Original Research Article

Relationship of absolute eosinophil count (AEC) and perioperative respiratory complications in paediatric patients receiving general anaesthesia, a prospective observational study

Shilpa Gaikwad[1*], Ganesh Kumbhar[2], Jyotsna Paranjpe[3], Pradnya Sawant[4]

1Associate Professor, [2]Assistant Professor, [3]Professor, Department of Anesthesia, Bharti Vidyapeeth Medical College and Hospital, Sangli, Maharashtra, INDIA.
[4]Chief Consultanat, B.J Wadia Hospital for Paediatric Surgery and Research Centre, Mumbai, Maharashtra, INDIA.
Email: sunshineshilpa@gmail.com

Abstract

This prospective observational study was formed to identify the association of absolute eosinophil count (AEC) and perioperative respiratory complications in 200 paediatric patients of 3-5 years receiving elective general anaesthesia over a period of one year. Preoperatively AEC was measured. Patients with AEC 0-800 were studied in three groups. All patients received uniform anaesthesia by a single paediatric anaesthesiologist. Respiratory complications such as cough, stridor, bronchospasm, laryngospasm, pulmonary oedema were studied in each group. The rate and severity of complications was proportionately increased with the rise of AEC irrespective of age, sex, weight of the patients. Complications were treated with appropriate measures and drugs. Other non-respiratory effects of high AEC were also studied

Keywords: Absolute Eosinophil count (AEC), Respiratory Complications.

[*]**Address for Correspondence:**
Dr. Shilpa Gaikwad, 252/33, RK Ext, Shamshree Hospital Sangli, 416 416, Maharashtra, INDIA.
Email: sunshineshilpa@gmail.com
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INTRODUCTION

Perioperative respiratory adverse events are frequent in paediatric patients. Morbidity and sometimes mortality due to respiratory adverse events are always worrisome factors for paediatric anaesthesiologist. Respiratory complications range from coughing episode, stridor, bronchospasm, and laryngospasm to more severe problems like pulmonary oedema and many more. Many risk factors are known to contribute for these respiratory adverse events. Upper respiratory tract infection (URTI) is well established risk factor. URTI may not be always clinically evident. Bronchopulmonary dysplasia, bronchial asthma, allergic rhinitis, pulmonary fibrosis, Hey fever, Reye syndromes are some known diseases where hypersensitivity of airway is evident cause for respiratory complications. Hypereosinophilic syndrome is also known entity which may lead to sever postoperative complications. Eosinophils play a major role in hypersensitive reactions by ingesting Ag-Ab complexes at various tissues. Eosinophil count is increased in allergic rhinitis, asthma, allergic skin disorders, fungal infections, worm infestations (significant factor in paediatric patients).Patient with eosinophilia are at risk of complications like bronchospasm, urticaria, bleeding disorders and idiosyncratic reactions known as DRESS syndrome(Drugreaction with Eosinophilia and systemic symptoms) and ARDS(Adult Respiratory Distress Syndrome) Many patients with high eosinophil count are asymptomatic otherwise, but when exposed to general anaesthesia may reveal some complications related to eosinophilia. We undertook this study to identify the association of eosinophilia and periopeartive respiratory

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untoward events in paediatric patients receiving general anaesthesia. We attempted to study the incidence and severity of adverse respiratory events associated with increased absolute eosinophilia count. As there is no study published regarding relation of AEC and respiratory complications in paediatric patients, this study may be a pioneer effort to confirm absolute eosinophil count as an important predictive risk factor for perioperative respiratory complication in paediatric patients of age 3-5 years.

MATERIAL AND METHODS

200 patients of 3-5 age group of either sex requiring general anaesthesia with endotracheal intubation for elective surgery were studied in a tertiary paediatric surgical centre a period of one year. Preoperative anaesthesia evaluation included detail history, examination and all necessary investigations like complete haemogram including total and differential leukocyte count, x ray chest were done. Absolute eosinophil count (AEC) was measured from differential leukocyte count. Patients with URTI, congenital anomalies, systemic diseases, difficult airway, and patients with AEC more than 800 were excluded from study. Patients with AEC less than 800 but chest x ray suggesting major pathology were also excluded from study. Patients were divided in four groups according to AEC. Each group consisted of 50 patients each. Group 1 (n=50) consisted patients with AEC between 0-200, group 2 (n=50) contained patients with AEC between200-400, patients with AEC between 400-600 were studied in group 3 (n=50), patients with AEC 600-800 were included in group 4 (n=50). All patients were anaesthetised by a single paediatric anaesthesiologist who was blinded for AEC. All patients were premedicated with 0.5 mg/kg Midazolam and Inj. Glycolpyrrolate 4mcg/kg orally after confirmation of nil by mouth status and informed consent. Anaesthesia was induced with Inj. Propofol 2 mg/kg, after confirmation of mask ventilation Inj. Atracurium 0.5 mg/kg was injected and trachea was intubated with appropriate size endotracheal tube. Inj. Fentanyl 2mcg was given as an analgesic. After surgery anaesthesia was reversed with Inj. Neostigmine 0.5 mg/kg and Inj. Glycopyrrolate 8mcg/kg. Standard extubation criteria were applied for successful extubation. Patients were monitored postoperatively for 6 hours. Perioperative record was maintainedincluding adverse respiratory events. Patients did not receive any steroid drugs preoperatively to avoid any bias. Any complications were treated with appropriate measures and drugs like oxygenation steroid, bronchodilator, antihistaminic and muscle relaxant and ICU care.

RESULTS AND OBSERVATIONS

Table 1: All demographic data were comparable

Groups	Mean Age (years)	Sex		Mean Weight (Kg)
		Male	Female	
Gr-1(n=50)	4..4	28	32	11.8
Gr-2(n=50)	3.9	34	26	11.6
Gr-3(n=50)	4.2	32	28	12.3
Gr-4(n=50)	4.0	27	33	12.5

Table 2: Respiratory complications, desaturation

Respiratory complications	Group1(n=50)	Group2(n=50)	Group 3(n=50)	Group 4(n=50)
Incidence	1(2%)	2(4%)	4(8%)	8(16%)
Cough	1	1	1	2
Stridor	0	1	1	1
Bronchospasm	0	0	2	3
Laryngospasm	0	0	0	1
Pulmonary oedema	0	0	0	1
Fall in Oxygen saturation	0	94%	90%	78%

Table 3: Non-respiratory complications

	Gr 1	Gr 2	Gr3	Gr 4
Skin rash	0	1	4	8

Table 4: X ray chest findings

X ray chest abnormal	Gr 1	Gr 2	Gr 3	Gr 4
	0	2	4	7

During this study we observed variety of adverse respiratory events like coughing episode, stridor, bronchospasm, laryngospasm and pulmonary oedema. In group 1,No patient showed pathology in the chest x ray. Cough was treated with simple measures like humidified oxygen and steroidal drugs like Dexamethasone0. 2 mg/kg. In group 2,2 patients revealed hilar lymphadenopathy on chest x ray. Stridor and cough was treated with oxygenation and Dexamethasone. Oxygen saturation was maintained up to 94%.One patient in this group developed skin rash which disappeared completely with Inj. Dexamethasone. In group 3, 4 patients showed hilar lymphadenopathy on chest x ray. In group 3.two patient developed bronchospasm and oxygen Saturation was drooped till 90%.Bronchospasm was managed with additional PEEP by mask, Inj. Hydrocortisone 2 mg /kg, and bronchodilator like Inj. Deriphylline. At the end recovery was uneventful. Skin rash was noticed in 4 patients. I n group 4, we observed more severe complications. One patient developed laryngospasm. Ventilation was difficult and oxygen saturation dropped till 86% in this patient and required Inj. Succinylcholine

1.5mg/kg for successful ventilation. Another patient in this group developed pulmonary oedema after intubation. This patient required additional treatment with Diuretic. Surgery was cancelled. Patient required paediatric intensive care and mechanical ventilation. Complete recovery of this patient was prolonged up to 3 days. Skin rash was observed in7 patients of this group which responded to steroid injection. None of the patient developed any type of coagulopathy, drug reactions, ARDS or any other major morbidity or mortality during our study

DISSCUSSION

Normal total white cell count is 4-11/cmm and normal eosinophil count is 1-6%[11]. Eosinophilia is labelled when eosinophil count is > 6%. Normally eosinophils are present in pulmonary and gastrointestinal tract and increased eosinophils in blood/peripheral more than 600/µl suggestseosinophilic disease.[12]. Eosionphilia is classifiedas mild (AEC 600-1500 cells/µl), moderate (1500-5000/µl) and severe (AEC->5000/µl)[12]. Eosinophilia may be primary with no specific identifiable cause (Idiopathic) or secondary to some disorder. Eosinophilis ingest Ag-Ab complexes releasing vasoactive mediators like histamine, leukotrienes, plasmakinin and thereby provoking hypersensitivity reactions. Clinically it is seen in the form of vasodilation,bronchospasm, urticaria and coagulopathy.[2] Persistent eosinophilia can develop hypereosinophilic syndrome with eosinophilic granules (granulomas) in various organs.[1] Eosinophilia is prominent in many allergic diseases such as Hay fever, bronchial asthma, and food and drug sensitivity.[2] Skin, collagen diseases, parasitic infections (Hookworm, amebiasis, Hydatid cyst) especially in children are most commonly associated with High AEC[3].Tropical or pulmonary eosinophilia is a common entity seen in South Asia and India.[14,2] This is a filarial infection characterised by asthma, cough, and splenomegaly.[10] Children with this condition show marked eosinophilia with hypersensitive immunological process. Cough in children is frequently associated within flammation, infection or allergic airway diseases. J C de Jongste, M D Shields *et al* suggested that children with chronic cough show eosinophilia with airway hypersensitivity. Airway hypersensitivity can be associated with increased eosinophils in tracheo-bronchial tree which give rise to chronic non-productive cough[6]. This pathophysiology was established in study conducted by Fujimura, Ogawa, Yasui *et al*[8]. This acute hyper-reactivity related to hyper eosinophilia may give rise to various complications during general anaesthesia. Shivendu Bansal *et al* reported a case of DRESS syndrome (Drug Reactions with eosinophilia and Systemic Symptoms) with very high absolute eosinophil count of 1360/ul[7]. Corticosteriods are recommended for hyperseosinophilia related skin reactions.[15] Patient developed seizures with fever and rash intraoperative. Patients with hypereosinophilic syndrome are at risk of developing perioperative complications when exposed to general anaesthesia. Complications may range from minor respiratory events to some life threatening adverse reactions. DRESS syndrome carries risk of mortality of about 10%.[13] G Samsoon *et al* presented two cases with markedly increased eosinophil count developing postoperative complications after general anaesthesia. One patient developed ARDS (Adult Respiratory Distress Syndrome) and other patient had coagulopathy and other mild respiratory problems.[5] In our study, amongst group 1 (n=50 with AEC=0-200), no patient showed any pathology in the chest x ray. Incidence of respiratory complication was 2%.Milder form of respiratory events like cough, not creating much drop in oxygen saturation. Respiratory events responded completely to treatment without any residual damage. Group 2(n =50 with AEC=200-400) chest x ray of 2 patients showed hilar lymphadenopathy. Incidence of respiratory events was 4%.In Group 3 (n=50, AEC= 400-600), 4 patients presented chest x ray pathology. Mild to moderate adverse events were noted. Desaturation was noticed up to 90%.In group 4 we encountered laryngospasm and Oxygen saturation had fallen up to 86%.More severe complication like pulmonary oedema creating desaturation up to78% was observed in one patient. Prompt, aggressive, and intensive care was required. Complete recovery was longer than previous 2 groups though no residual damage was seen. Skin rash was observed more in group 3and 4. To avoid bias we did not administered any steroidal drugs to the patients. Steroids were administered only after respiratory complications. As review of literature has suggested steroid cover is useful for hypereosinophilic hypersensitivity respiratory and skin reactions. Parasitic and fungal infections can be worsened by disseminated use of steroids.[12]

CONCLUSION

This study conclude that AEC >600 is a definite risk factor for perioperative respiratory complication for paediatric patients. Eosinophil count should be considered as a helpful pre-anaesthesia assent guide.[7] Hypereosinophilic patients should be further investigated for cause of eosinophilia before scheduling for administering anaesthesia.

RECOMMENDATIONS

A large scale study to identify the probable safe limit of eosinophilia should be performed.

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