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POST OPERATIVE RECOVERY RESTLESSNESS FOLLOWING ENT SURGERIES IN THE PEDIATRIC AGE GROUP - A CLINICAL STUDY OF 246 CHILDREN

Nagula Parusharam¹, Kamreddy Ashok Reddy²

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ABSTRACT: INTRODUCTION: Post-operative restlessness is observed commonly among children following Ear Nose Throat surgeries. This post anesthetic problem is also termed as Emergence Agitation (EA) which interferes with patient's recovery, presenting a challenging task to the anesthetist in terms of assessment and convincing the parents. Many factors play a role singly or in combination in producing EA. EA consist of restlessness, excessive crying and spells of breath holding, head banging and incoherent speech. In this prospective clinical study the incidence of post-operative recovery restlessness EA in children aged between 3 to 12 years, enumeration of the causes, and prediction of EA in Indian population. **MATERIALS AND METHODS:** 246 Children undergoing elective surgeries of Ear Nose and throat are selected and their demographic data, socio-economic back ground and emotional attachment with parents were elicited. Parents of the children were interviewed prior to surgery using a questionnaire enquiring of their children's personality, and emotional attachment and meekness. Their preoperative clinical data are documented. Their post-operative general condition, behavior, time taken for awakening, period of total recovery and treatment factors are recorded and analyzed. **RESULTS:** The incidence of EA was found in 23.6% of the children. EA lasted between 21 minutes to 52 minutes with a mean period of 28.4 ± 9.5 minutes. 67% of the children required medication with sedatives, analgesics and anti-emetics. Post-operative stay in the Surgical ICU ranged between Hrs. 3.12 ± 0.36 mts to Hrs. 8.39 ± 2.10 mts in the children showing restlessness, compared to those not showing agitation. **CONCLUSIONS:** The factors associated with EA were, age, emotional attachment, meekness, adaptability, previous surgery, analgesics, sedatives, dose of pentothal sodium for induction, time taken for awakening and duration of surgery. Shorter was the time of awakening, longer the period of recovery restlessness noticed in the present study. **KEYWORDS:** Anesthesia, Children, Induction, Analgesics, Sedatives, Agitation, Post-Operative, Anesthetics, ENT Surgeries.

INTRODUCTION: It is commonly noticed that children undergoing ENT surgeries exhibit restlessness at the time of the recovery from general anesthesia. This type of restlessness makes the recovery more complicated. There are many factors playing a role in the causation of agitation. Recovery agitation poses many problems to the staff in the post anesthesia recovery room. Though short, during recovery period children present with simple restlessness to beating with fists, crying, moaning, unintelligible speech, disorientation and breathe holding. Some children experience paranoid reactions during this period which might result in after effects on

ORIGINAL ARTICLE

the child.¹ Even though Recovery restlessness is self-limiting, it may cause physical harm to the child or to the site of surgery resulting in complications. In few children it may last for more than 2 days as noticed by the parents, but its long term psychological implication is not reported in the literature.² Emergence agitation, post anesthetic excitement and delirium during post-operative period are terms used interchangeably to define an acute phenomenon occurring following surgeries under general anesthesia especially in children.³ Children exhibit non-purposeful restless movements, agitation, crying or moaning, thrashing, incoherence and disorientation.⁴ In earlier literature showed a 5.3% incidence of EA in all postoperative patients, with a more frequent incidence in children (12%–13%).^{5,6} Few authors have reported this phenomenon with the usage of sevoflurane^{7,8} certain peri operative medications.^{9,10} Even though etiology is uncertain few authors reported pain and patient related factors in the post-operative period as one of the factors.^{11,12,13} The present study is a prospective study to find the incidence of EA in Indian children, evaluate the various factors associated with EA and its predictability and outcome in healthy children undergoing ENT surgeries under general anesthesia.

MATERIALS AND METHODS: After obtaining approval from the Ethical committee of this institute and informed consents from the parents of the children included in the study are obtained before undertaking the study. The study was conducted in the Mahatma Gandhi Medical attached to Kakatiya Medical College, Warangal, Telangana.

Inclusion Criteria:

1. Healthy children aged 3 to 12 years undergoing ENT surgeries under General Anesthesia.
2. Children with ASA physical status I and II.
3. Children with intact cognitive function.

Exclusion Criteria: 1. Children with ASA index more than III. 2. Children under psychiatric treatment. 3. Children with disturbed of cognitive function were excluded. Demographic data, socio economic data and educational status of the parents and prior history of surgeries undergone were recorded prior to undertaking the surgery. The anesthetist was blinded and was given authority to decide the nature of peri operative medication for the children during the surgery. The status of the children before separating them from parents is grouped as group 1. Calm and co- operative. 2. Anxious and tearful and 3. Highly frightful and non-cooperative. The nature of Anesthetics used, peri operative medications, duration of anesthesia and time to awakening were carefully recorded. In the post-operative recovery room trained nursing staff and informed duty interneers recorded the behavior of the children in terms of comprehensive check list. It included presence or absence of EA (yes/ No). When EA was present the duration it lasted was recorded. All the analgesics used, non-pharmacological interventions used, and the time of shifting the patient from PACU to the general ward was recorded. In addition the child is discharged only when the pain level and fluid levels can be managed at the regular ward comfortably. The emotional status, tolerance to pain and reaction to frightful events were elicited from the parents during the period of surgery by a senior staff nurse who was trained for the study. All the data was analyzed using standard statistical methods using SPSS software (Chicago).

ORIGINAL ARTICLE

OBSERVATIONS: 246 children undergoing ENT surgeries like Adenoidectomy, Tonsillectomy, Grommet insertion, minimal FESS, correction nasal bones fractures and cortical Mastoidectomy and Tympanoplasty were included in the study. Children were selected at random without a bias and blinded to the anesthetist involved in giving anesthetic services, to eliminate the possibility of giving preferential treatment. There were 161(65.44%) male children and the remaining were females 85(34.55%). The children were aged between 3 to 12 years, the youngest one was 3 years and the eldest child was 12 years with a mean age of 7 ± 3.4 years. Children belonging to rural domicile were 184(74.79%) and the remaining 62(25.20%) were belonging urban areas. Children belonging to low socio economic group were 188(76.42%) and the remaining were to middle class 58(23.57%). The educational status showed that the parents belonged to undergraduate level in 210(85.36%) children and the remaining 36(14.63%) were graduate and P.G. level. History of previous surgery was elicited in 79(32.11%) children. Pre-operative physical health assessment by ASA was used and found that the children belonging to grade I and II were 179(72.76%). Difficulty in separating the children from parents before taking them to the operation theater was graded as I to III. Grade I was observed in 80(32.52%), grade II in 84 ((34.14%) and grade III in 78(31.70%) children. During induction in the operation theater, children posing difficulty to cooperate was found in 124 (50.40%), (Table 1).

| Observation | EA(n=58) | No EA(n=188) | P value |
|--|---------------|----------------|---------|
| Mean Age | 5.5 \pm 3 | 6.8 \pm 2.1 | 0.003 |
| Male | 39(67.24%) | 122(64.89%) | 0.742 |
| Female | 19(32.75) | 66(3.10%) | 0.742 |
| Low socio-economic-200(81.30%) With EA=49/200=24.5% Without EA=151/200=75.5% | 37/49(75.51%) | 151(75.5%) | 0.010 |
| Middle class=46(18.69%) With EA= 25/46=54.34% Without EA=21/46=45.65% | 21/25(84%) | 21(45.65%) | 0.010 |
| ASA grading I &II | 30(86.20%) | 149(79.25%) | 0.018 |
| Difficulty separating | 12(20.68%) | 68(36.17%) | |
| Pre-operative status group I | 22(37.93%) | 62(32.97%) | 0.482 |
| Pre- OP-Group II | 16(27.58%) | 68(36.17%) | 0.482 |
| Pre-Op-Group III | 20(34.48%) | 58(30.85%) | 0.482 |
| Un cooperative at induction | 38(65.51%) | 86(45.74%) | -- |
| History of previous surgery- 79(32.11%) | 22/58(37.93%) | 57/188(30.31%) | -- |

Table 1: Showing the Age, Sex, Economic status, ASA grading, Pre-Op status and history of previous surgery of children(n=246).

In the present study 58 (23.57%) children showed emergence agitation following different ENT surgeries as shown in Table 2 with the non EA group break up of surgeries and single variable p value less than 0.05 and statistically significant (Table 2).

ORIGINAL ARTICLE

| Nature of Surgery | EA-58 | NON EA-188 | P VALUE |
|---|--------------|-------------------|----------------|
| Adeno-Tonsillectomy | 19(32.75%) | 54(28.72%) | 0.023 |
| Grommet insertion | 14(24.13%) | 57(30.13%) | 0.038 |
| Minimal FESS | 09(15.51%) | 32(17.02%) | 0.610 |
| Correction of nasal bones fracture | 05(8.62%) | 14(7.44%) | 0.762 |
| Cortical Mastoidectomy with Tympanoplasty | 11(18.96%) | 31(16.48%) | 0.049 |

Table 2: Showing the number of different ENT surgeries in EA group and non EA groups(n=246)

Intravenous anesthetic agents used in the children during induction for general anesthesia were Propofol 88.27%, Pentothal sodium 41.37% and Ketamine 10.34% of the emergence agitation group (Table 3).

| Induction medication | EA group-58 | P value | Non EA group-188 |
|-----------------------------|--------------------|----------------|-------------------------|
| Propofol | 28(48.27%) | 0.048 | 76(40.42%) |
| Pentathol sodium | 24(41.37%) | 0.041 | 61(32.44%) |
| Ketamine | 06(10.34%) | 0.08 | 51(27.12%) |

Table 3: Showing the intravenous induction agents used in both the EA and non EA groups(n=246)

Anesthetic gases used during the ENT surgeries were nitrous oxide in 27.80%, Isoflurane 29.315, Sevoflurane 24.13% and Halothane 18.96% of the children who showed Emergence agitation. The percentages of children without EA are shown in (Table 4).

| Anesthetic Drugs used | EA group-58 | P value | Non EA group-188 |
|------------------------------|--------------------|----------------|-------------------------|
| Halothane | 11(18.96%) | 0.08 | 45(23.93%) |
| Sevoflurane | 14(24.13%) | 0.009 | 32(17.02%) |
| Isoflurane | 17(29.31%) | 0.007 | 21(11.17%) |
| Nitrous Oxide | 16(27.80%) | 0.09 | 90(47.87%) |

Table 4: Showing the different anesthetics used for ENT surgeries(n=246)

During the surgeries midazolam 24.13%, Diclofenac Sodium 31.03%, Ketorolac tromethamine 27.58% and Tramadol in 16 (27.58%) of the children who showed agitation. Same drugs were also used in the children who did not show any signs or symptoms of agitation and are shown in (Table 5).

ORIGINAL ARTICLE

| Intra-Operative Analgesia | EA group- 58 | P value | Non-EA group 188 |
|---------------------------|--------------|---------|------------------|
| Midazolam | 14(24.13%) | 0.047 | 43(22.87%) |
| Diclofenac sodium | 18(31.03%) | 0.039 | 92(48.93%) |
| Ketorolac- tromethamine | 10(17.24%) | 0.028 | 23(12.23%) |
| Tramadol | 16(27.58%) | 0.022 | 30(15.95%) |

Table 5: Showing the intra-operative analgesics used in the EA and non EA group(n=246)

The mean awakening time form different surgeries of ENT were recorded and found that it was 2.23 ± 0.25 for Adeno-tonsillectomy, 1.10 ± 0.15 for Grommet insertion, 1.50 ± 1.20 for minimal FESS, 2.00 ± 0.50 for nasal bones fracture correction and 2.50 ± 0.50 for Cortical Mastoidectomy with Tympanoplasty (Table 6).

| Type of surgery | Mean time of agitation in Hrs | Mean time of stay in SICU in Hrs | Mean Recovery room medication doses of analgesia |
|---|-------------------------------|----------------------------------|--|
| Adeno-Tonsillectomy | 2.23 ± 0.25 | 6.30 ± 1.45 | 1.5 |
| Grommet insertion | 1.10 ± 0.15 | 3.12 ± 0.36 | 1 |
| Minimal FESS | 1.50 ± 1.20 | 4.30 ± 1.20 | 1.5 |
| Correction of nasal bones fracture | 2.00 ± 0.50 | 3.40 ± 1.22 | 1.5 |
| Cortical Mastoidectomy with Tympanoplasty | 2.50 ± 0.50 | 8.39 ± 2.10 | 2.5 |

Table 6: Showing the Mean time of awakening, time of stay in SICU and total time of stay in SICU and mean doses of analgesia used in EA group (n=58)

DISCUSSION: Restlessness experienced by the children following ENT surgeries under general anesthesia is a frequent phenomenon requiring increasing demand by the parents and care by the nursing staff of the SICU and duty doctors. Delay in awakening time and disappearance of restlessness makes the reunion with parents. The predictability of such type of restlessness and risk factors would help the surgeon and the anesthetist in preventing and shortening the awakening time. The present study was conducted prospectively with single blinding of anesthetist to identify different factors producing restlessness in children undergoing surgeries under G.A. Voepel-Lewis et al¹⁴ identified in their study, factors associated with agitation as Isoflurane, short time to awakening and ENT surgeries. They found that pharmacological intervention was required in 52% of the patients. In the present study the risk factors were Isoflurane, halothane. Few studies have reported that Sevoflurane and desflurane as primary risk factors in children producing recovery restlessness.^{15,16,17} The incidence of Recovery restlessness in children was reported between 24 and 66% who received these anesthetics. In the present

ORIGINAL ARTICLE

study the incidence was 23.6%. Some data show that the low solubility of the anesthetics used is associated with increased incidence of restlessness in children and it is common with these anesthetics to cause abrupt emergence.¹⁸ Cravero et al¹⁹ suggested that the restlessness on recovery negates the advantage of fast recovery; hence due to this restlessness in spite of quicker recovery with sevoflurane, the discharge time is more when compared to halothane. In this study recovery restlessness prolonged the SICU stay because of hypnotics used and other supportive therapies like midazolam, tramadol and Ketorolac used. Many authors suggest that pain during impaired consciousness is the main cause for recovery restlessness; however there is no clear correlation established.²⁰ Administration of Ketorolac, tramadol, fentanyl and Diclofenac sodium during the recovery stage reduces the recovery restlessness.¹² Few studies have shown a clinically significant incidence of recovery restlessness in pain free children suggesting pain cannot be a proven factor causing recovery restlessness.²¹ Even though there is no direct evidence between the type of surgery and recovery restlessness, early descriptive reports show that it is encountered more frequently with tonsillectomy or head and surgery.²² Children undergoing ENT surgeries are more likely suffer from recovery restlessness.²³ Eckenhoff et al and Bastron^{22,24} and Moyers guessed that a feeling of suffocation may contribute to restlessness in patients undergoing head and neck procedures, yet there are no scientific data to support this. Several other factors like younger age, anxiety, meekness in children and previous surgery also contribute to restlessness during recovery.²⁵ Recently few studies have shown use of midazolam or clonidine pre operatively reduces the agitation but causes slow awakening.¹⁵ Children with lower thresholds for pain and low adaptability presented after surgeries with restlessness.²⁶ Low adaptability is not an independent risk factor but associated with post-operative agitation. In the present study an attempt is made to evaluate various factors leading to agitation in a routine post-operative recovery room clinical management of children. Since the study is not double blinded and had limitations by observational capabilities of trained nurses and duty doctors is likely to give variation in results. Similarly the doses of anesthetics and timing of delivery is not controlled hence the possibility of selection bias and use of hypnotics and narcotic analgesics might have caused low incidence of agitation and prolonged recovery period and stay in the SICU. But the data is consistent with other previous studies which have used randomized controlled designs gives credibility to this study.

CONCLUSIONS: Emergence Agitation or Recovery restlessness in healthy children undergoing ENT and Head and Neck surgeries is a recognized phenomenon. It depends upon the age, pre-operative anxiety, meekness of the child and adaptability. Anesthetic agents used like sevoflurane, Isoflurane contribute to EA due to their early awakening with disorientation. Pre anesthetic medication with midazolam reduces the duration of EA but prolongs the stay in the SICU. Use of narcotic analgesics like tramadol, midazolam, NSAIDs like diclofenac sodium, and Ketorolac reduce the severity of EA and stay in the SICU. The incidence of the EA in the present study was 23.6%. The present study is supported by similar studies in the literature which are cohort and double blinded in nature. The predictability of EA should guide the surgeon as well as the anesthetist while operating on pediatric group patients to avoid psychological trauma to the child and the parents.

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ORIGINAL ARTICLE

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AUTHORS:

1. Nagula Parusharam
2. Kamreddy Ashok Reddy

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of ENT, Kakatiya Medical College, M. G. M. Hospital, Warangal, Telangana.
2. Assistant Professor, Department of ENT, Kakatiya Medical College, M. G. M. Hospital, Warangal, Telangana.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Nagula Parusharam,
Assistant Professor,
Department of ENT,
Kakatiya Medical College,
M. G. M. Hospital, Warangal,
Telangana.
E-mail: parashuramnagula@gmail.com

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