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Efficacy of Dexamethasone as an Adjuvant to Bupivacaine in Caudal Anaesthesia for Lower Abdominal Surgeries in Children

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Abstract:-
Background : EFFICACY OF DEXAMETHASONE AS AN ADJUVANT TO BUPIVACAINE IN CAUDAL ANAESTHESIA FOR LOWER ABDOMINAL SURGERIES IN CHILDREN

Methodology:
Group C: 30 Children received 1 ml/kg of 0.125% bupivacaine in the caudal epidural space
Group D: 30 Children received 1 ml/kg of 0.125% bupivacaine with 0.1 mg/kg dexamethasone in the caudal epidural space.

- **The pain score was assessed using Face, Legs, Activity, Cry, Consolability (FLACC) scale at intervals of 0, 1, 2, 3, 4, 8, 12,16, 20, 24 hours.**
- **Patients were shifted to the ward after observation in the post-anaesthesia care unit for 3hours up to 24 hours.**
- **Postoperative analgesic efficacy was assessed by using the paediatric observational FLACC pain scale with its 0–10 score range, each child's pain intensity was assessed upon arrival and then every hourly till the time of discharge from the PACU.**

Results: The total duration of postoperative analgesia in group C was 281.2 ± 51.2 minutes with a range of 190 – 405 minutes, while in group D, it was 657.7 ± 150.0 minutes with a range of 380 – 860 minutes.

Conclusion: Duration of postoperative analgesia is prolonged by addition of dexamethasone to bupivacaine to as much as around 12-16 hrs and reduces the need for rescue analgesia on the first postoperative day.

Keywords:- *Caudal anaesthesia , bupivacaine ,dexamethasone , pain score, post operative analgesia,post anaesthesia care unit*

I. INTRODUCTION

- The International Association for the Study of Pain (IASP) has defined pain as an "Unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage".
- The single-shot caudal blockade continues to be one of the traditionally opted techniques for perioperative pain management strategies in paediatrics.
- The technique of caudal block is one of the best options to ensure reliable and satisfactory analgesia in the intraoperative and postoperative period.
- The use of fluoroscopic guidance and, more recently, ultrasonography can help guide correct needle placement and reduce the rate of a failed block . On ultrasound the sacral hiatus appears as a hypoechoic region between two hyperechoic band like structures and described it as "the evil eye", "mickey mouse ears" and "the two nuns."
- Dexamethasone is a long-acting corticosteroid with anti-inflammatory action. When administered in combination with local anaesthetics in the epidural space, it has been found to reduce the need for postoperative rescue analgesia consumption following lower abdominal surgeries.
- The intense anti inflammatory effects of dexamethasone promote analgesic effectiveness and have the added advantage of minimal side effects when compared to other adjuvants and make this drug an attractive choice for consideration in epidural blockade for both perioperative and postoperative purposes .

II. AIMS AND OBJECTIVES

A. Aims :

The aim of the study is to analyse and assess the analgesic efficacy of dexamethasone and duration of action of analgesia in caudal block.

B. Objectives :

To compare the effectiveness of postoperative analgesia with dexamethasone and bupivacaine against plain bupivacaine.

III. MATERIALS AND METHODS

Patients posted for elective lower abdominal surgeries among paediatric age group from 6 months to 6 years at Kurnool Medical College , Kurnool of which surgeries were confined to the department of paediatric surgery.

A. Inclusion criteria

- ASA grade I and II.
- Patients belonging to age of 6 months – 6 years.
- Weight from above 5 kgs to 20 kgs
- Informed written consent from parents.
- Paediatric patients undergoing elective sub-umbilical surgeries .

B. Exclusion criteria

- Parental refusal for the procedure
- Patients belonging to ASA III & IV having comorbidities like cardiac, respiratory, renal and hepatic dysfunction.
- Infection at the site of caudal block
- Sacral bone abnormalities
- History of developmental delay and neurological diseases
- Bleeding diathesis .

IV. METHODOLOGY

- Pre-anaesthetic assessment of the patient was done with a complete history, physical examination, and routine investigations.
- The surgeries considered under this study were appendicectomies (McBurney's incision), herniotomies, anal fistula excisions, urethroplasties, circumcisions, orchidopexies, cystoscopy related procedures, stomal repairs.

A. PREOPERATIVE FASTING:

- Solid foods were restricted for 6 hours, breast milk for 4 hours and clear fluids for 2 hours before surgery.

B. PREMEDICATION:

- All the children were premedicated with Intravenous midazolam 0.1mg/kg and injection atropine 0.02mg/kg, 30 minutes before induction of anaesthesia.

C. MONITORING:

- pre-induction monitors were instituted. The continuous monitoring of Heart rate (H.R.), Electrocardiogram (ECG), Mean Arterial Pressure (MAP) for children above 1 year of age and Oxygen Saturation
- The intra-operative vitals were documented at 0, 5, 10, 15,30, 45, 60 and 90 mins and varied according to the duration of the surgery.
- The baseline values were recorded and documented.

D. INDUCTION:

- Inhalation induction of anaesthesia was done using oxygen 100% and up-to sevoflurane 8%, and an intravenous line was secured.
- Injection fentanyl 1 µg/kg was given intravenously to blunt the intubation responses and aid the induction and intubation process.

E. AIRWAY MANAGEMENT:

- laryngeal mask airway, or endotracheal tube was used. An appropriate crystalloid infusion was started according to the calculated requirements.

F. MAINTENANCE OF ANAESTHESIA:

- 33% oxygen, 67% nitrous oxide and sevoflurane 2%. Place the patient in the lateral position for the administration of caudal block.

G. ADMINISTRATION OF CAUDAL BLOCK:

- Under strict aseptic conditions, sacral hiatus was identified by running the thumb up from coccyx towards the sacrum.
- Following the identification of the sacral hiatus, a 22 G or 23 G hypodermic needle was inserted with its bevel facing anteriorly at an angle of 60-70° to the skin till the sacrococcygeal membrane was pierced, when a distinct "pop" was felt.
- The needle is further advanced to hit the posterior surface of the anterior sacral wall. The needle was then lowered to an angle of 20° and advanced 2-3 mm so that the entire bevel was within the caudal space.
- GROUP C: Children received 1 ml/kg of 0.125% bupivacaine in the caudal epidural space.
- GROUP D: Children received 1 ml/kg of 0.125% bupivacaine with 0.1 mg/kg dexamethasone in the caudal epidural space.
- A lax anal sphincter can predict the effectiveness of analgesia after caudal blockade .
- After extubation the pain score was assessed using Face, Legs, Activity, Cry, Consolability (FLACC) scale at intervals of 0, 1, 2, 3, 4, 8, 12,16, 20, 24 hours.
- Patients were shifted to the ward after observation in the post-anaesthesia care unit for 3hours up to 24 hours.
- Postoperative analgesic efficacy was assessed by using the paediatric observational FLACC pain scale with its 0–10 score range, each child's pain intensity was assessed upon arrival and then every hourly till the time of discharge from the PACU.
- FLACC score 0 = no pain 1-3 = mild pain 4-7 = moderate pain 8-10 = severe pain If the FLACC pain scale score was noted at any time to be 3 or more, it suggested as moderate pain, paracetamol suppository 30mg/kg rectally or oral paracetamol 15 mg/kg was given as rescue analgesia.
- The duration of action of adequate caudal analgesia was defined as the time interval from the administration of caudal block to the first requirement of supplementary analgesia and noted accordingly.

Category	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to; distractable	Difficult to console

Each of the five categories is scored from 0 – 2, resulting in total range of 0 – 10. FLACC = Face, Leg, Activity, Cry, Consolability

Table 1: FLACC Scoring

V. OBSERVATIONS AND RESULTS

- A total number of 60 children in the age group of 6 months - 6 years, belonging to ASA physical status I and II were enrolled in this study. They were divided into two groups of 30 each by random allocation.

➢ *CHANGES IN HEART RATE:*

- Baseline heart rate was 102.8±10.8 per minute in group C and 104.1 ± 10 per minute in group D; the difference is not statistically significant, and it has a pvalue of 0.622
- After induction, at 5minute, heart rate was 102.4±12.2 per minute in group C and 99.6 ± 18.3 per minute in group D. The difference between the changes in heart rate is statistically insignificant.
- After 15 minutes of induction, the heart rate was 100.8± 12.7 per minute in group C and 100.8 ± 5.2 per minute in group D, the difference is statistically not significant
- At 60 minutes there was a reduction in heart rate in both the groups 100±00 per minute in group C and 98.0 ±11.0 per minute in group D.

Parameters	Time	Intervention (N=60)				p-value
		Group C(Bupivacaine) (N=30)		Group D (Bupivacaine with Dexamethasone) (N=30)		
		Mean	SD	Mean	SD	
Heart Rate	0	102.8	10.8	104.1	10.0	0.622
	5	102.4	12.2	99.6	18.3	0.484
	10	101.3	12.4	101.9	6.2	0.804
	15	100.8	12.7	100.8	5.2	0.989
	30	100.6	13.2	100.5	6.1	0.977
	45	101.0	12.0	100.0	8.0	0.864
	60	100.0	14.0	98.0	11.0	0.821
	90					

Table 2: Changes in Heart Rate (beats per min)

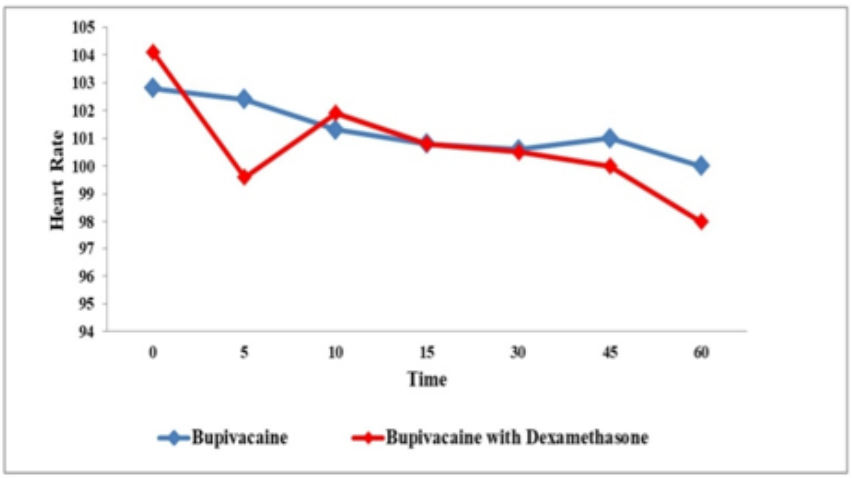

Chart 1: Changes in Heart Rate

➢ *CHANGES IN MEAN ARTERIAL PRESSURE :*

- The baseline mean arterial pressure in group C was 65.4 ± 4.9 mm Hg, whereas, in group D, it was 65.8±4.8mm Hg, which is statistically not significant.
- MAP gradually decreased to 63.8 ±4.7 mm hg at 10 minutes in group C, whereas in group D, it gradually decreased to 62.2 ± 4.5 mm hg.

Parameters	Time	Intervention (N=60)				p-value
		Group C(Bupivacaine) (N=30)		Group D(Bupivacaine with Dexamethasone) (N=30)		
		Mean	SD	Mean	SD	
MAP	0	65.4	4.9	65.8	4.8	0.759
	5	64.5	4.3	63.9	4.5	0.651
	10	63.8	4.7	62.2	4.5	0.222
	15	64.4	4.1	62.3	4.9	0.118
	30	64.6	4.4	61.5	4.8	<0.031
	45	64.9	4.1	62.9	5.8	0.345
	60	63.1	4.1	60.0	5.3	0.337
	90					

Table 3: Changes in Mean Arterial Pressure (mm Hg)

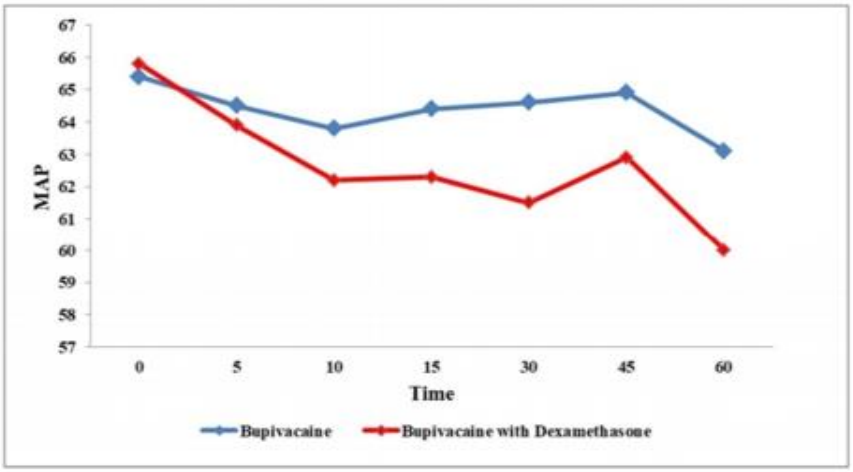

Chart 2: CHANGES IN MEAN ARTERIAL PRESSURE (mm Hg)

➢ *CHANGES IN OXYGEN SATURATION :*

- The baseline oxygen saturation (SpO2) was 98.9 ± 0.9 % in group C. In group D, the baseline oxygen saturation (SpO2) was 98.5±1.1%.
- There was no significant difference between the groups. At 5, 15 and 30 minutes SpO2 values were 98.8 % ± 0.8, 98.3% ± 10 and 98.7% ± 1.0 respectively in group C and 99.0% ± 0.8, 99.0% ±0.7and 98.9% ±0.8 respectively in group D.
- The differences were statistically insignificant except at 15 mins. There were no desaturation events at any time interval .

Parameters	Time	Intervention (N=60)				p-value
		Group C (Bupivacaine) (N=30)		Group D (Bupivacaine with Dexamethasone) (N=30)		
		Mean	SD	Mean	SD	
SPO2	0	98.9	0.9	98.5	1.1	0.175
	5	98.8	0.8	99.0	0.8	0.280
	10	98.7	0.9	99.0	0.8	0.131
	15	98.3	1.0	99.0	0.7	0.002
	30	98.7	1.0	98.9	0.8	0.336
	45	98.8	0.8	98.6	0.7	0.478
	60	98.8	0.8	98.6	0.5	0.679
	90					

Table 4: Changes in Spo_2

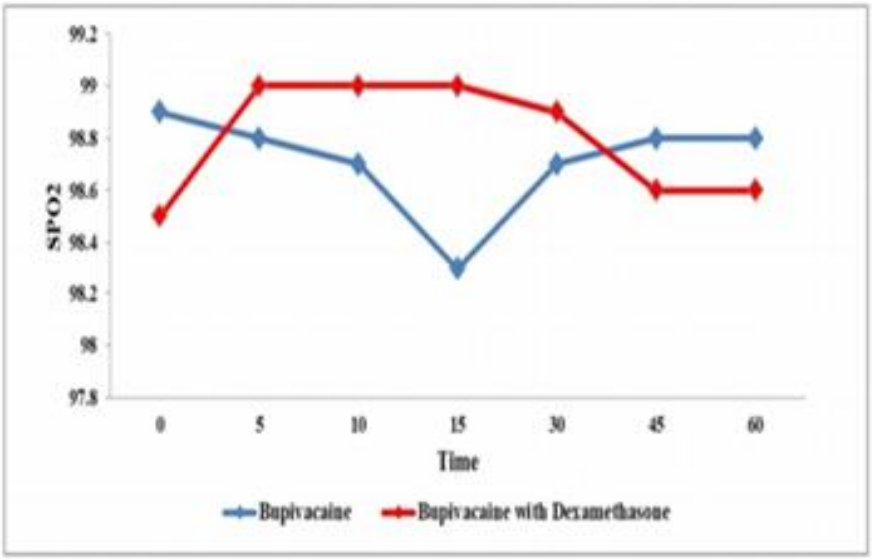

Chart 3: Changes in Spo2 (%)

➢ *CHANGES IN PAIN SCORES*

- The Paediatric observational FLACC Pain Score was below 3 at the end of the first and second hour in both the groups and did not require any analgesia.
- At the end of the third and fourth hour,5(16.67%) and 11(36.6%) of the patients in group C had a pain score of ≥ 3 respectively and required rescue analgesia whereas none of the patients had a score of ≥ 3 in group D.
- The difference is statistically highly significant. The pain score was ≥ 3 in 4(13.3%) of patients in group C and 10(33.3%) in group D by the end of the eighth hour. The difference is statistically highly significant.
- At the end of 12th, group C had 18(60%) patients with a pain score of ≥ 3 while group D had 5 (16.67%) patients with similar pain score. The difference is statistically insignificant.
- At the end of 16th-hour group C had 5(16.67%) patients with a pain score of ≥ 3 while group D had 4(13.33%) patients with similar pain score. The difference is statistically significant.
- At the end of 24th hour, group C had 14(46.67%) patients with a pain score of ≥ 3 and group D had 6(20%) with similar pain score respectively, the difference being statistically insignificant.

Time	Mean Ranks		p-value
	Group C (Bupivacaine)	Group D (Bupivacaine with dexamethasone)	
0	30.50	30.50	1.000
1	33.00	28.00	0.021
2	43.00	18.00	<0.001
3	43.13	17.87	<0.001
4	39.25	21.75	<0.001
8	26.15	34.85	0.046
12	34.08	26.92	0.101
16	26.37	34.63	0.050
20	27.92	33.08	0.236
24	33.65	27.35	0.145

Table 5: Changes in the the Pain Score

➢ *DURATION OF POSTOPERATIVE ANALGESIA :*

- The total duration of postoperative analgesia in group C was 281.2 ± 51.2 minutes with a range of 190 – 405 minutes, while in group D, it was 657.7 ± 150.0 minutes with a range of 380 – 860 minutes.

Variables	Intervention (N=60)		p-value
	Group C (Bupivacaine) (N=30)	Group D (Bupivacaine with Dexamethasone) (N=30)	
	Mean (SD)	Mean (SD)	
Duration of Analgesia	281.2 (51.2)	657.7 (150.0)	<0.001
Range min	190-405	380-860	

Table 6: Duration of Analgesia

VI. CONCLUSION

- Addition of dexamethasone to bupivacaine in caudal anaesthesia significantly prolongs the duration of postoperative analgesia to as much as around 12 to hours and reduces the need for rescue analgesia on the first postoperative day (upto24 hours)
- Dexamethasone, in combination with bupivacaine administered by a caudal epidural route along with general anaesthesia before the commencement of surgeries, reduces the requirement for inhalational agents, relaxants and systemic analgesics during the operative period.
- Addition of dexamethasone to bupivacaine in a caudal epidural doesn't compromise the hemodynamics or recovery from general anaesthesia at the end of the surgery.
- Dexamethasone, as an adjuvant to bupivacaine also reduces the incidence of nausea and vomiting in the immediate recovery period.

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