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Continuous Epidural Catheter for Analgesia-Risk and Incidence of Infection in Pediatric Population Undergoing Surgeries

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ABSTRACT

Medical studies reported a considerable increase in epidural catheter associated infections in recent times especially in low and middle income countries. Estimating the rates of infection at primary level is complex, because of insufficient study material and diverse clinical conditions of large pediatric populations. Therefore an attempt has been made to explore the infection diversity considering available limited pediatric population. Though sample size is concise the results are localized and interpreted based on the real time primary data. A prospective study of 200 patients belongs to pediatric age group (0-18 yrs) undergoing various surgeries during a span of one year is conducted and studied for the incidence of epidural catheter associated infection and risk. A result of more than three days of epidural catheter placement is showing 75% of infection risk. The single incident of infection in suspected patient was with *Staphylococcus aureus*. Therefore, based on the regional primary data, it is evidentially concluded that the risk of epidural catheter associated infection in the given area and point of time is almost negligible. Nevertheless more localized studies with varied pediatric populations and diverse hygienic conditions may help in understanding more about the incidence of the infection.

Keywords: Analgesia, Epidural catheter, *Staphylococcus aureus*, Infection rate

INTRODUCTION

Pain management for the pediatric population undergoing surgeries was a big challenge for clinicians before the 1980s. Revolutions in regional anesthesia along with the use of epidural catheters leading to the continuous indwelling of catheters for anesthesia and analgesia for Intra & post surgery pain management mitigated these challenges in the past five decades. [1] The use of Epidural Catheters (EC's) showed several benefits like reduction in level and duration of pain along with the relatively lesser dosage of analgesic drugs for intra and postoperative management. [2] Additional care needs to be taken for the pediatric age group who undergoes surgeries for pain-free intra and post operative period. With the progress in management protocols in anaesthesiology departments, and the current availability of experts with advanced regional anesthesia training in children and also by better understanding the local anesthetic pharmacology, it is now safe to use ECs. [3,4]

Children are very sensitive and more prone to diseases; ECs are usually placed with aseptic precautions in operation theatres and are indwelling for 2-5 days depending on the postoperative requirement. Though utmost care was taken, it is unfortunate that some cases are prone to infections and cause serious complications. [5] Delay in diagnosis and treatment of EC related infections has serious consequences like epidural space infection, neurologic deficit, and meningitis. [6,7] ECs may also act as a source of infection and in some instances, the infection starts from the site and transfers through the bloodstream.

Some of the culture studies showed infection at the catheter tips and skin swabs irrespective of the number of catheter insertion attempts. [8]

Clinically many retrospectives and prospective studies on EC related infections reported that the incidence was 1-5% after a certain period of indwelling EC. The majority of cases taken up for EC were from obstetric and gynecologic patients over the other disease population, and it is observed that the serious complications like deep tissue infections and epidural abscess were rare. [9] The majority of the cases were observed to be catheter tip culture positive but it is negative for the epidural space infection. [10-12] During the catheter insertion, microorganisms may reach the epidural space via contaminated syringes, catheter tracks and hematogenous spread from other parts of the body. [13] When the suspected catheter tips were sent for culture, prevalent bacteria were *Staphylococcus epidermidis, Staphylococcus aureus* and *Streptococcus specie*. [5,13] Severe infections were seen only in the longer duration of indwelling EC cases. In such instances also deep infection rate was only 0.48%, mortality was reported in deep infection cases. [14]

In some studies, it is observed that regional blockade leading to paraesthesia, increases the risk of postoperative neurologic complications. [15] Benefits of EC include improvement in respiratory function, decrease in perioperative cardiac complications and shorter hospital stays making risks associated minimal in comparison. [16-19] The main objective of the present study is to estimate the incidence of epidural catheter related infections and complications associated with continuous EC infusion.

METHODOLOGY

Study Approvals

The present prospective study was conducted in the tertiary care government hospital from 2018-2019 in pediatric age groups of 0-18 years. Institutional Ethics Committee approval and consent from the parents of the respective children were taken.

Study Design

Pre Anesthetic Checkup (PAC) was done for all the patients as per the standard protocol. An inclusion criterion was all the patients who gave consent, elective surgical procedures and qualified in PAC. Exclusion criteria included patients who have not given consent, did not qualify in PAC, coagulation abnormalities and those with local/systemic infection. Qualified anesthesiologists inserted ECs for all the 200 patients after the induction of anesthesia for intra and postoperative analgesia. A standard procedure was followed with appropriate personal protective equipment, hand hygiene and other aseptic precautions in the operation room. Precautions during the procedure included wearing a cap, sterile gloves, and a mask. All the ECs used were 20-gauge polyamide catheters while placing the EC. Care was taken with 2% chlorhexidine for 15 seconds for disinfection on the skin and the EC insertion site was covered with sterile 3M Tegaderm post insertion. An intraoperative epidural infusion was calculated as per the body weight i.e. 0.25% bupivacaine was administered via 50 ml syringe infusion pumps. Postoperatively 0.0625-0.125% bupivacaine was administered as EC infusion to all the patients based on the bodyweight (The range of infusion rates was between 0.1 and 0.4 ml.kg−1h−1for bupivacaine). Postoperative pain was assessed in infants by Wong-Baker Faces Pain Scale and based on their physiological monitoring of vitals. All the children below 18 years undergoing surgery were monitored for infections and risk.

All the ECs were placed at the lumbar region at L1-L2, L2-L3, L3-L4, and L4-L5 except for one patient where EC was placed at T12-L1 according to surgical requirement. ECs were kept at *in-situ* for 3-5 days depending on the requirement of the patient.

Catheter-associated infections are defined as patients in whom infection of soft tissue (cellulitis and paraspinal musculature) or epidural space was diagnosed and confirmed by blood culture test or culture of purulent discharge from the skin in combination with radiologic imaging. Patients with local dermal erythema and/or induration that resolved spontaneously or with disinfection care were excluded. [5]

Continuous daily monitoring was done by inspection of the insertion site for signs of inflammation and estimating Total leukocyte count (TLC). Neurosurgical consultation was obtained in suspected cases to diagnose epidural and deep tissue infections. If any pus and redness were observed at the insertion site the catheters/Pus /Pus Swabs were sent for microbial culture and sensitivity test. Deep Pus was collected after disinfecting the insertion site to avoid skin contamination Also, catheters were removed immediately if pyrexia developed (±39°C). Samples were transported immediately to the lab. Culture and Sensitivity were done as per standard Microbiology guidelines on Blood agar and MacConkey agar. Pus was inoculated in Primary media and Gram Stain was done. The inoculated media were incubated aerobically at 37C for 48-72 hours. Examination and interpretation were done at 24, 48 and 72 hours of incubation for any growth. Growth in culture positive specimens was identified by automated method up to species level. Antimicrobial susceptibility tests were done by the minimum inhibitory concentration method. Microbiological quality control was done as per standard guidelines.

RESULTS

Total cases of 200 children who underwent surgeries were inserted with EC for Intra and post operative analgesia during the study period. All the data was collected and analyzed using MS Excel and SPSS software as per the demographic parameters, the incidence of infection, and the duration of the catheter. Children who underwent surgeries during one year were categorized as per the WHO defined age groups and analyzed (Figure 1). Among all the enrolled patients 45% of them were infants (1-2yrs), 32.5% of them were young children (2-6yrs), and the least number of patients were of neonate group (0-30 days).

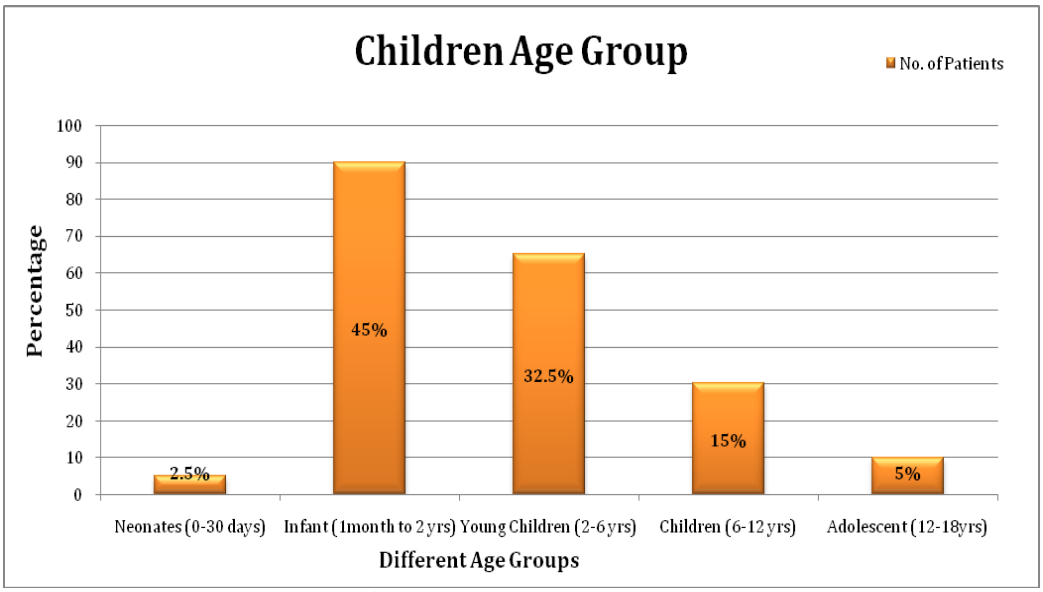

Figure 1: Percentage of age groups underwent surgery during one year period.

It is observed that 77% of children who underwent for procedure were males and 23% were female (Figure 2).

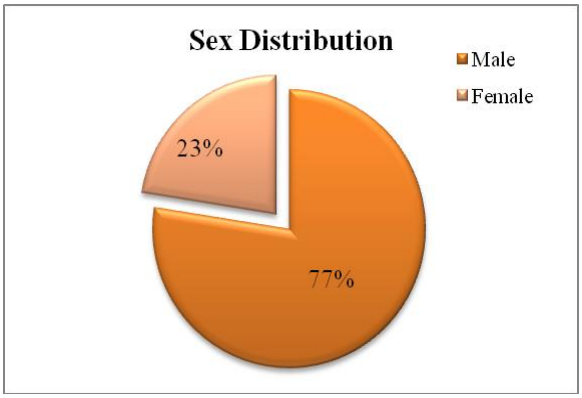

Figure 2: Graphical representation of the sex distribution of surgeries.

The majority of surgeries i.e. 47.5% (95) were Urethroplasty, followed by Ureteric reimplantation 12.5% (25) and Pyeloplasty was done in 10% (20) patients. Infection was detected in one percent of patients who underwent Pyeloplasty. Culture and sensitivity test of pus grew *Staphylococcus aureus* susceptible to methicillin, vancomycin, teicoplanin, and linezolid. Other suspected cases from EC sites of a sacral tumor, decortication, and laparotomy surgeries did not show any growth in pus culture after 48-72 hours of aerobic incubation. Overall the rate of infection was observed to be only one percent.

Table 1: Different surgeries for children during the study period.

Procedure	No. of patients (%)	Infection rate (%)
Expl Lap	2.5	0
Opexy	2.5	0
Urethroplasty	47.5	0
Laparotomy	2.5	0.5
Ureteric Reimplantation	12.5	0
Decortication	2.5	0.5
Ileostomy	2.5	0
Cholecystectomy	5	0
Sacral Tumour	2.5	0.5
Pyeloplasty	10	1
Psarp	5	0
Vaginoplasty	5	0
Ureterostomy	2.5	0

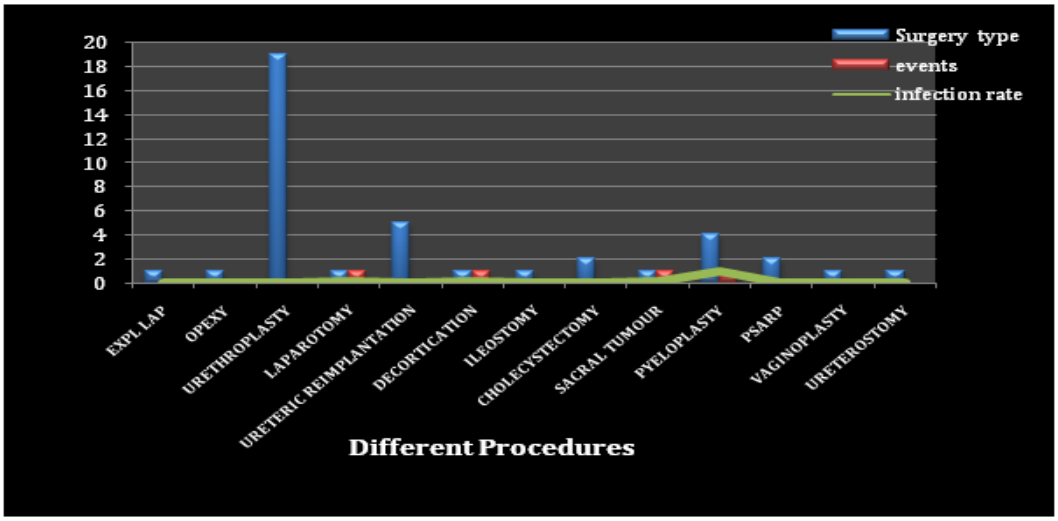

Figure 3: Graphical representation of different procedures and the rate of infection.

The postoperative catheter was used for 1-5 days in all the procedures depending on the requirement. Results in figure 4 show that, the incidence of catheter infection before and after 3 days. Seventy five percent of them were prone to infections after three days and only 25% were suffering from the infection before three days. In all the patients with suspected infection, we did not find any neurological deficits in clinical examination.

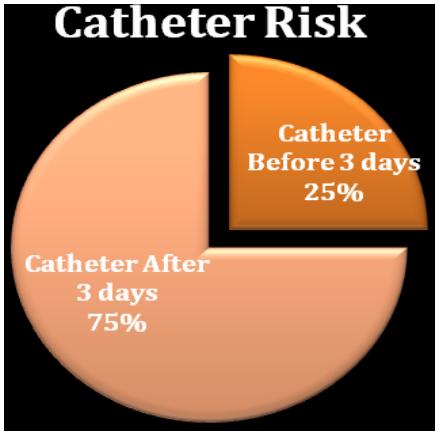

Figure 4: Infection during 5 days of catheter.

DISCUSSION

Epidural catheter analgesia is an effective, beneficial and safe method for children in relieving postoperative pain over the other conventional methods. [20] A follow-up study by Dahlgren N, and Tornebrandt K observed transient neurological injury in 1 to 8: 10,000 epidural technique patients. [21] However, none of the neurological deficits were observed in the present study. A national audit of 10,663 numbers of children by Llewellyn N and Moriarty A. [22] revealed that 1 in 2000 people are facing serious complications following EC insertions. Another study showed approximate severe incidents in 40:10,000 children with three deaths and five neurological complications. [23] When compared to the above discussed studies, in the present prospective study of 200 children there were no neurologic complications and associated morbidity.

It is observed that the EC related infection rate is less in children and is a rare event, but there is an observational increase in the incidence of infection in recent years. [5] This phenomenon could be expected because of the increased epidural analgesia practice in the past two decades. In the present study incidence of infection was less which is considerable 1% when compared to the aforementioned studies. The literature says that the common infected bacteria in ECs are *Staphylococcus aureus and Staphylococcus epidermidis.* [24] Similarly, in the present study, the observed infection in one case was methicillin sensitive *Staphylococcus aureus.* Other suspected infections were culture negative.

The short duration of EC use (≤ 3 days) does not consistently result in superficial or epidural infections in adult or pediatric patients, although the probability of such a risk is likely to increase with longer usage. [10,19,25,26] The rate of infection was significantly higher with longer EC use for the management of chronic pain when compared with postoperative pain. [5] A recent prospective adult trial reported no association between the frequency of colonization or infections after short term 2-4 days EC retention and the use of perioperative antibiotics. [10] In the present study, 75% of infections were seen in EC use which extended to more than 3 days in the patients (Figure 5).

CONCLUSION

The incidence of epidural catheter related infections is low in the present study in spite of the pediatric age group population. It can be concluded that proper care, early diagnosis, and aseptic conditions will further reduce the infections. Continuous monitoring for infections and the timely antibiotic course shall help to recover faster and help to save from the severity of the disease. As the duration of the catheter in situ increases the incidence of infection will increase hence daily assessment has to be done for rapid removal of EC.

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