Evaluation of Endotracheal Intubation with and without Neuromuscular Blocking in Pediatric Anesthesia

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ABSTRACT:

BACKGROUND:

Endotracheal intubation is an important step in airway control in pediatric age group, the drugs used for this purpose are ultra-short acting hypnotic agents plus neuromuscular blocking agents (NMBA). NMBA have many serious side effects.

OBJECTIVE :

To evaluate endotracheal intubation without using NMBA, and assess the intubation conditions and hemodynamic response to this method of intubation in pediatric age group

PATIENTS AND METHOD:

This is a prospective randomized double blind study done in Rizgary teaching general hospital from 1/ October to 1/ December 2012 included 60 patients age 4-8 years,American society of anesthesiologist (ASA) I or II.

Patients were allotted to one of these two groups randomly 30 patients per each group. Group (F): those patients that receive Fentanyl 4 μg/kg I.V +Propofol 3 mg/kg I.V. Group (S): those patients that receivePropofol 3 mg/kg +suxamethonium 1 mg/kg I.V. Intubation conditions and hemodynamic changes have been measured and compared between both groups.

RESULTS:

In group F acceptable intubation conditions were obtained in 27 (89%) patients.whileFair intubation conditions occurred in only 3 (11%) patients. In group S acceptable intubation conditionsoccurred in 30 (100%) of patients.In S group there was a significant rise in systolic arterial pressure(SAP) and heart rate (HR) in 0, 1, 3 minute after intubation (P<0.001).

In F group there was significant decrease in SAP (P<0.001) in post induction reading. In F group there was non-significant decrease in HR in post intubation time 1, 3 minutes (P>0.05).

CONCLUSION:

Endotracheal intubation can be accomplished in pediatric age group using Fentanyl and Propofol without the need to use muscle relaxant with acceptable hemodynamic response.

KEY WORDS: endotracheal intubation, fentanyl, Propofol, suxamethonium.

INTRODUCTION:

The placement of an endotracheal tube is considered the "gold standard"– of the definitive airway management for two principal reasons. First, the possibility of aspirationof gastric contents into the airways is greatly reduced. Second, it is via anendotracheal tube that greatest positive airway pressure can be achieved with mechanical ventilation [(1)].The drug used for this purpose are short hypnotic agents plus neuromuscular blocking agents (NMBA). The NMBA like Suxamethonium (depolarizing muscle relaxant) which has many side effects [(2)], likeMuscle pain, Increased intra-ocular pressure [(3)],malignant hyperthermia [(4)],Anaphylaxis[(5)], increased intracranial pressure [(6)]Hyperkalaemia[(7)] and the worst is cardiac arrest in pediatrics.Although these side effects, it is stillthe faster onset of action and the shortest duration of action among all other NMBA. While the other NMBA, (the non depolarizing agents) are several in types and different in their side effects and ways of elimination, but generally these agents are with slower onset and longer duration of action, and this is problematic in case of difficult intubation if encountered considering that the intubation in pediatric carries more difficulty than adults because of age-related anatomic differences:short neck, relatively small mandible,larynx lies at the level of C3/4 rather than C5/6 seen in later life[(8)].

Propofol is an ultra short acting intravenous anesthetic drug, its pharmacodynamics effects on muscle is decreasing tone, but movements may occur in response to surgical stimulation.[(2)]

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Fentanyl is a potent synthetic opioid is extremely fat soluble, which accounts for its rapid onset and relatively short duration. [9] Laryngoscopy and tracheal intubation are highly stimulating procedures and fentanyl 1–2 μg kg−1 IVmay be a useful adjunct in attenuating the cerebrovascular response [10]

In this study we estimated endotracheal intubation with propofol and fentanyl without using NMBA and assessed the intubation conditions and hemodynamic effects in pediatric age group and this is done to avoid the use of suxamethonium chloride in pediatrics which although has many benefits it has many side effects which can be life threatening.

PATIENT AND METHOD:

This is a prospective randomized double blind study done in Rizgary teaching general hospital from 1/ october to 1/ december 2012 included 60 pediatric patients.

Inclusion criteria: patients with ASA I or II, 4-8 years, endotracheal intubation indicated elective surgery.

Exclusion criteria: patient parent refusal, full stomach, emergency operations, allergy to any drug used in this study, suspected difficult intubation, ophthalmologic and neurosurgical operations.

Written informed parental consent was obtained. Patients were allocated to one of the following groups randomly:

Group F- those patients that receive Fentanyl 4 μg/kg IV. + Propofol 3 mg/kg IV.

Group S-those patients that receive Propofol 3 mg/kg IV + suxamethonium 1 mg/kg. IV.

All the patients were pre-medicated with Midazolam 0.05 mg/kg IV and atropine 0.01 mg/kg I.V., 10 minutes prior to induction.

Group F (study group) Fentanyl 4μg/kg was given I.V. over 30 seconds. Five minutes later, the children received Propofol 3 mg/kg over a period of 30 seconds I.V.

In Group S (control group), anesthesia was induced by Propofol 3 mg/kg followed by suxamethonium 1 mg/kg; endotracheal intubation was performed 60 seconds later.

Lignocaine 1mg/ml was added to Propofol solution to minimize pain on injection in both groups Laryngoscopy and intubation were attempted 60 seconds after induction of anesthesia in both groups.

Laryngoscopy and intubation were done in all patients by a senior consultant anesthesiologist. The quality of intubation was graded by the consultant using the scoring system devised by Helbo-Hansen Raulo and Trap-Andersonas shown in (table: 1)

A senior anesthesiologist assessed each patient for the following four variables during laryngoscopy and intubation,:

- Ease of laryngoscopy
- Position of vocal cords
- Degree of coughing
- Jaw relaxation

The observed conditions with respect to each of the above were allocated scores of 1 to 4. A total score of 4 was considered excellent; 5-8, good; 9-12, fair; and 13-16, poor. Excellent and good scores were considered as clinically acceptable, and fair and poor scores were considered as clinically unacceptable.

Measurements of heart rate, systolic arterial pressure and arterial O_2 saturation were noted at different time intervals (pre-induction, post-induction, post-intubation at 0, 1, 3 minutes). Measurements at 1 minute after injection of atropine were taken as baseline values.

Balanced anesthesia was maintained subsequently as necessary for each case. All the data are statistically analyzed and regarded as significant when the p value less than 0.05

Table1:Scoring criteria for intubating conditions.

	1	2	3	4
Laryngoscopy	Easy	Fair	Difficult	Impossible
Vocal cords	Open	Moving	Closing	Closed
Coughing	None	Slight	Moderate	Severe
Jaw relaxation	Complete	Slight	Stiff	Rigid

RESULTS:

The measurements taken from the patients were entered to a special form sheet prepared for this research; the demographic data is shown in table (2)

The intubation conditions in group F were excellent in 16 patients (53%) representing score 4, while good intubation conditions obtained in 11 patients (36%) of patients represented by score (5-8), so acceptable

intubation conditions were obtained in 27 (89%) patients, table NO. (3 and 4). Fair intubation conditions in group F occurred in only 3 (11%) patients represented by score (9-12), while poor intubation conditions were nil. This make unacceptable intubation conditions in 3 (11%) of patients, tables NO. (3 and 4).
In group S, excellent intubation conditions were obtained in 26(86%) of patients represented by score (4), and good intubation conditions occurred in 4 (14%) of patients represented by score (5-8), while fair and poor intubations were not present in any patients, this make acceptable intubation conditions in 30 (100%) of patients, table NO. (3 and 4).
The hemodynamic changes during intubation was as follow, the mean basal systolic pressure was 105.633 in group S while it was 100.666 in group F.
In S group there was non significant increase in the pre induction SAP (P>0.05), while there was a significant rise in SAP in 0, 1, 3 minute after intubation (P<0.001)
In F group there was non significant rise in SAP at preinduction (P>0.05), while there was significant decrease in SAP (P<0.001) in post induction, in SAP at post intubation 0, 1 minute there was none significant decrease in SAP (P>0.05), while there was significant decrease in SAP at post intubation time 3 minute (P<0.001) .
The heart rate in S group increased non significantly in pre induction and post induction (P>0.05), while it increased significantly at post intubation time 0, 1, 3 minutes (P<0.001) .
The heart rate in F group showed non significant decrease in HR pre induction (P>0.05), while there was significant decrease in HR at post induction (P<0.001), also there was none significant increase in HR at post intubation time 0 (P>0.05), while there was no significant decrease in HR in post intubation time 1, 3 minutes (P>0.05).
In S group HR increased non significantly in pre induction and post induction (P>0.05), while it increased significantly at post intubation time 0, 1, 3 minutes (P<0.001) .
The oxygen saturation changes were not significant between the F and S groups neither within the same group and it was maintained above 96% over the whole monitoring time.

Table 2: Patient's data

item	Group F(mean/SD)	Group S(mean/SD)	P vale
No. of patients	30	30	
Age	5.333/1.2452	5.916/1.1603	NS
Weight	17.683/2.9783	18.833/3.3577	NS
Sex F/M	12 /18	17 /13	S

Table 3: Scoring conditions for tracheal intubation

Group	Scoring 4 (Excellent %)	Scoring 5-8 (Good %)	Scoring 9-12 (Fair %)	Scoring 13-16 (Poor %)
F (N=30)	16(53%)	11(36%)	3(11%)	0
S (N=30)	26(86%)	4(14%)	0	0

Table 4 : Intubation conditions in the two groups.

Intubation condition	Group 1 F	Group 2 S	P value
Acceptable(excellent+ good)	27(89%)	30(100%)	NS
Not acceptable(fair= poor)	3(11%)	0	NS

P value is NS if P >0.05

Table 5: Comparison of scoring criteria.

	Laryngoscopy				VC position				Coughing				Jaw mobility			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Group F	29	1	0	0	25	5	0	0	27	3	0	0	22	4	4	0
Group S	30	0	0	0	28	2	0	0	30	0	0	0	28	2	0	0

DISCUSSION:

Tracheal intubation without muscle relaxants was studied extensively in order to find a way to avoid muscle relaxants and their serious complication while keeping good intubation conditions and favorable hemodynamic conditions.
In this study tracheal intubation was acceptable in 27 patients (89%) of F group, while it was associated with excessive cough (not acceptable

intubation condition) in 3 patients (11%). While in S group in 30 patients (100%) intubation condition was acceptable.

This showed that Propofol and fentanyl is an acceptable method to intubate pediatric patients although not as good as Propofol and suxamethonium but with non-significant difference and this is nearly similar to the findings observed by Tahira Hakeem [(11)] who had acceptable intubation condition 87% of Fentanyl group and 99% of suxamethoniumgroup

It is also nearly similar to the findings observed by SafiyaI sheikh [(12)] who had acceptable intubation condition in 95% of Fentanyl group and 100% of suxamethonium group.

While this was not the case with Tsuda A et al [(13)], who did not recommend endotracheal intubation without muscle relaxants due to unacceptable intubation condition.

Also Mencke et al [(14)] did not recommend intubation without muscle relaxant because he found that this method increase vocal cord injury.

Hemodynamic results showed significant rise in SAP and HR in S group , while there was a significant decrease in SAP and HR in group F, this was similar tothe results of Tahira Hakeem [(11)] who also found high increase in SAP and HR in group S while both parameters decreased in group F, also likeSafiyaShaikh [(12)] who found the same results and also Gupta A. et al [(15)] found that there was significant increase in SAP and HR in group S while there was significant decrease in SAP and HR in group F .

Muscle rigidity was not observed in group F in our study, and this may be attributed to the small dose of Fentanyl and also to the slow injection technique of Fentanyl which also affect the incidence of muscle rigidity.

There was no significant change in SPO2 neither in group S nor in group F.

In all these cases the SPO2 was above 97% on simple face mask.

CONCLUSION:

Endotracheal intubation can be accomplished in elective surgery for pediatric age group using Fentanyl and Propofol without the need to use muscle relaxant with acceptable hemodynamic response.

Recommendations:

We recommend to accomplish the endotracheal intubation in elective surgery for pediatric age group using Fentanyl and Propofol without using muscle relaxants in elective surgical operations specially when there is a contraindication to use of muscles relaxant.

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