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Perioperative analgesic management in patients with bladder exstrophy: A clinical study

Monika[1], Prakriti[2], Mohit Jain[3], Kiranpreet Kaur[4], Karishma Dhankhar[5], Sahil Turkia[6]

[1,2]Senior Resident, [4]Consultant, [5,6]Resident, Department of Anesthesiology, PGIMS, Rohtak, Haryana, India, [3]Consultant, Department of Anesthesiology, Maharishi Markandeshwar Medical College and Hospital, Solan, Himachal Pradesh, India

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ABSTRACT

Background: Bladder exstrophy is a complex, rare congenital malformation with an incidence of 3.3 cases in every 100000 live births and is slightly more common in males. Primary surgical repair requires many hours of surgery with fluid and blood loss. Because of wide fluctuations in hemodynamics, a longer duration of surgery, smaller age, risk of hypothermia and post-operative intensive care may be required. We evaluated the use of continuous caudal epidural infusion of bupivacaine and fentanyl under general anesthesia for urinary bladder exstrophy-epispadias surgery in children. **Aims and Objectives:** Aim of the study was to evaluate the postoperative analgesia in patients undergoing surgery for bladder exstrophy. The primary objective was to assess the postoperative pain using FLACC scale and sedation score after successful caudal administration. Secondary objective was to assess the hemodynamic changes after caudal administration. **Materials and Methods:** A total of 13 patients aged between 9months and 13 years of either sex, weighing between 5kg to 30kg, belonging to ASA grade II to IV, underwent surgery for epispadias–exstrophy complex. Initial bolus 0.75ml/kg of 0.25% bupivacaine with fentanyl 1ug/kg was given through epidural. Postoperative analgesia was maintained by continuous infusion of 0.0625% bupivacaine @0.1ml/kg/hr in young children and 0.125% bupivacaine with fentanyl 1ug/ml in older children for 4-5 days with the help of ON-Q pump or infusion pump. Baseline hemodynamic parameters including MAP, heart rate and SpO2 was recorded at various time intervals. Postoperative pain was assessed using face, legs, activity, cry and consolability (FLACC) pain scale and sedation score was assessed by using ramsay sedation score. **Results:** There was a statistically significant decrease in mean pulse rate in the study group from baseline to thirty minutes after reversal ($p<0.001$). Similar observation was made for mean arterial pressure which also showed statistically significant decrease from baseline to thirty minutes after reversal ($p<0.001$). No change was observed in SpO2 from baseline to any other follow-up interval. **Conclusion:** Perioperative anesthetic and analgesic management of the bladder exstrophy patient can improve the success rate. Epidural bupivacaine with or without fentanyl infusions for short duration can provide safe analgesia.

Key words: Analgesia; Bladder exstrophy; Caudal epidural catheter; Bupivacaine; Fentanyl

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INTRODUCTION

Bladder exstrophy is a complex, rare congenital malformation with an incidence of 3.3 cases in every 1,00,000 live births and is slightly more common in males (2.3/1 male-to-female ratio).[1] Multiple surgical procedures are usually necessary during the initial years of life. Primary surgical repair requires many hours of surgery with fluid and blood loss. Because of wide fluctuations in hemodynamics, a longer duration of surgery, smaller age, risk of hypothermia, and post-operative intensive care may be required. Appropriate patient and pelvic immobilization, sedation, and pain management are

Address for Correspondence:
Dr. Kiranpreet Kaur, Consultant, Department of Anesthesiology, PGIMS, Rohtak, Haryana, India. **Mobile:** +91-9671436493.
E-mail: kiranpreet72@rediffmail.com

essential to hasten surgical outcomes. Caudal epidural block is a commonly used technique for surgical anesthesia along with profound intra and post-operative analgesia for a longer duration without suppressing the respiratory drive.[2,3] It reduces the intra-operative requirements of opioids and inhalational anesthetic agents. We evaluated the use of continuous caudal epidural infusion of bupivacaine and fentanyl under general anesthesia for urinary bladder exstrophy–epispadias surgery in children. The purpose of our study was to highlight the role of the caudal epidural technique in children with bladder exstrophy for better outcomes as the literature was scarce, potentially due to the rarity of the disorder.

Aims and objectives

Aim of the study was to evaluate the postoperative analgesia in patients undergoing surgery for bladder exstrophy. The primary objective was to assess the postoperative pain using FLACC scale and sedation score after successful caudal administration. Secondary objective was to assess the hemodynamic changes after caudal administration.

MATERIALS AND METHODS

A retrospective study was conducted on 13 patients aged between 9 months and 13 years of either sex, weighing between 5 and 30 kg, belonging to ASA grade II to IV, underwent surgery for epispadias–exstrophy complex under combined general and epidural anesthetic techniques.

Written informed consent was taken from the parents of all the patients for the study. Pre-operative evaluation of all patients was performed. A detailed clinical history, general physical examination, and systemic examination were performed. All routine baseline investigations along with 2D echocardiography were performed. All the patients received epidural anesthesia after receiving general anesthesia. Initial bolus of 0.75 mL/kg^{-1} of 0.25% bupivacaine with fentanyl 1 μg/kg was injected through epidural. Post-operative analgesia was maintained with continuous infusion of 0.0625% bupivacaine at 0.1 mL/kg/h in young children and 0.125% bupivacaine with fentanyl 1 μg/mL in older children for 4–5 days with the help of ON-Q pump or infusion pump. Baseline hemodynamic parameters including mean arterial pressure (MAP), heart rate, and SpO_2 was recorded and thereafter measurement was done following induction, after epidural administration, and subsequently after 5, 10, 15, 30, 60, and 120 min, and finally at the end of the surgery and 30 min after giving reversal. Peri-operative blood loss was also monitored. Blood transfusion (4 mL/kg) as and when required was taken into note.

Post-operative pain was assessed using the face, legs, activity, cry, and consolability (FLACC) pain scale (Table 1), and the sedation score was assessed using Ramsay sedation score (Table 2).[4] The surgical procedures done performed included primary bladder closure, anterior abdominal wall closure, pelvic osteotomy, ureteric re-implantation, bladder neck repair, epispadias repair, and vaginal reconstruction.

Statistical analysis

Data were entered into MS Excel and analyzed using SPSS version 20.0. Continuous parametric data were reported as means and standard deviation while non-parametric data were reported as median. Categorical data were reported in percentages. Comparison of categorical data between two or more groups was done using Chi-square test. Comparison of continuous data between two groups was done using independent t-test and more than two groups were done using one-way analysis of variance (ANOVA). Comparison of continuous variable across time intervals was done using paired t-test for a single interval while for multiple intervals was done using repeated measures ANOVA. $P<0.05$ was considered to be statistically significant.

RESULTS

Thirteen patients were analyzed for various parameters. Age, sex, and weight distribution in the study are shown in Table 3. Demographic profile in the study patients was found to be non-significant. More than 60% of the cases

Table 1: FLACC scale

Categories	Scoring 0	Scoring 1	Scoring 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, a normal position moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake/asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Relaxed	Reassured by occasional touching hugging or being talked to, distractable	Difficulty to console or comfort

FLACC: Face, legs, activity, cry, and consolability

Table 2: Ramsay sedation scale

Score	Definition
1	Anxious, agitated, or restless
2	Co-operative, oriented, and tranquil
3	Responds to commands
4	Asleep but brisk response to light
5	Asleep sluggish response to light
6	No response

Table 3: Sociodemographic profile of the study

Age of the patient (years)	N (Number of patients)
<1	1 (7.69)
1–2	5 (38.46)
2–5	3 (23.07)
More than 5	4 (30.76)
Sex of the patient	
Male	10 (76.92)
Female	3 (23.07)
Weight of the patient (kg)	
<10	5 (38.46)
10–<20	5 (38.46)
20 or more	3 (23.07)

Table 4: Distribution of cases according to an analgesic drug used (n=13)

Bupivacaine administration	Number of cases (%)
Bupivacaine infusion	5 (38.46)
Bupivacaine with Fentanyl	8 (61.53)

Table 5: Distribution of cases according to duration of surgery (n=13)

Duration of surgery	Number of cases (%)
5 h or less	2 (15.38)
6–8 h	6 (46.15)
9 h or more	5 (38.46)

were administered bupivacaine with fentanyl while five cases were administered only bupivacaine (Table 4). All the cases underwent a procedure that lasted more than 6 h except two cases (Table 5). Total 11 patients required blood transfusion. There was a statistical significant decrease in mean pulse rate in the study group from baseline to 30 min after reversal (P<0.001) as shown in Figure 1. The statistical significant decrease in MAP was also noted from baseline to 30 min after reversal (P<0.001) (Figure 2). No change in SpO_2 was observed from baseline to any other follow-up interval. A statistical significant increase in the median FLACC score was observed from baseline to 120 h from zero to six for the study group (P<0.001) as shown in Figures 3 and 4.

DISCUSSION

The fundamental objectives of bladder exstrophy correction are bladder closure, renal function preservation, adequate urinary continence, and adequate external genitalia cosmesis. Bladder exstrophy repairs imply correcting the genitourinary malformation and closing and stabilizing the pelvic girdle with external fixation and traction.[5-7]

Thirteen patients were operated for bladder exstrophy/epispadias under general anesthesia along with epidural analgesia. We employed a multidisciplinary strategy to

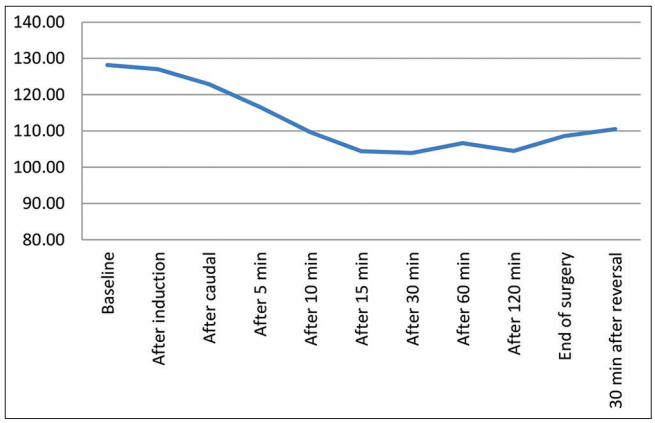

Figure 1: Changes in pulse rate across the follow-up

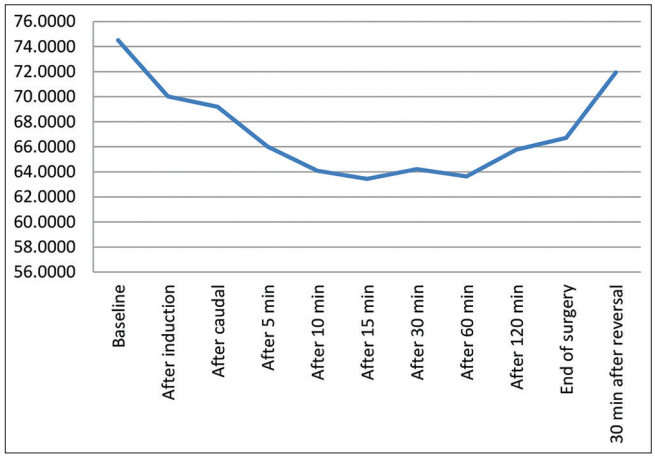

Figure 2: Changes in mean arterial pressure across the follow-up

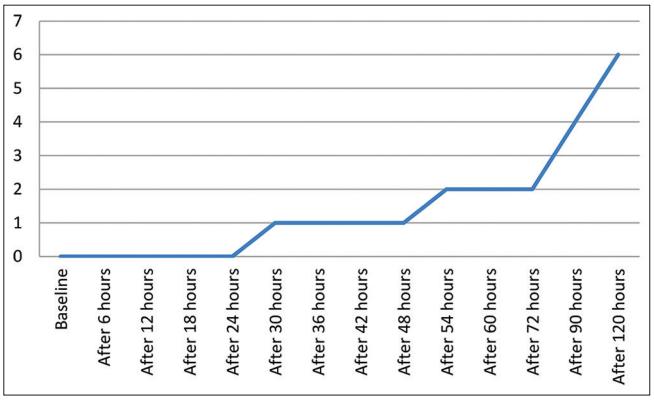

Figure 3: Changes in the face, legs, activity, cry, and consolability score for the study group

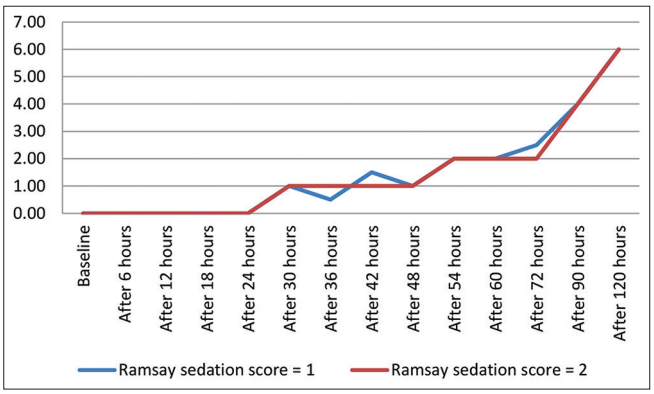

Figure 4: Comparison of face, legs, activity, cry, and consolability score with Ramsay sedation score

address these patients. It entails the collaboration of an anesthesiologist, surgeon, nursing staff, intensive care unit personnel, and parents. A discussion with the surgeon was held to determine the approximate time of the surgery, blood loss, and the formation of an anesthesia strategy.[8]

Goals of anesthesia management include proper history and thorough physical examination. Prolonged anesthesia time requires eternal vigilance. Avoiding hypoxia, hypercarbia, hypothermia, hypovolemia, hypervolemia, and the lighter plane of anesthesia should be our anesthetic goals. Warm blankets can be used to avoid hypothermia. Proper intra- and post-operative pain relief, adequate fluid, and blood replacement should be provided to avoid hemodynamic instability. Prevention of post-operative catheter site infection and change of dressing every day avoid last by avoiding high doses.

Caudal catheter was placed in ten patients. One patient had kyphoscoliosis for which local site ultrasonography was done, followed that lumbar epidural placement was done. The use of caudal catheters allows the administration of local anesthetics with adequate pain control throughout peri-operative period and also in post-operative period.[6] Caudal analgesia decreases the requirement of intravenous opioids and its related side effects such as respiratory depression, gastrointestinal disturbances, urinary retention, post-operative nausea, and vomiting.[3] Smaller age and weight of patients in the study have an effect on the risk of toxicity from epidural local anesthetics, and hence, dose should be calculated as per the body weight. We used an initial bolus of 0.75 mL/kg, of 0.25% bupivacaine with fentanyl 1 μg/kg followed by continuous infusion of 0.0625% bupivacaine at 0.1 mL/kg/h in young children and 0.125% bupivacaine with fentanyl 1 μg/mL in older children for 4–5 days. The risk of infection is also significantly increased with caudal catheters because of proximity of the insertion site to the perineum. To avoid the risk of infection, proper sterile technique with a transparent Tegaderm was used. Epidural dressing was checked daily for any local site infection and changed under sterile conditions. Tunneling prolongs catheters in-dwelling time with better analgesic results, less infection, and improved surgical outcome. We kept the caudal catheter *in situ* for duration of 72 h, and sterile dressing was applied. Later, the catheter was removed and tip was checked for its intactness. Local site was checked for any redness or infection. None of our patients had any serious systemic and local site infection after caudal analgesia.[3,6] Engineer and Solanki, also showed similar observations using epidural bupivacaine with or without fentanyl infusions for a short duration.[5]

Combination of opioids along with local anesthetic agents is used to prolong the duration of pain relief. Post-operative analgesia was assessed by the FLACC scale which is moderately reliable for patients aged between 5 and 16 years.[4] SR Engineer et al. found that replacing clonidine in place of epidural fentanyl resulted into comparable analgesia with fewer side effects. Tsui and Charles, showed that ketamine or clonidine to a caudal epidural prolong the duration of block.[9]

These children usually undergo multiple surgical corrections in their early life or during the follow-up period. Experience of good analgesia and anesthesia will prevent post-surgical stress and allays the anxiety of children as well as parents. As shown in our study, most of the surgery went for more than 6 h. For such a prolonged duration of surgery, epidural analgesia decreases the requirements of intravenous opioids and inhalation anesthetic agents. Parents also have so many doubts and stress regarding the complex surgical and anesthesia exposure. Having a pain free and comfortable child during the post-operative period allays anxiety of parents and educating them about it makes their future exposure a little less cumbersome.

Successful exstrophy bladder closure depends on numerous factors from surgical technique to the details of the child's post-operative care. Hence, we have to formulate a comprehensive plan for bladder drainage, immobilization, pain control, nutrition, antimicrobial prophylaxis, and adequate healing time for better post-operative management.[10]

CONCLUSION

The caudal epidural technique provided opioid free pain relief in children who underwent for surgery for bladder exstrophy resulting in a notable reduction in anxiety in children which in turn facilitated better peri and post-operative outcomes. Pain management allays the anxiety of pediatric patients as well as in parents. Hence, we

found it to be a very cost-effective and safe technique for successful anesthetic and analgesic treatment of bladder exstrophy patients. Peri-operative anesthetic and analgesic management of the bladder exstrophy patient can improve the success rate of surgery along with a pain-free child.

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Authors Contribution:
KK- Concept and design, manuscript preparation, revision of manuscript, and treating physician.

Work attributed to:
Pt. B.D. Sharma University of health sciences, Rohtak, Haryana, India.

Orcid ID:
Dr. Kiranpreet Kaur - https://orcid.org/0000-0003-3592-0061
Mohit Jain - https://orcid.org/0009-0001-0095-9487

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