 0.25 mg/kg dexamethasone combined with bupivacaine significantly prolonged postoperative analgesic duration, with comparable analgesic profile between the caudal and intravenous routes, and without adverse effects.

Keywords: Caudal block, Dexamethasone, Infraumbilical surgeries

INTRODUCTION

Providing adequate postoperative analgesia safely to children through simple, cost effective techniques, without triggering systemic upheaval is a desirable goal for paediatric anesthesiologists. Caudal block, following its description for paediatric urological procedures by Campbell in 1933, has evolved to become one of the most common and effective regional blocks used in children undergoing infraumbilical srgeries.[1,2] It is perhaps the most easily learned and mastered of all regional anesthetic techniques. Jöhr and co-workers have shown that only 32 blocks are needed for an anesthetist registrar to reach about the same level of skill as older and more experienced colleagues.[3]

The reliability and simplicity of a single-shot caudal block technique notwithstanding, the associated relatively short postoperative analgesic duration poses gross limitation.[3] Edomwonyi and Egwakhide[4] in their study did not find single-shot caudal bupivacaine superior to local infiltration adjacent to the ilioinguinal and iliohypogastric nerves for postoperative pain management in children. Besides, the continuous catheter technique for prolonging analgesia raises concerns about infection due to its proximity to the anorectal area.[5] Therefore, to achieve prolonged postoperative analgesic

effect using caudal bupivacaine, many opioid and non-opioid additives have been co-administered with bupivacaine over years.[6] Survey by Sander et al reported that use of adjuvants was so popular that the majority of British paediatric anesthetists (58%) used an adjuvant drug when performing caudal block, with commonly used being ketamine, clonidine, fentanyl, diamorphine and dexamethasone.[7] Administered epidurally, dexamethasone, potent, selective glucocorticoid possessing anti-inflammatory properties and minimal mineralocorticoid action has been shown to decrease postoperative pain and analgesic requirements.[8,9] In addition, its antiemetic and antipyretic actions reduce delayed oral intake in children postoperatively.[9]

This study, therefore, sought to examine the effect of caudal versus intravenous dexamethasone on postoperative pain in children receiving bupivacaine-based caudal block for infra-umbilical surgeries.

METHODS

Following ethical clearance from the university of Port Harcourt teaching hospital for a prospective, randomized, double blind, placebo controlled, comparative study, and written informed consent from the parents, 69 children, aged 1-6 years, of ASA classification I or II scheduled for infraumbilical surgeries, were randomized into three groups, A, B and C, of 23 each. All 69 subjects completed the study which was conducted from July to December 2022, in the university of Port Harcourt teaching hospital, Port Harcourt, Nigeria.

Sample size determination

Sample (n) size was calculated using the formula for comparison of means:[10]

$$N=(U+V)^2(SD_1^2+SD_1^2)/(\mu_1-\mu_2)^2$$

Where, n=sample size, u=1.28 using power of 90% for this study, u=1.28; v=1.96 at 5% significance level. SD_1=SD of group 1 and SD_2=SD of group 2.

In a related study,[11] the standard deviation of the group that had 0.25% bupivacaine alone was 1.1. Based on the null hypothesis, the standard deviation for the intravenous and caudal dexamethasone groups, it was assumed, were not different. So, $SD_1 = SD_2 = 1.1$.

$\mu_1 - \mu_2$=the expected difference in hours of the duration of effective analgesia between the two groups; for this study, it was 1.2 hours

Substituting: $N=(1.28+1.96)^2(1.1^2+1.1^2)/(1.2)^2$

n=21.3465, approximately 21 per group.

Accommodating 10% attrition, sample size was increased to 23 subjects, totaling 69 for the three groups.

Randomization and blinding

Patients were assigned to three groups (A, B and C) each consisting of 23 subjects, by simple randomization, ensured via recruitment of trained Research Assistants. Parents of the subjects were made to pick one out of 69 opaque envelopes from a bag on the morning of surgery by the nurse in the theatre reception supervised by a registrar anesthetist (first research assistant). Each envelope concealed an alphabet (A, B, or C) in it. The envelope picked was excluded from the rest and the patient allocated to that group designated by the alphabet picked. Another registrar anesthetist (second research assistant) blinded to the intra- and postoperative outcomes prepared the study agents based on subject's weight and group allocation, assigning different code against each subject's group and hospital number; the lead researcher performed the caudal block, administered the study agents and recorded the parameters. The nurse in the paediatric surgical ward in conjunction with the second Research Assistant kept the codes for rapid access to every subject, in the event of any adverse effects.

Every subject was preoperatively evaluated and prepared the day before surgery; the parents withheld solid food 6 hours, breast milk 4 hours but gave clear glucose-based fluid up to 2 hours prior to surgery. Children aged 1-6 years scheduled for elective infraumbilical surgeries, in ASA class I or II and whose parents gave consent comprised the inclusion criteria, while age <1 year or >6 years, ASA >II, respiratory tract infection, obesity, failed caudal block, infection at the sacral region, known allergy to study drugs, haemoglobinopathy, epilepsy, day-case/emergency surgeries and parental refusal to participate in the study constituted the exclusion criteria. The Face, leg, activity, cry, consolability (FLACC) pain scale was explained to the parents of all the participants.[12] On the morning of surgery, preoperative sedatives and analgesics were withheld; anxiety was allayed by adopting child distractive techniques such as the use of cartoon videos and toys. A multiparameter monitor (Dash 4000®) was attached for recording pulse rate, peripheral temperature, non-invasive blood pressure (NIBP) and peripheral arterial haemoglobin oxygen saturation (SpO_2), and a precordial stethoscope for breath sound.

All children received caudal block, aseptically, under LMA general anaesthesia induced with propofol 2.5 mg/kg, and maintained with Isoflurane 1.5% in 100% oxygen connected to Mapleson F breathing system. Each child's caudal space was accessed with size 22 gauge intravenous cannula (MEDIFLON, GLOBAL MEDIKIT, INDIA), and injected with 1 ml/kg of plain bupivacaine 0.25% (Duracaine 0.5%, Aspen), in the left lateral position; additionally, group A received intravenous 5ml of 0.9% normal saline placebo, group B received 0.1 mg/kg preservative free dexamethasone (Nouvasant Pharmahealth LTD) plus intravenous 5 ml of 0.9% normal saline, while group C was given intravenous 0.25 mg/kg of same dexamethasone at induction.

Non-invasively parameters monitored intra-operatively included: SpO_2 to maintain a value >95%, peripheral temperature targeting normothermia (36.0-37.4ºC), pulse rate (PR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial blood pressure (MAP) every 2 minutes following caudal block for the first 16 minutes, thereafter, every 5 minutes and blood loss (by counting swabs).

Failure of caudal block was defined as sustained increase in PR and MAP within 15 minutes of skin incision greater than 15% of pre-incision values; the affected child was to be given fentanyl 2µg/kg plus acetaminophen 15mg/kg, and discontinued from the study; intraoperative hypotension or bradycardia was said to occur if there was >30% reduction in baseline values[13] and was to be corrected with intravenous 0.9% saline bolus, Atropine and Ephedrine as appropriate.

At end of surgery, patients were shifted to recovery room; SpO_2, RR, PR, SBP, DBP, MAP and temperature were recorded quarter-hourly for 2 hours. Pain was assessed every 30 minutes for 60 min, thereafter at 2, 4, 6, 12 and 24 hours. At a FLACC score of ≥4, intramuscular Pethidine 1 mg/kg was given to provide analgesia. Occurrence of adverse effects was treated and recorded. Lactated Ringer's solution was administered intraoperatively, while 5% dextrose-saline was given postoperatively using 4-2-1 rule.

Data collection and analysis

Data was entered into spread sheet and analyzed using tstatistical product and service solutions (SPSS) version 20 (SPSS, Chicago, IL, USA) software for statistical analysis. Statistical significance was set at $p<0.05$.

RESULTS

All groups of study were comparable in demographics and ASA physical status classification. The subjects' mean ages (months) in groups A, B and C respectively were 38.8 ± 20.0, 39.3±19.4 and 37.9±21.7, p=0.914; their mean weights (kg) were 13.22±4.54 (group A), 14.03±3.77 (group B) and 15.31±4.18 (group C), p=0.254. The children in all the three groups had ASA classification of I. As observed, their baseline blood pressure (SBP, DBP, MAP in mmHg), PR (b/m), SpO_2 (%)**,** temperature (º C) and respiratory rate (c/m) were comparable across all groups, as well as their mean durations of surgery (Table 1).

Postoperatively, FLACC pain scores at different time points (Table 2) were comparable across the groups at the 30th and the 60th minutes, p=0.583 and 0.821 respectively; however, at 2nd, 4th, 6th, 12th, and 24th hours pain assessment scores in 3 groups were significantly higher in group A compared to groups B and C, with corresponding p=0.025, 0.001, 0.012, 0.015, and 0.004.

The TTFAR observed in groups B and C which recorded respectively 485.40±24.50 and 459.60±36.40 minutes, were longer than the duration of 253.80±18.30 minutes observed in group A. Intergroup analysis showed that while the observed TTFAR which was longest in group B was not significantly different from that in group C, p=0.968, the differences in absolute analgesic duration were statistically significant between groups A and B, p=0.001, and between groups A and C, p=0.024. Also, it was observed that the total pethidine consumption (in mg) in the groups within the first 24 hours was significantly more in group A, recording 35.43±11.05, compared to groups B and C which had corresponding values of 19.98±7.13 and 26.73±13.44. Again, on intergroup analysis these differences were significant between groups A and B, and groups A and C, p=0.001 and p=0.025 respectively, but not significant between groups B and C, p=0.106 (Table 3).

There was no occurrence of postoperative complication such as vomiting or fever in any of the groups (Table 4).

Table 1: Demographic characteristics, ASA classification, baseline vital parameters and mean duration of surgery in the 3 groups.

Variables, n=23	Group A, n=23	Group B, n=23	Group C, n=23	P value
Age (In months)	38.8±20.0	39.3±19.4	37.7±21.7	0.914
Weight (kg)	13.22±4.54	14.03±3.77	15.31±4.18	0.254
ASA I	23 (100)	23 (100)	23 (100)	
SBP (mmHg)	112.80±10.51	116.82±7.98	115.20±8.32	0.47
DBP (mmHg)	50.55±13.65	64.41±19.23	60.68±20.33	0.110
MAP (mmHg)	57.71±6.78	56.62±9.73	64.24±15.01	0.056
PR (b/m)	110.71±6.78	118.82±11.86	122.14±16.22	1.188
SpO_2	99.90±0.21	99.90±0.29	99.80±0.53	0.250
Temp. (ºC)	35.76±0.58	35.36±0.72	35.56±0.72	1.463
RR (c/m)	30.86±13.18	23.29±7.86	25.91±9.26	0.620
Mean duration of surgery (minutes)	32.59±13.55	33.18±12.20	32.05±12.18	0.087

Data are expressed as mean ± SD, number (%).

Table 2: Post-operative pain assessment using FLACC pain scores at different time points.

Pain assessment (FLACC)	Group A, n=23	Group B, n=23	Group C, n=23	P value
30 minutes	0.22±0.54	0.09±0.29	0.13±0.46	0.583
60 minutes	0.77±0.86	0.63±0.58	0.68±0.71	0.821
2 hours	2.72±0.77	2.18±0.59	2.31±0.65	0.025*
4 hours	3.50±1.01	2.40±0.67	3.04±0.67	0.001*
6 hours	3.36±0.79	3.18±0.73	3.18±1.01	0.012*
12 hours	4.50±1.06	3.72±0.55	4.04±0.84	0.015*
24 hours	4.95±1.09	3.34±0.74	4.01±1.54	0.004*

Data are expressed in mean ± SD; *Statistically significant.

Table 3: Time to first analgesic request (TTFAR) and total analgesic (pethidine) consumption in 24 hours by the subjects.

Variable	Group A, n=23	Group B, n=23	Group C, n=23	P value
Mean analgesic duration (minutes)	253.80±18.30	485.40±24.50	459.60±36.40	*0.001[1], *0.024[2], 0.968[3]
24 hours pethidine consumption (mg)	35.43±11.05	19.98±7.13	26.73±13.44	*0.001[1], *0.025[2], 0.106[3]

Data are expressed as mean ± SD; Turkey Posthoc: [1]Group A versus Group B, [2]Group A versus Group C, [3]Group B versus Group C. *Statistically significant (p<0.05).

Table 4: Post-operative complications amongst subjects in the groups of study.

Variables	Group A, n=23	Group B, n=23	Group C, n=23
Vomiting			
Yes	0 (0.0)	0 (0.0)	0 (0.0)
No	23 (100.0)	23 (100.0)	23 (100.0)
Fever			
Yes	0 (0.0)	0 (0.0)	0 (0.0)
No	23 (100.0)	23 (100.0)	23 (100.0)

Data are expressed in freq. (%).

In the distribution of surgeries (Figure 1) herniotomy was highest, with values of 14 (60.9%), 13 (56.5%) and 15 (65.2%), followed by orchidopexy which recorded 7 (30.4%), 6 (26.1%) and 5 (21.8%), in groups A, B and C respectively. Hypospadias repair had the lowest number with the corresponding values of 2 (8.7%), 4 (17.4%) and 3 (13.0%) for groups A, B and C.

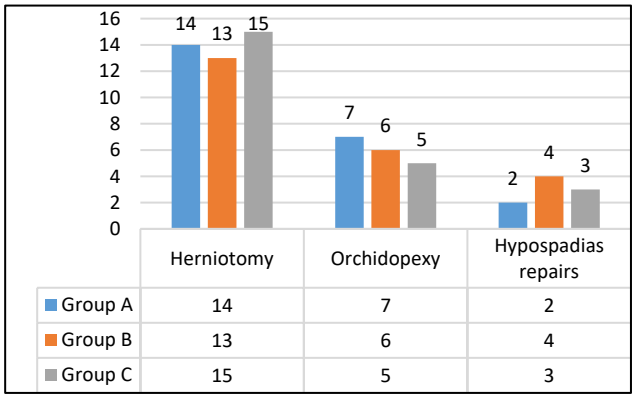

Figure 1: Distribution of surgeries across the three groups.

DISCUSSION

In this study, as observed, the addition of caudal or intravenous dexamethasone to bupivacaine significantly prolonged TTFAR, as well as significantly reduced pain scores and decreased total 24-hour analgesic consumption, compared to bupivacaine alone. Also, the analgesic profiles though longer amongst subjects who received caudal dexamethasone and bupivacaine (group B), were comparable to group C which received intravenous dexamethasone and caudal bupivacaine, without adverse effects.

Combining suitable adjuvant with local anesthetic favourably prolongs the duration of effective antinociception as well as reduces the total dose of local anesthetic agent required; without adjuvant addition the duration of postoperative analgesia from local anesthetic administered via single shot caudal is limited.[14] This finding also corroborates the scientific reports of other researchers. Yousef et al, studying ropivacaine-dexamethasone combination versus ropivacaine alone for caudal block in children undergoing inguinal herniotomy, observed a significantly prolonged duration (720 minutes) of analgesia, without the need for rescue pethidine, in the group that received caudal ropivacaine-dexamethasone compared to 240 minutes in the ropivacaine-alone group.[15] Similarly, Aruna and co-workers,[16] in their evaluation of the analgesic effect of combining caudal 0.125% bupivacaine and 0.1mg/kg dexamethasone versus 0.125% bupivacaine alone for infraumbilical surgeries in children, reported that the administration of caudal dexamethasone-bupivacaine combination increased the duration of analgesia effectively, giving a mean duration of 435.85±144.72 minutes of analgesia in the group without dexamethasone, in comparison with 1033.92 ±392.29

minutes in the group given caudal dexamethasone. The authors also documented that mean pain scores were similar across their groups of study for the first 4 hours, but became significantly lower in the group with adjuvant dexamethasone at the 5th, 6th, 16th, 20th and 24th hours compared to the corresponding values in the control group.[16]

A caudal adjuvant dose of 0.1 mg/kg dexamethasone was used in this study to achieve a prolonged mean TTFAR, and this was similar to the dose used by Aruna et al.[16] However, Aruna et al despite using a lower concentration of bupivacaine (0.125%), in contrast with 0.25% used in this study, reported a longer mean duration of analgesia than was observed in this study.[16] This is attributable to the sedative and analgesia potentiating effects of oral 0.5mg/kg midazolam premedication administered to the children for separation anxiolysis by Aruna et al.[16] The effectiveness of midazolam in prolonging TTFAR, reducing postoperative pain scores, and decreasing postoperative analgesic consumption post dental surgery is documented.[17] Besides, sedation in the non-verbal age group of children may be mistaken for analgesia during pain assessments. In this study, sedative premedication was avoided so as not to introduce confounding variables.

The analgesic efficacy of dexamethasone administered by the epidural route had also been documented by Wang and colleagues[18] who demonstrated that prophylactic 5 mg epidural dexamethasone reduced the incidence and severity of post-epidural backache after epidural anaesthesia for haemorrhoidectomy. They stated that the anti-inflammatory action of dexamethasone causing reduction of oedema, shrinkage of connective tissue or suppression of neurotransmission within the spinal nerve roots might be responsible for decreased incidence of postepidural backache, and recommended the addition of a low dose dexamethasone during lumbar epidural anaesthesia, especially if multiple attempts at needle placement occurred. Compared to the control group in this study, a significant prolongation of the duration of analgesia was observed when 0.25 mg/kg dexamethasone was administered via the intravenous route in combination with caudal 1ml/kg bupivacaine 0.25%. This finding compares to the result obtained by Salami and colleagues,[19] who had earlier documented that the use of low dose intravenous dexamethasone in combination with caudal bupivacaine prolonged the duration of analgesia, reporting a TTFAR duration of 625.18±31.56 versus 261.5±10.82 min for their intravenous dexamethasone and control groups respectively, $p<0.0001$.

The duration of effective analgesia following caudal block bears a direct positive relationship with the volume of the concentration of local anaesthetic administered. Hong et al demonstrated that a single dose of intravenous 0.5 mg/kg dexamethasone in combination with a volume of 1.5 ml/kg of ropivacaine 0.15% prolonged the duration of analgesia, reduced postoperative pain and decreased rescue analgesic requirements compared to a caudal block using bupivacaine alone.[20] In their study, the control group recorded 430±205 minutes of analgesia; this value is almost twice that observed in the control group of this study.[20] The use of a larger 1.5 mg/kg volume of moderately dilute local anaesthetic (ropivacaine 0.15%) solution most likely underscores this observation. Importantly, 1 ml/kg of bupivacaine 0.25% used in this study had a longer TTFAR in the control group (253.80±18.30 minutes) than (170 minutes) reported by Akinyemi and Soyannwo who used 0.5 ml/kg of bupivacaine 0.25% for caudal block.[21] The relatively shorter TTFAR reported by Akinyemi and Soyannwo[21] is attributable to the lower volume of local anaesthetic (0.5 ml/kg) compared to (1 ml/kg) used for this study. To note, the reduced efficacy of a low volume (0.5 ml/kg) compared to an average (0.75 ml/kg) of same concentration (0.25%) of bupivacaine in paediatric caudal block was also reported scientifically by Akpoduado et al.[22] This further corroborated the empirical finding by Verghese and colleagues that a caudal block with larger volume (1 ml/kg) of bupivacaine 0.20% concentration was more effective than a smaller volume (0.80 ml/kg) of a more concentrated (0.25%) solution in preventing peritoneal response to spermatic cord traction.[23] Furthermore, Sharpe et al opined that a volume of plain bupivacaine as low as 0.5 ml/kg was insufficient for anaesthetizing the spinal cord for adequate caudal anaesthesia.[24] In this study, therefore, an optimal volume of 1ml/kg bupivacaine and a 0.25% concentration from a maximum safe dose of 2.5 mg/kg was used. This agreed with the earlier scientific finding by Verghese et al that the utilization of a higher volume of local anaesthetic agent produces longer duration of analgesia.[23]

In their research Murni and co-workers lent further support to the analgesic efficacy of intravenous dexamethasone combined with caudal bupivacaine, with findings comparable to the those in this study.[25] The authors demonstrated that a single dose of intravenous 0.5 mg/kg dexamethasone combined with caudal 0.75 ml/kg levobupivacaine 0.25% significantly prolonged postoperative analgesia in paediatric day care surgeries, reporting a mean TTFAR duration of 800 minutes in the group with dexamethasone compared to the 520 minutes in the control, $p =0.001$.[25] The mean duration of analgesia in the intravenous dexamethasone group in the study by Murni et al is almost twice the value observed in this study, despite their use of a relatively smaller volume (0.75 ml/kg) of same concentration (0.25%) of levobupivacaine, indicating an association of superior analgesic efficacy with a higher dose (0.5 mg/kg) of intravenous dexamethasone compared to a lower dose of 0.25 mg/kg as was used in this study.[25] Again, Srinivasan et al reported TTFAR of 620 minutes when intravenous 0.5 mg/kg dexamethasone was combined with 1.5 ml/kg of 0.15% of ropivacaine for caudal block, which was longer than the 459.60±36.40 minutes observed in the group that had 0.25 mg/kg intravenous dexamethasone in this study, lending further support to the findings by Murni et al.[25,26]

An intergroup evaluation of the absolute mean analgesic duration revealed a significantly longer TTFAR in each of the groups that received caudal or intravenous dexamethasone in combination with bupivacaine relative to the control group in this study. Although showing no associated statistically significant difference, the analgesic duration noted was longer in the caudal than in the intravenous dexamethasone group (485.40±24.50 versus 459.60±36.40 minutes respectively). To note, drugs administered via the epidural route are distributed into epidural fat forming a reservoir, from where the molecules of the pharmacological agents later diffuse slowly into the systemic circulation via epidural veins, thus, giving rise to a longer half-life of drugs administered through the epidural route.[27] Secondly, epidural dexamethasone may cause reduction of intraspinal production of prostaglandin associated with enhanced nociception in inflamed tissue during surgical procedure.[28]

Postoperative total analgesic consumption bears relevance to duration of adequate analgesia. In this study, the observation, on intergroup evaluation, of a significant decrease in total 24 hours analgesic consumption in groups B and C, compared to group A, indicates a direct correlation between longer TTFAR and reduced total analgesic consumption, thus corroborating the documentation by Srinivasan et al.[26] The authors noted that the total number of rescue doses of acetaminophen (paracetamol) was significantly lower in the groups of children who received intravenous or caudal dexamethasone in combination with caudal ropivacaine, relative to their ropivacaine alone group ($p<0.001$), while the number of rescue paracetamol doses was equal (1 versus 1) between the caudal and intravenous dexamethasone groups.[26] This similarity, between the findings by Srinivasan et al and this present study in relation to total analgesic consumption, further depicts that the analgesic duration achievable is statistically the same following intravenous 0.25 mg/kg or 0.1 mg/kg caudal dexamethasone in combination with bupivacaine 0.25% for caudal block. Although Srinivasan et al used a lower concentration (0.15%) of Ropivacaine, the administration of a greater volume (1.5 ml/kg) and higher dose of intravenous dexamethasone must have compensated for the lower concentration of Ropivacaine used in their study.[26]

Pain scores derived from reliable pain assessment tools provide empirical basis for the timing of analgesic administration postoperatively, especially in non-verbal paediatric subjects. In the present study, while FLACC pain scores were comparable across the three groups up to 60 minutes postoperatively, there was a consistent finding in the groups that were given dexamethasone-bupivacaine combination of significantly lower postoperative pain scores, from the 2nd hour; this agrees with the empirical findings by Srinivasan et al, who as well observed that pain scores were lower before the 6th hour in their dexamethasone group, with 54.29% of patients without dexamethasone and 0.0% in the dexamethasone group recording a VAS score of >4.[26] The observation in the present study also corroborates the report by Amlan et al[14] that without the use of adjuvants the duration of postoperative analgesia provided by local anaesthetic-based single-shot caudal block is limited. Furthermore, Mohamed et al assessing the effect of caudal dexamethasone added to bupivacaine for caudal block on postoperative pain following hypospadias repair in 70 male children, aged 2-5 years, similarly reported significantly decreased pain scores at the 3rd, 6th, 12th and 24th hour postoperatively, compared to the control.[11] Correspondingly, subjects in the bupivacaine alone group were earlier in requesting rescue analgesia as interpreted from their earlier attainment of higher FLACC pain scores; inferentially, a faster waning analgesic efficacy of caudal bupivacaine without adjuvant underpins this observation.

The exact mechanism by which dexamethasone prolongs the regional block remains to be elucidated; however, this has been linked to its intrinsic anti-inflammatory and immunosuppressive properties.[29,30] This fact is backed by the scientific observation that analgesic duration increases with glucocorticoid potency, and that it is totally reversible by the administration of a specific glucocorticoid receptor antagonist.[31] Dexamethasone administered as an adjuvant to local anaesthetic for peripheral neuraxial block has been shown to suppress transmission in unmyelinated nociceptive C-fibres.[32] Again, by its anti-inflammatory actions and inhibition of both phospholipase A2 and cyclo-oxygenase-2 enzymatic activities, dexamethasone may suppress hyperalgesic state through antagonism of pro-inflammatory prostaglandin synthesis from arachidonic acid in damaged tissues. The development of hyperalgesic state in the spinal cord following peripheral tissue damage during surgery had been documented.[28] Inferentially, therefore, a preoperative administration of dexamethasone causing suppression of the development of hyperalgesic state in the spinal pain transmission pathway underpins the observed analgesic action.

Taguchi et al had demonstrated that short-term use of dexamethasone was safe. Similarly, in this study, there were no incidences of systemic complications such as vomiting or fever in any of the groups.[33]

CONCLUSION

Amongst children undergoing infraumbilical abdominal surgeries, compared to caudal bupivacaine alone, dexamethasone administered caudally or intravenously combined with caudal bupivacaine demonstrated significantly more prolonged duration of analgesia and reduced 24-hour total analgesic consumption; however, these profiles were statistically comparable between caudal and intravenous dexamethasone groups, and there were no adverse effects.

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