

LOCAL ANESTHESIA FOR MINOR SURGICAL PROCEDURES IN CHILDREN; A CROSS-SECTIONAL STUDY AT KHYBER TEACHING HOSPITAL PESHAWAR.

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ABSTRACT

BACKGROUND: One of the most rapidly developing and intriguing areas of pediatric anesthesia nowadays is pediatric regional anesthesia and its multifaceted benefits. Despite advancements such as improved postoperative pain relief and facilitating early discharge after surgery, the article highlights the underutilization of these techniques, emphasizing the need for broader adoption in clinical practice.

OBJECTIVE: To determine the success rate of local anesthesia with lidocaine and define safe range of age in children for local anesthesia.

METHODOLOGY: This cross-sectional study was carried out in the Pediatric Surgery unit, Medical Teaching Institute, Khyber Teaching Hospital, Peshawar from June'22 to October'23. Nonrandom consecutive sampling was done and patients aged 0-15 years, both genders and both from in-patient and outpatient undergoing minor surgical procedures were included. Patients were stratified based on gender and procedure type and post-stratification chi-square test was used for comparison.

RESULTS: The mean age of the patients was 45.88 months (SD \pm 40.28) with 64% males and 36% females. The mean operative time of all procedures was 14.07 minutes (SD \pm 10.85) and the mean FLACC (facial expression, leg movement, bodily activity, cry or verbalization, and consolability) score of the patients was 3.51 with SD of \pm 3.12. The complication rate was 4%, and 5% of patients were converted to General Anesthesia.

CONCLUSION; The study evaluated different age groups and concluded that local anesthesia is effective and safe in children less than 2 and greater than 8 years of age.

KEYWORDS: Paediatric regional anaesthesia, peripheral blocks, mean operative time, FLACC

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INTRODUCTION

Various methods of local anesthesia (LA) delivery are known including topical application, subcutaneous infiltration, ring blocks and nerve blocks.¹ LA is being used in children since long as reported by Pryor et al in 1980 where they concluded from their study that local application of lidocaine with adrenalin was superior to wound infiltration in terms of safety and acceptability by the patient. A study reported that simple local application of anesthetic may not be effective and infiltration is not received due to pain and fear of needles, they delivered local application of anesthetics with iontophoresis and concluded that lidocaine application with iontophoresis is a safe and effective mode of local anesthesia delivery.² With the advent of virtual reality, a recent randomized control trial showed that the use of virtual reality can considerably reduce time to complete plastic surgery procedures in awake patients with no to little effect on the pain and anxiety reduction.³

The use of conscious sedation with LA has been practiced in order to reduce anxiety and agitation of the children. Surgeons have administered conscious sedation with LA for minor procedures

was reported to be safe and effective in children with insignificant number of the patients developing hypoxia, hypotension with no major cardiac or respiration complications.⁴ Intracorporeal spongiosum injection of local anesthetic for procedures on the glans and anterior urethra has favorable outcome in terms of pain control.⁵ Seizures, dysrhythmias, cardiovascular collapse, and transient neuropathic symptoms have been reported in children and infants after LA.⁶ The complications of local anesthetics in children is greater as compared to adults owing to the decreased metabolism, elimination and low level of acid alpha1 glycoprotein. The reported incidence of local anesthetic systemic complication (LAST) is 0.03% to 0.27% with seizures (51%) being the most common and a mortality of 4.3%.⁷

French-Language Society of Pediatric Anesthesiologists reported their experience in nerve blocks under general anesthesia (GA) and found that complication rate was significantly higher in patients aged less than 6 months as compared to those greater than 6 months old.⁸ The overall perioperative mortality in children after GA is high (13.4 per 10,000 anesthetics).⁹ The

children undergoing GA are developmentally high risk and have poor reading skills.¹⁰

Local anesthesia for minor surgical procedures seems to be a reasonable option owing to the high morbidity and mortality of GA in children. Apart from pain control during a surgical procedure, reduction of fear, anxiety and agitation in children are important for better outcome in terms of completion of the procedure in the same setting, practice of good surgical techniques, no additional energy requirement from surgeon's perspective and early recovery of the patient with minimal complications. Age is an important predictor of local anesthesia success as described in literature.¹¹ Our study will determine the success rate of LA and will define safe range of age in children for local anesthesia.

METHODOLOGY:

This cross sectional study was carried out in Pediatric Surgery unit, Medical Teaching Institute, Khyber Teaching Hospital, Peshawar. Nonrandom consecutive sampling was done. Considering that 11.6% of the patients experience ineffective pain control under LA, a sample of 158 patients was selected keeping 95% confidence limit and 5% margin of error ($n = Z^2 * p(1-p) / e^2$).¹¹ Patients aged 0-15 years, both genders and both from in-patient and outpatient undergoing minor surgical procedures were included. Minor surgical procedures are surgical intervention that does not intervene with body cavity organs and are expected to be completed in less than 30 minutes. Patients with congenital heart disease, known case of epilepsy/seizure disorder, cerebral palsy and peripheral nerve disease were excluded. Retrospectively, charts were reviewed and patients full filling inclusion and exclusion criteria were selected and informed consent was obtained. Data such as age, gender, procedure type, procedure time, immediate complication, the FLACC (face, leg, activity, cry, consolability) pain scale score, conversion to GA and use of additional agent/sedative was recorded in a proforma. Lidocaine 0.5% 3mg/kg was used in all patients. Age was reported in months and procedure time in minutes. Patients were

categorized into 3 age groups; 1-24 months (Group 1), 25-96 months (group 2) and greater than 96 months (group 3). Quantitative data such as age and procedure time was reported as mean and standard deviation (SD). The mean operative time (MOT) was calculated using stopwatch from incision till dressing the wound. The FLACC pain scale score was calculated during the procedure. The MOT and FLACC score of each age group was compared using one way ANOVA. Qualitative data such as procedure type, complications, and use of additional sedative was described as frequency and percentages. Patients were stratified based on gender and procedure type and post stratification chi square test was used for comparison with 5% level of significance.

The ethical approval No. 80/DME/KMC was taken from IRB Khyber Medical College/Khyber Teaching Hospital on 15/2/2023.

RESULTS

The mean age of the patients was 45.88 months (SD ±40.28) with 64% males and 36% females. Frequency of different age groups is shown in the Table 1. Eight different surgical conditions operated under LA were evaluated including circumcision, meatotomy, incision and drainage, repair of incised/lacerated wound, superficial skin/mass biopsy, dermoid/sebaceous cyst excision, chest intubation and Umbilical granuloma/polyp excision. The frequency of different surgical procedures carried out under LA is shown in pie chart. The MOT of all procedures was 14.07 minutes (SD ±10.85) and the MOT of age groups is shown in Table 1. Additional measures in the form of intravenous analgesia or sedation was required in 31% of the patients; 3% in group 1, 19% in group 2, and 9% in group 3. Only 4% percent of the patients showed complications, 2% had seizures, 1% had transient bradycardia and 1% had transient loss of consciousness. The conversion rate to GA was 5% and a greater proportion of which were in the age group 2. Frequency of different surgical procedures performed is shown in Figure 2.

Table 1. Frequency of different age groups, its MOT and frequency of additional measures required.

Age group (in months)	Percent	MOT (in minutes)	Additional measures among 31% patients	
Group 1	1-24	45.0%	12.35	20%
Group 2	25-96	37.0%	20.89	51.35%
Group 3	>96	18.0%	10.72	16%

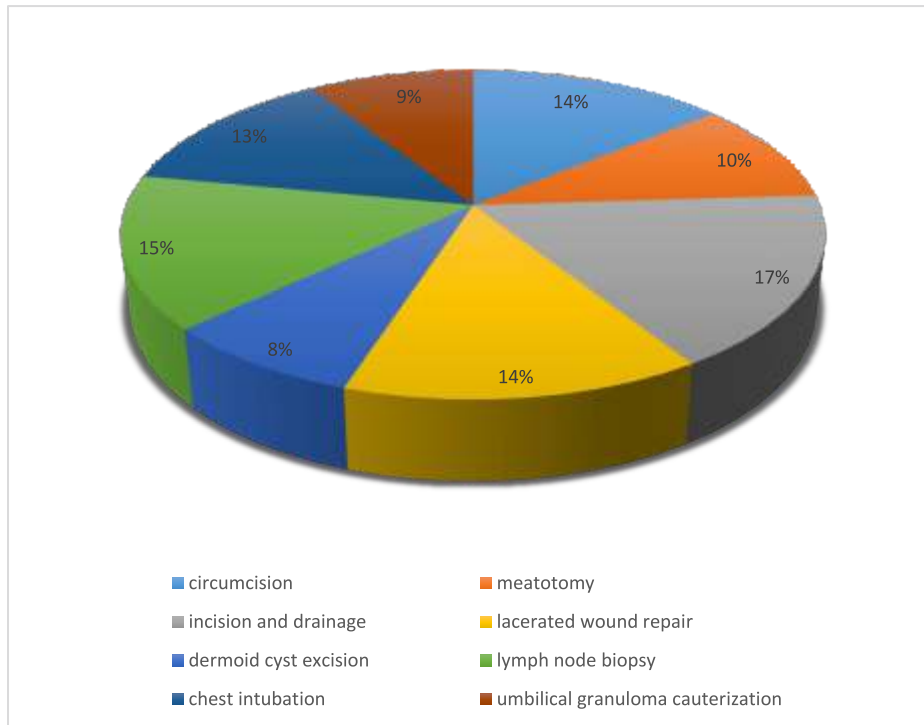


Figure 1: Showing frequency of different surgical procedures performed under LA.

The requirement for additional measures was significantly higher in patients in the age group 25-96 months (group 2) as compared to other age groups ($\chi^2 = 11.43, p < 0.05$). Using one way ANOVA, the MOT of different age groups was compared. The MOT of the patients was significantly different among different age groups ($F_{2,97} = 8.56, p < 0.05$). Post hoc Student-Newman-Keuls (S-N-K) test was used assuming homogeneity of variance and it showed significantly higher MOT for age group 2 as compared to others ($\mu = 20.89, SD \pm 3.50, p < 0.05$). The minor surgical procedures can be performed rapidly in patients under 2 years or greater than 8 years of age. The mean FLACC score of the patients was 3.51 with SD of ± 3.12 . The means FLACC score of each age group was compared with one way ANOVA and a significant difference was found ($F_{2,97} = 169.97, p < 0.05$). The post hoc analysis assuming homogeneity of variance and using S-N-K test, the age group 2 had a significantly higher score as compared to age group 1 and 3 ($\mu = 7.08, SD \pm 1.68$). MOT and Mean FLACC score of different minor surgical procedures is shown in Table 2.

Table 2: MOT and Mean FLACC score of different minor surgical procedures.

Procedure Type	Mean operative time	Std. Deviation	Mean FLACC Score	Std. Deviation
Circumcision	10.7286	2.18225	1.3571	1.82323
meatotomy	10.5000	2.99073	2.2000	1.81353
Incision & Drainage	17.5294	5.63879	4.8235	3.24491
Lacerated Wound Repair	14.2500	6.69888	3.7143	3.12382
Dermoid cyst Excision	17.1875	6.25607	3.8750	3.39905
Lymph Node Biopsy	18.1333	5.74912	5.2667	2.57645
Chest intubation	23.0385	26.79355	4.6154	3.77577
Umbical Granuloma Cauterization	6.6667	1.58114	.6667	.86603

DISCUSSION

Between 2015 and 2020, randomized clinical trials and national surveys have indicated high diversity in rapid sequence intubation techniques. In between 25% and 75% of patients who were at risk of aspiration, rapid sequence intubation without neuromuscular blockers was initiated. Concerns regarding the potentially serious side effects of neuromuscular blockers, such as allergy, delayed curarization, metabolic disruption, and postoperative breathing difficulties, may help to explain this observation.¹² Intraoperative hypoxemia was more common in patients under general anesthesia (45.2% vs. 29.0%; odds ratio: 2.0 [0.9–4.3], p-value: 0.09).¹³ In a large cohort, reported by Waleed et al, the incidence of perioperative severe critical events after GA in children was found to be 5.2% (95% CI 5.0-5.5).¹⁴ These findings warrant the evaluation of risks Vs. benefit of general anesthesia especially for minor surgical procedures which can be carried out in fairly less time. The problems with children include not only good quality analgesia, but also relieve of anxiety and fear. To address this issue, a number of studies have reported different techniques including the use of virtual reality and hypnosis in addition to LA. Choi et al used cartoon distraction technique coupled with local anesthesia in children for facial lacerated wound repair and found it useful in children 3-6 years of age.¹⁵

The findings that the mean operative time and FLACC scale score of patients between 2-8 years of age in our study are significantly higher with greater requirement of additional measures in the form of IV analgesia or sedation shows that LA is less effective in this age group. These findings are unique as no previous study have been found which have compared the effectiveness of LA in different pediatric age groups. However, one study reported that the audiovisual and transcutaneous nerve stimulation along with LA had better results in terms of analgesia and anxiety in patients 6-8 years of age.¹⁶ The effect observed can be because of the greater requirement of additional measures for being in the age group in which LA is less effective (group 2 of our population). Hazkour and colleagues reviewed 18 patients who underwent facial hemangioma excision and concluded that LA alone was feasible and safe option for patient less than 4 years of age.¹⁷ These findings are consistent with our results, however, the fixed age for opting LA or GA cannot be assured and combining preoperative assessment for anxiety coupled with patient and parents counselling considering the age may greatly help in making a decision to opt for LA. The analgesia provided by local anesthetic lignocaine is better in patients below 2 years and those above 8 years. It is pertinent to mention here that FLACC score was originally adapted for pain evaluation in patients from 2 months to 7 years. A unified pain score does not exist that can be applied across age groups. The FLACC pain scale seems to be a reasonable option in pediatric age group i.e. from birth to 15 years of age.

A prospective cohort study and found that major neonatal surgeries or laparotomy under LA was safer than GA in selected patients with low birth weight being the only independent risk

factor for mortality.¹⁸ A randomized control trial assessed the efficacy and safety of local anesthesia with sedation against general anesthesia with penile block and found no difference in terms of intraoperative pain control and post operative procedural complication and advocated the use of LA instead of GA for meatotomy.¹⁹ A systematic review conducted by Dougall et al found that very few absolute contraindications are found for the use of LA in medically compromised children, however, the available literature was lacking and further studies were suggested.²⁰

The complication rate of LA in our population is comparable to the reports in literature. All the complication were of mild to moderate intensity easily reversed with phentolamine mesylate. Owing to the severe critical events associated with GA, the LA is a safe alternative option in children undergoing minor surgical procedures.²¹

CONCLUSION

Local anesthesia is safe and effective in pediatric patients less 2 or greater than 8 years of age, however a greater additional IV analgesia or sedation may be required in those 2-8 years of age with higher mean operative time for the procedure.

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- A. Conception and Planning of the research
- B. Acquisition of data/participation in designing methodology
- C. Interpretation, analysis and discussion
- D. Review of the manuscript