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Original Article

Clinical Analysis of Emergence Delirium and Post-operative Pain after ENT Surgeries under General Anesthesia in Children in a Tertiary Teaching Hospital

C H Anil Kumar

Assistant Professor, Department of Anesthesiology, Viswabharathi Medical College, R.T. Nagar, Penchikalapadu, Kurnool, Andhra Pradesh, India

Abstract

Background: Post-operative restlessness in children undergoing ENT surgeries under general anesthesia is very common. The post-operative negative behavior in children may be due to emergence delirium (ED) or due to pain and is difficult to differentiate. The management of both these conditions also differs.

Aim of the Study: The aim of the study was to identify clinical variables of ED and pain behavior due to post-operative pain in children undergoing ENT surgeries under general anesthesia.

Materials and Methods: A total of 150 consecutive children undergoing ENT surgeries under general anesthesia were included in the present study. The American Society of Anesthesiology (ASA) I and II grade children were included in the study. Induction was done with sevoflurane (2–5%); propofol (2–7 mg kg^{-1}) and fentanyl (1.5–2 mcg kg^{-1}) administered before tracheal intubation. Anesthesia was maintained using sevoflurane (2–3%), fentanyl was used as required, and paracetamol (15 mg kg^{-1} intravenous [I.V.]) was given intraoperatively. Two anesthetists, who were trained, observed and determined simultaneously and independently each single item of faces, legs, activity, cry, and consolability (FLACC) and pediatric anesthesia ED (PAED) scales every 5 min during the first 20 min after awakening in the operation theater to observation in the post-operative recovery room. Awakening was defined as "spontaneous eyes opening." FLACC scales are routinely used clinically in the hospital's participants.

Observations and Results: A total of 150 children following ENT surgeries under general anesthesia with the ASA status I and II were observed for ED and post-operative pain. 97 children (64.66%, −95% confidential interval [CI] 61–77) showed ED and/or during the 20 min post-awakening period in the recovery room. There were 95/150 (63.33%) male children and 55/150 (36.66%) female children. The mean age was 8.16 ± 2.55 years. 111/150 (74%) children displayed early post-operative negative behavior (e-PONB) with minimum one episode of ED and/or pain during the first 20 min following awakening. Children were more than twice likely demonstrated e-PONB with sevoflurane than with propofol. ED at awakening was seen in 51/111 at the time of awakening (45.94%, 95% CI 41–49); 42/111 (37.83%, 95% CI - 32–39) after 15 min; and 18/111 (16.21%, 95% CI - 14–18) after 20 min. The prevalence of ED seems to decrease with the passage of time during post-operative recovery of children.

Conclusions: The clinical scales PAED and FLACC allowed clear distinction between ED and pain in the early awakening phases after general anesthesia. Children with ED demonstrated "no eye contact" and "no awareness of surroundings." The association of these two characteristics had a high sensitivity to identify ED during the first 20 min after awakening. The combination of "abnormal facial expression," "crying," and "inconsolability" has a high sensitivity and specificity to detect pain in the early post-operative period.

Key words: Awakening, Emergence delirium, ENT diseases, General anesthesia, Pain, Sedation

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INTRODUCTION

The common problem in children undergoing ENT surgeries under general anesthesia is their negative behavior also called as early post-operative negative behavior (e-PONB).[1] Identifying the e-PONB and its management in post-operative recovery room is a challenge to the

Corresponding Author: C H Anil Kumar, Department of Anesthesiology, Viswabharathi Medical College, R.T. Nagar, Penchikalapadu, Kurnool, Andhra Pradesh, India. Phone: +91-9573633853. E-mail: pratibhaadhi@gmail.com

anesthetist despite the availability of multiple assessment tools and treatment options.[2-4] As this condition leads to self-injury of the child or accidental pulling of intravenous (I.V.) catheters, drainages, or dressing by the child which requires extra nursing care, stay of extra time in recovery room. The child also requires supplemental sedatives or analgesic drugs.[5,6] e-PONB dissatisfies the parents/caregivers or onlookers as the child is restless.[7,8] In terms of short- or long-term psychological implications of e-PONB in children are not clear. Children with e-PONB may have a higher risk of developing separation anxiety, apathy, and sleep and eating disorders up to 30 days after surgery.[9-11] Emergence delirium (ED) and post-operative pain are two indistinct clinical terms of e-PONB and present in the early post-operative period following general anesthesia.[12] The children may also have both the clinical conditions of ED and post-operative pain simultaneously.[2,3,13] This leads to unnecessary pharmacological treatment of ED or under or delayed treatment of post-operative pain. There are different tools for the assessment of e-PONB available in the literature; the pediatric anesthesia ED (PAED) scale is the only validated scale to quantify ED, the most commonly used behavioral pain scales during the post-operative period, generate composite scores to characterize ED and pain.[14] It shares some descriptors with the faces, legs, activity, cry, and consolability (FLACC) scale,[15] children's and infants' post-operative pain scale; or children's hospital of eastern Ontario pain scale.[16-18] The clinical need of a simple scale allowing reliable identification of the two major components of e-PONB (ED and pain) during the early post-anesthesia period is the need of the time. In the present context, the study was conducted with an aim to identify clinical variables of ED and behavior due to post-operative pain in children undergoing ENT surgeries under general anesthesia.

Type of Study

This is a prospective cross-sectional analytical study.

Institute of Study

This study was conducted in Viswabharathi Medical College Hospital, RT Nagar, Penchikalapadu, Kurnool, Andhra Pradesh.

Period of Study

The study duration was from December 2014 to November 2016 (2 years).

MATERIALS AND METHODS

A total of 150 consecutive children undergoing ENT surgeries under general anesthesia were included in the present study. An ethical committee clearance from the institution was obtained. An ethical committee cleared consent form was used for the study.

Inclusion Criteria

(1) Children aged between 6 and 12 years were included. (2) Children undergoing elective ENT surgeries were included. (3) Children undergoing surgeries under general anesthesia were included. (4) Children who were not given preanesthetic medication were included. (5) Children of both genders were included. (6) Children with the American Society of Anesthesiology (ASA) Grades I and II only were included in the study.

Exclusion Criteria

(1) Children aged <6 and above 12 years were excluded. (2) Children with intra-operative or post-operative complications were excluded. (3) Children who were given preanesthetic medication were excluded. (4) Children on psychiatric treatment were excluded. (5) Children with nutritional deficiencies were excluded. (6) Children with the ASA grading >III grade were excluded from the study. All the children were assessed preoperatively using the ASA anesthetic grading. Children were induced with sevoflurane (2–5%); propofol (2–7 mg kg^{-1}) and fentanyl (1.5–2 mcg kg^{-1}) administered before tracheal intubation. Anesthesia was maintained using sevoflurane (2–3%), fentanyl was used as required, and paracetamol (15 mg kg^{-1} I.V.) was given intraoperatively. Two anesthetists, who were trained, observed and determined simultaneously and independently each single item of FLACC and PAED scales every 5 min during the first 45 min after awakening in the operation theater to observation in the post-operative recovery room. Awakening was defined as "spontaneous eyes opening." FLACC scales are routinely used clinically in the hospital's participants. No medication (sedatives or analgesics) was given for 20 min after they were shifted to the recovery room. Patients were defined as having ED (if PAED score ≥10), pain (if FLACC score ≥4), both ED and pain (if PAED score ≥10 and FLACC score ≥4), or normal behavior (if PAED score <10 and FLACC score <4). The onset of ED, defined as the first evaluation for each patient with PAED score ≥10, and the onset of pain, defined as the first evaluation with a FLACC score ≥4 were analyzed during the course of observation time. The categories "no eye contact" and "no awareness of surroundings" are included in the PAED scale and are considered as the most important items for ED identification. Each evaluation was analyzed as a single event to characterize ED and pain. All the data were analyzed using standard statistical methods.

OBSERVATIONS AND RESULTS

A total of 150 consecutive children undergoing ENT surgeries under general anesthesia with the ASA status

I and II were observed for ED and post-operative pain. 97 children (64.66%, - 95% confidential interval [CI] 61–77) showed ED and/or during the 20 min post-awakening period in the recovery room. There were 95/150 (63.33%) male children and 55/150 (36.66%) female children with a male to female ratio of 1:1.72. The youngest child was aged 6 years, and the eldest one was 12 years with a mean age of 8.16 ± 2.55 years. Adenotonsillectomy was undertaken in 38/150 (25.33%) children, mastoidectomy with tympanoplasty was done in 25/150 (16.66%) children, adenoidectomy was undertaken in 24/150 (16%) children, adenoidectomy with grommet insertion was done in 20/150 (13.33%) children, functional endoscopic sinus surgery was done in 19/150 (12.66%) children, adenoidectomy with antral lavage was done in 13/150 (08.66%) children, and tongue tie release in 11/150 (07.33%) children and (Table 1). Sevoflurane was used as general anesthesia maintenance in 92/150 (61.33%) and propofol in 68/150 (45.33%) children.

A total of 150 children with the ASA status I and II undergoing ENT surgeries under general anesthesia were observed, and 450 individual evaluations were made in this study (Table 1). 111 children of 150 (74%) with CI 95% and CI 66–79, displayed e-PONB with minimum one episode of ED and/or pain during the first 20 min following awakening. The children who received sevoflurane were 76/111 (68.46%), and 35/111 children (31.53%) received propofol. Children were more than twice likely to have e-PONB with sevoflurane than with propofol. The number of children observed with ED at awakening was 51/111 at the time of awakening (45.94%, 95%, and CI, 41–49); 42/111 (37.83%, 95% CI - 32–39) after 15 min; and 18/111 (16.21%, 95% CI - 14–18) after 20 min. The prevalence of ED seems to decrease with the passage of time during post-operative recovery of children in this study (Table 2). 10/111 (9.0%, 95% CI - 4–10) children were evaluated to have pain at the time of awakening. 21/111 (18.91, 95% CI - 11–18) children had pain at 15 min after awakening, and 39/111 (35.14%, 95% CI - 32–36) children were observed as having pain after 20 min. The number of children with the combination of both ED and pain was observed in 12/111 (10.81%, 95% CI - 8–13) at awakening, 09/111 (8.10%, 95% CI - 17–11) at 15 min, and 6/111 (05.40%, 95% CI - 15–21) at 20 min (Table 2).

Table 1: The demographic data and types of ENT surgeries (*n*=150)

Observation	*n* (%)	*P* value
Male	95 (63.33)	NS
Female	55 (36.66)	NS
Adenotonsillectomy	38 (25.33)	NS
Mastoidectomy and tympanoplasty	25 (16.66)	NS
Adenoidectomy	24 (16)	NS
Adenoidectomy with grommet insertion	20 (13.33)	NS
Adenoidectomy with antral lavage	19 (12.66)	NS
Functional endoscopic sinus surgery	13 (8.66)	NS
Tongue tie release	11 (7.33)	NS

DISCUSSION

The present study was analyzed and found that the behavior scales used were useful in the quantitative description of e-PONB children undergoing general anesthesia during elective ENT procedures. "No eye contact" and "no awareness of surroundings" were distinctive clinical features of ED and help in identifying positively ED episodes in the early post-operative period. Whereas the characteristics of pain behaviors in the study group was found to be more complicated. However, the observation of "abnormal facial expression," "crying," and "inconsolability" demonstrated high sensitivity and specificity to detect pain in young children during the first 15 min after awakening. Review of literature showed the variability in clinical presentations of e-PONB which makes the identification and the management of ED or pain in young children difficult.[2,4] ED is described in the literature as an early self-limiting behavior.[12,18,19] In the present study, ED began almost always at the awakening, resolved within 15 min, and did not recur even without pharmacological treatment. The children complaining of pain as the first behavioral upset after awakening developed ED later. In the present study, 10/111 (9.0%, 95% CI - 4–10) children were evaluated to have pain at the time of awakening. 21/111 (18.91, 95% CI - 11–18) children had pain at 15 min after awakening, and 39/111 (35.14%, 95% CI - 32–36) children were observed as having pain after 20 min. Nearly 45% of children with ED also presented with pain behavior during the early awakening period. Similar studies showed and postulated a cause-effect association between pain and emergence agitation during the early phases of the post-operative

Table 2: The e-PONB scores in the study group children (*n*=150)

Observations	Awakening (%)	15 min (%)	20 min (%)
ED onset PAED score≥10	51 (45.94) 41–49	42 (37.83) 32–39	18 (16.21) 14–18
Pain onset FLACC score≥4	10 (9) 4–10	21 (18.9) 11–19	39 (35.13) 32–36
Combination of ED and pain	12 (10.81) 8–13	9 (8.10) 7–11	6 (5.40) 5–8

e-PONB: Early-post-operative negative behavior

period.[20,21] The present study showed and proved that ED and pain were independent of each other and had a different trend over time. In this study, the children who received sevoflurane were 76/111 (68.46%), and 35/111 children (31.53%) received propofol. Children were more than twice likely to have e-PONB with sevoflurane than with propofol. This finding was consistent with similar studies which concluded that propofol anesthesia was associated with a reduced incidence of ED.[22] The observational scales used in assessing ED and pain in this study are critical in identifying the major components of e-PONB due to the following main reasons: (1) There are no behavioral indices clearly specific to pain or distress or agitation or ED. (2) The same observational variables are used to assess different behaviors. (3) These scales are open to subjectivity in scoring with suboptimal interobserver reliability.[23,24] Our results suggested that ED and pain could be assessed independently using five simple, observational, and dichotomous (true/false) criteria in children after receiving general anesthesia. The observations such as abnormal facial expression and crying are part of most of the observational scales that assess pain. The results of this study confirm the relationship with pain, during the early post-operative period. A similar study also confirms that crying is a nonspecific symptom of ED and could occur equally in other situations of distress, such as pain, hunger, or parental separation.[25] In this study, inconsolability was the most important indicator of pain behavior in children. In this study, the combination of abnormal facial expression, crying, and inconsolability demonstrated high sensitivity and specificity to detect pain behavior but not ED. Only >20% of children with ED also demonstrated these three characteristics. This study applies 2 scales namely PAED and FLACC at a single time point, and hence does not allow the discrimination between ED and pain in approximately 11% of children. This could be explained probably due to a real overlap of the two behaviors ED and pain. The association of no eye contact and no awareness of surroundings in children presenting both pain and ED decreased significantly every 5 min. The number of children with the combination of both ED and pain was observed in 12/111 (10.81%, 95% CI - 8–13) at awakening, 9/111 (08.10%, 95% CI - 17–11) at 15 min, and 6/111 (05.40%, 95% CI - 15–21) at 20 min (Table 2). This suggests that if a child presents an unclear etiology of e-PONB, clinicians should observe the child for a period of 5–15 min. Further study may be required to find whether it is possible that decision time may be reduced further. If e-PONB persists, clinicians should consider pain treatment as the primary option. The limitation of the present study is that it is a small sample and observation duration was only 20 min.

CONCLUSIONS

The two different scales PAED and FLACC scales used for observation of post-operative behavior of children undergoing ENT surgeries under general anesthesia allowed clear distinction between ED and pain in the early awakening phases after general anesthesia. All the children with ED demonstrated "no eye contact" and "no awareness of surroundings." The association of these two characteristics had a high sensitivity to identify ED during the first 20 min after awakening. The combination of "abnormal facial expression," "crying," and "inconsolability" has a high sensitivity and specificity to detect pain in the early post-operative period. In case of an unclear etiology for e-PONB, an observation period of 5 min may be useful to distinguish between ED and pain, potentially allowing the identification of children requiring treatment.

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