

Nasotracheal Intubation in Children with TMJ Ankylosis Comparing Induction with Sevoflurane and Ketopropofol: A Novel Approach

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Key Points

Sevoflurane is commonly used agent, for induction in difficult tracheal intubation. It lacks pungency, airway irritation and is safe, reliable and well accepted by the patients. Different studies have been done using combination of ketamine and propofol for procedural sedation. Combination of these two agents help to minimize adverse effects like hypotension and respiratory depression.

Abstract

Background: We have compared sevoflurane induction/ketopropofol for nasal fiberoptic intubation in children with TMJ ankylosis who were posted for correction, in elective operation theater.

Methods: 28 children of ASA grade 1 and 2, aged 5 - 14 yrs, weight 20 - 30 kg, height 100 - 130 cm of either sex were randomized to one of the group.

After securing intravenous drip. Inj. Ranitidine and Inj. Metoclopramide were given ½ hr before operation.

According to weight of the patient. I/M Glycopyrronium 0.1 - 0.2 mg was given preoperatively.

Patients was shifted to operation theater, after preoxygenation, monitors were attached. Children were induced with either Sevoflurane/IV Ketopropofol, 50% O₂ + 50% N₂O and 6 - 8% Sevoflurane. Nasopharyngeal airway was introduced with 100% O₂ attached. On the other nose fiberoptic bronchoscope was introduced after child was deep. Flexometallic tube was railroaded and after visualising the glottis, trachea was intubated.

Children of Group KP were induced with I/V Ketamine 1 mg/kg bolus followed propofol 0.5 mg/kg in 5% dextrose diluted in 100 ml in paediatric set and was given slowly 30 - 40 drops/min till intubation. Total amount required was noted.

In both the groups preoxygenation with 100% oxygen was given via nasopharyngeal airway at 6 L/min throughout the procedure.

Heart rate, systolic BP, diastolic BP, MAP, SpO₂, ETCO₂, and ECG were monitored at basal level, post induction, at intubation at 1, 2, 3 minutes.

Intubation score and intubation time were noted in each group preoperatively.

Results: Hemodynamic parameters at basal level and post induction were comparable between both the groups. Heart rate was statistically significant between two groups at intubation with P-value of 0.02, post intubation P-value at 1 min = 0.02, 2 min = 0.02, 3 min = 0.06.

Systolic BP at intubation was statistically significant at intubation with P-value of 0.04, Diastolic BP P-value of 0.04 and MAP with P-value of 0.01.

Post intubation at 1 minute, 2 minutes, 3 minutes, P-values were comparable between two groups.

Moreover increase of heart rate in Group KP was less than 20%, when compared to basal level. Heart rate became normal at post intubation 3 minutes.

Conclusion: Both sevoflurane and ketopropofol can be used as inducing agents for nasotracheal fiberoptic intubation. Haemodynamic response with sevoflurane during intubation was more stable than ketopropofol group.

Keywords: Children; TMJ Ankylosis Correction; Nasotracheal Fiberoptic Intubation; Sevoflurane/Ketopropofol

Introduction

Nasotracheal fiberoptic intubation is an effective technique for the management of patient with difficult airway like TMJ ankylosis.

This study was aimed to compare the effectiveness of sevoflurane as inducing agent v/s target controlled ketopropofol infusion for providing sedation during nasotracheal fiberoptic intubation. Twenty eight children of TMJ ankylosis for elective operation were enrolled and randomly allocated into either group (n = 14) each.

Intubating conditions and patients haemodynamics including heart rate, systolic BP, diastolic BP, MAP were evaluated as primary outcome. Readings were taken as basal values, at intubation, post intubation at 1, 2, 3 minutes.

Intubation was successful in all the patients. Intubating scores were found to be 3/12 in Group S and 4/12 in Group KP. Intubation time were 90 seconds and 100 seconds respectively. There was no intubation problem in either group.

The sevoflurane group experienced less changes in heart rate response to intubation than ketopropofol group. Systolic BP, diastolic BP and MAP response to intubation was statistically significant between two groups. Whereas Post intubation 1, 2, 3 minutes P values were statistically comparable.

Method and Material

Following written informed consent and clearance from department ethical committee. 28 children of ASA grade 1 and 2, aged 5 - 14 yrs, weight 20 - 30 kg and height 100 - 130 cm of either sex included for the study. Excluding the children with history of snoring and adenoid enlargement.

All the children were posted for elective operation and correction of unilateral TMJ ankylosis under general anaesthesia.

Before surgery, all the patients were fasted overnight and glucose water was given 6hrs pre-operatively. Patients were pre-medicated with syrup phenergan 10 mg/kg body weight, 2 hr before induction. A 20G intravenous cannula was inserted into the vein of dorsum of the hand and crystalloid infusion was started at the rate of 4 - 5 ml/kg/hr. inj. Ranitidine and inj. Metoclopramide were given ½ hr before operation according to weight of the patient. I/M Glycopyrronium 0.1 - 0.2 mg was given half hour before operation. pre-operatively, Nose was prepared with xylocaine jelly and Nasivion drops. Patient was shifted to OT and random selection of either group was done.

Group S- Sevoflurane induction (n = 14).

Group KP- I/V Ketamine 1 mg/kg followed by propofol 0.5 mg/kg (n = 14).

After patient entered the operating room, non-invasive BP and heart rate were measured, after a stabilization period of 10 minutes as baseline readings. ECG lead II and Spo₂ were monitored. Before induction, fiberoptic bronchoscope was checked, focussed and flexometallic tube of adequate size was lubricated with 2% lidocaine gelly and was threaded over a paediatric fiberoptic bronchoscope (2.8 mm). All the children were preoxygenated for 5 minutes with 100% O₂ using Ayer's T- piece/Mapelson D circuit according to age and weight of the patient.

Group S (sevoflurane) n = 14.

Along with 5 minutes of preoxygenation, inj Fentanyl 1.0 µgm/kg was given to coincide with intubating time of approximately 5 minutes child was induced with inhalational agent using face-mask ventilation with sevoflurane in 100% O₂ at 6 - 8 l/min volume using Ayer's T piece/Mapelson D circuit according to age and weight of the patient. Children were induced slowly at normal tidal volume with sevoflurane at 4 - 6 MAC with 100% oxygen. On line ETCO₂, SpO₂, Heart rate, non-invasive BP and ECG were monitored every one minute.

Nasal airway of appropriate size was inserted into one of the nostril after lubrication with lidocaine jelly and fixed. The circuit tubing was attached to nasal airway and spontaneous respiration was maintained with sevoflurane 1 - 2 MAC at 6 l/min flow with O₂:N₂O (50:50%) was continued till the patient was deep enough to tolerate fiberoptic bronchoscope.

After 1 minute, fiberoptic bronchoscope was introduced into other nostril slowly and after visualising the glottis, tracheal rings and carina flexometallic tube was railroaded into trachea. SAGO of 2% xylocaine was given via port if required. Intubation time was recorded from the start of FIBEROPTIC introduction to tracheal cuff inflation and intubation scoring was noted. Tube confirmation was done by auscultation, chest expansion, ETCO₂ reading and capnograph. Tube was secured and NM blocking agent vecuronium bromide 1 mg/kg was injected. HR and BP were recorded at intubation, post intubation 1, 2, 3 minutes. Intubation scoring and intubation time were noted.

Group KP (Ketopropofol) (n = 14).

In this group after putting I/V line, patients was prepared like first group.

Fiberoptic bronchoscope was prepared and checked. Children were preoxygenated with 100% O₂ using mask which was attached to Ayer's T- piece/Mapelson D circuit according to age and weight of patients. Heart rate, systolic BP, diastolic BP, MAP, ECG and SpO₂ were monitored simultaneously, at basal level. Injection ketamine 1 mg/kg was given and patient response was observed, inj. Propofol 0.5 mg/kg was prepared in 5% dextrose of 100 ml using paediatric set and was started at 30 drops/min. Total amount required was noted. Haemodynamics were noted at post induction.

While performing fiberoptic intubation, online ETCO₂ was continuously monitored, after the glottis was visualised, 2% xylocaine as SAGO was given if required, the bronchoscope was introduced between the vocal cords and downward till carina was seen. A flexometallic nasal tube was gently advanced over the bronchoscope into the trachea. Intubation scoring and time were noted like in first group. Fiberoptic bronchoscope was removed and tube was secured after confirming its position with chest expansion, auscultation, ETCO₂ graph and value. Haemodynamic response to intubation were recorded at intubation and every 1, 2, 3 minutes thereafter. All the fiberoptic intubations were performed by single experienced anaesthetist.

After checking I/V neuromuscular blocking agent inj. Vecuronium 1 mg/kg was given and closed circuit tubing was connected and patient was put on ventilator.

Anaesthesia was maintained in both the groups with O₂:N₂O (33 - 67%) with isoflurane 0.8% and top up dose of inj. Vecuronium (0.01 mg/kg). Throughout operation, HR, BP, ETCO₂, SPO₂ and ECG were monitored.

Duration of surgery was approximately 1 to 1 ½ hr. Half an hour before the end of operation I/M Pethidine 1 mg/kg was given for post-operative analgesia. Neuromuscular blocking agent was reversed with Glycopyrronium 0.02 mg/kg and Neostigmine 0.04 mg/kg. The trachea of patient was extubated, when patient was totally awake. And patient was oxygenated by facemask.

In both the groups intubation time i.e. start of fiberoptic bronchoscopy to cuff inflation was noted along with intubation score.

Statistical Method

Descriptive stats mean +/- SD have been used for continuous variables like age, weight, Heart rate, systolic BP, diastolic BP, MAP statistical method was compared using unpaired standard T- test, chi square test was used for categorical data. P value < 0.05 was taken as statistically significant.

Results

Demographic variable were statistically comparable in between two groups including age, weight and height.

P-values 0.98, 0.99, 0.99.

Gender - M/F

P-value was comparable (0.8).

Basal haemodynamic parameters were comparable in two groups i.e. Heart rate, systolic BP, diastolic BP, MAP.

P-values were 0.99, 0.06, 0.06, 0.07.

Comparison of Heart rate at basal level, post induction were comparable but values at intubation and post intubation 1, 2, minutes were statistically significant with P-value of 0.02 at intubation, 0.02 at 1 minute post intubation, 0.04 at 2 minutes in two groups. Group S was haemodynamically more stable than Group KS. Increase of Heart rate, which occurred after intubation came back to basal level at post intubation 3 minutes.

Systolic BP, diastolic BP, MAP showed significant P-values only at intubation with P-value of 0.04, whereas post intubation P values were statistically comparable between the two groups.

Group S showed mean intubation score of 3/12 with mean intubation time of 90 second.

Group KP showed mean intubation score of 4/12 with mean intubation time of 100 second.

Almost 20% of the patients required SAGO at vocal cord level, in both the groups.

Propofol requirement was between 20 - 30 ml, in all the patients of Gr. KP.

Demography

	Group S	Group KP	P-Value
Age(yrs)	9 ± 6.77	10 ± 11.3	0.98
Weight(kg)	22.4 ± 12.0	22.7 ± 12.58	0.99
Height(cms)	116.66 ± 16.20	131.84 ± 19.73	0.99
Sex			
Male	55.56%	60%	0.8
Female	44.44%	40%	

P-values were statistically comparable.

Haemodynamic Parameters between Two Groups at all Events

Heart rate

Heart Rate	Group S	Group KP	P-Value
Basal	89.8 ± 17.20	90.4 ± 12.87	0.99
Post Induction	85.20 ± 17.91	89.8 ± 17.20	0.60
At Intubation	96.3 ± 20.10	114.7 ± 12.68	0.02
Post Intubation			
1 Min	95.1 ± 19.10	113.3 ± 19.10	0.02
2 Min	96.8 ± 18.99	110.7 ± 9.45	0.04
3 Min	96.1 ± 17.99	55 ± 13.53	0.06

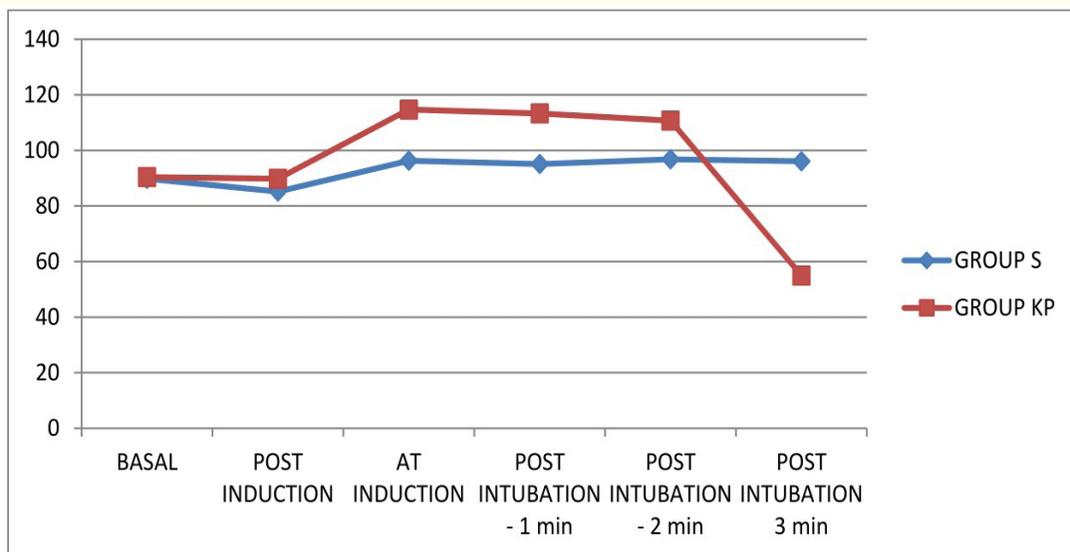


Figure 1

Systolic Blood Pressure

Systolic BP	Group S	Group KP	P-value
Basal	110.3 ± 18.53	116.7 ± 8.09	0.06
Post Induction	110.0 ± 19.64	116.6 ± 12.02	0.44
At Intubation	111.3 ± 18.48	126.2 ± 11.07	0.04
Post Intubation			
1 Min	109.8 ± 19.07	117.1 ± 9.85	0.67
2 Min	107.8 ± 18.99	110.7 ± 9.45	0.24
3 Min	107.6 ± 18.88	115.3 ± 6.73	0.29

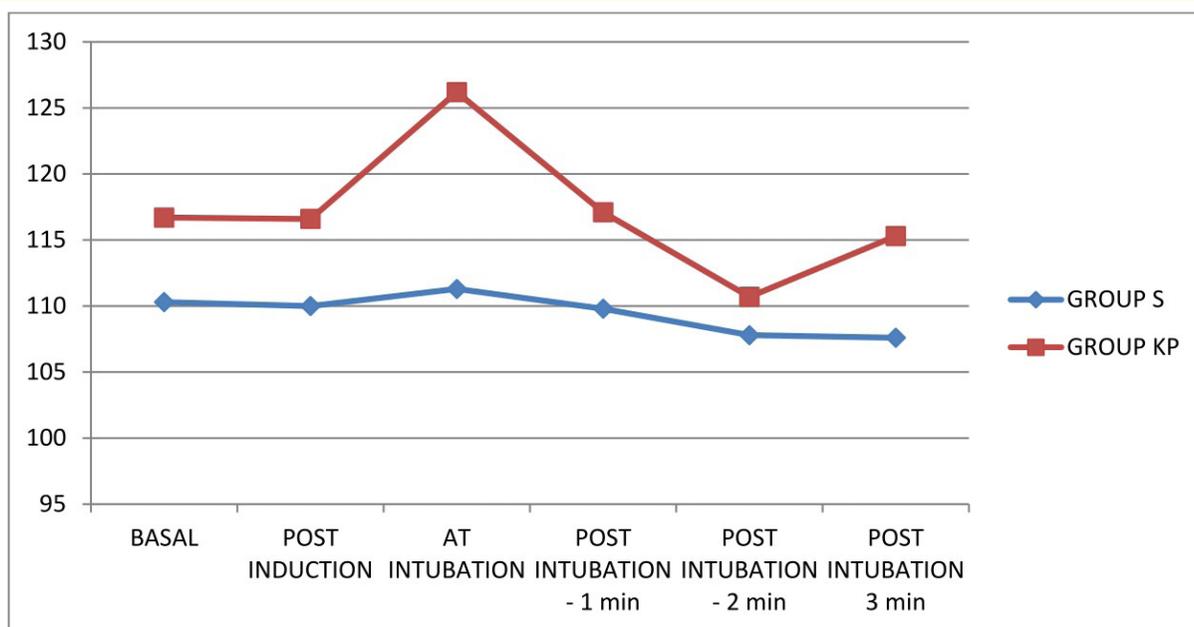


Figure 2

Diastolic Blood Pressure

Diastolic BP	Group S	Group KP	P-value
Basal	60.4 ± 10.63	66.6 ± 12.09	0.07
Post Induction	68.3 ± 10.92	64.9 ± 13.18	0.68
At Intubation	63.9 ± 9.98	78.6 ± 17.64	0.04
Post Intubation			
1 Min	84.44 ± 10.33	89.4 ± 8.78	0.27
2 Min	80.3 ± 11.09	88 ± 10.96	0.13
3 Min	80.9 ± 21.41	88 ± 8.61	0.15

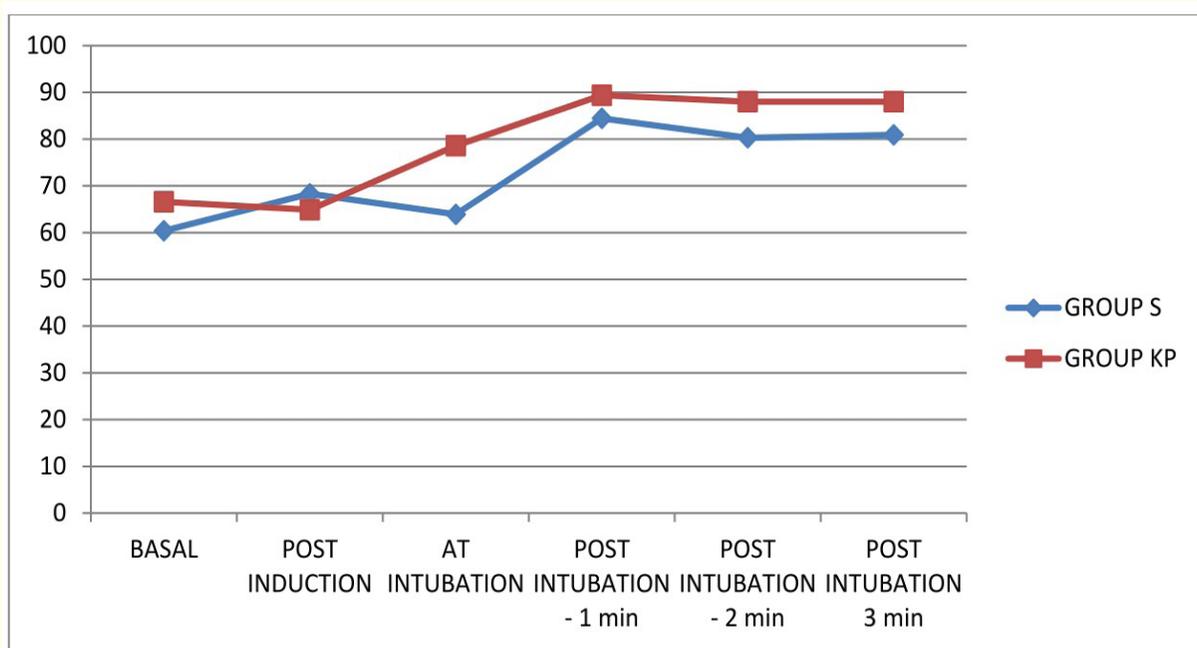


Figure 3

Mean Arterial Pressure

MAP	Group S	Group KP	P-value
Basal	74.7 ± 12.19	80.4 ± 8.77	0.06
Post Induction	81.4 ± 12.50	83.8 ± 12.24	0.06
At Intubation	86.4 ± 9.97	110 ± 16.45	0.01
Post Intubation			
1 Min	84.4 ± 10.33	89.4 ± 8.78	0.37
2 Min	80.3 ± 11.09	88 ± 10.96	0.13
3 Min	80.9 ± 21.41	88 ± 8.61	0.15

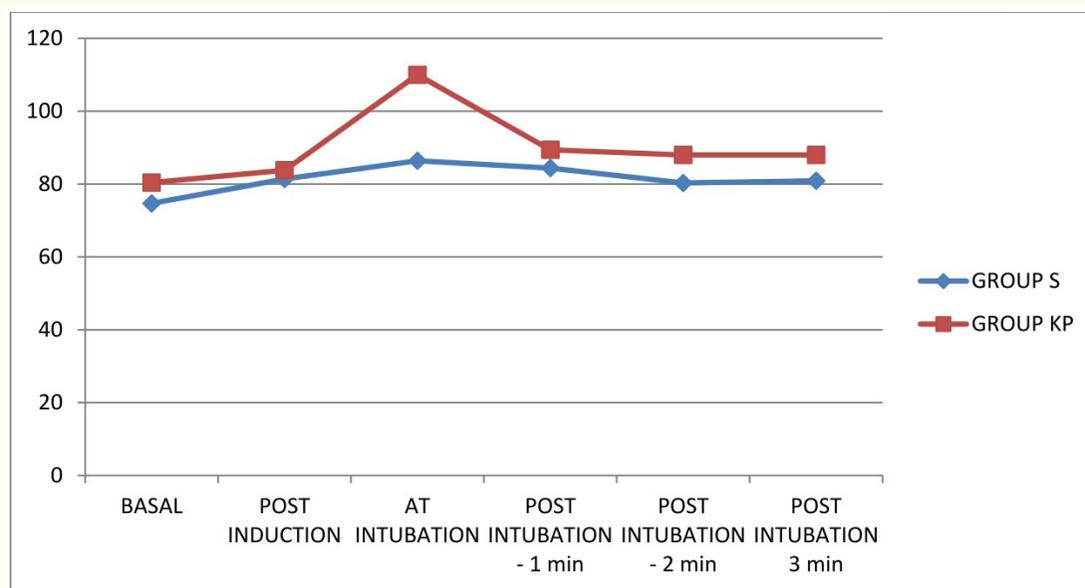


Figure 4

Intubation Score

Parameters	Score			
	1	2	3	4
Jaw Relaxation	Full Relax	Mild Resistance	Tight but can Open	Impossible
Vocal Cord Position	Wide Open	Mid Position	Moving but Open	Closed
Intubation Response	None	Diaphragmatic Movements	Mild/Moderate Cough	Severe Cough

Intubation score: 3/12 in Group S.

Intubation score: 4/12 in Group KP.

Intubation time: 90 seconds in Group S.

Intubation time: 100 seconds in Group KP.

Discussion

All the children had minimal mouth opening but thyromental distance were within normal limits. Children had history of fall from height/tree and they presented for surgery after 5 - 6 months/2yrs when trismus slowly lead to closure of mouth opening, Micrognathia was found to be seen in 80% of the children.

This study showed that with both Sevoflurane and Ketopropofol could be easily used for induction, trachea could be easily intubated by nasal route under spontaneous respiration.

Singh S studied cardiovascular changes during nasotracheal intubation and found both heart rate and blood pressure, increased for 2 minutes post intubation above baseline and heart rate took longer than BP to come to baseline [1].

Holm-Knndsen R., *et al.* reported that combination of nasopharyngeal airway under Sevoflurane induction and fiberoptic guided nasotracheal intubation is very safe to manage the difficult airway [2].

Sevoflurane produces dose related depression of MAP without changes in HR during anaesthesia.

Also consensus appears to favour stepwise approach by slowly increasing Sevoflurane concentration by 1 - 2% after preoxygenation [3].

Small doses of Fentanyl given as premedication before intubation blunts the circulating responses to tracheal intubation at its best [4].

Erb., *et al.* used Halothane to induce children under spontaneous ventilation and found no complication [5].

Kawasaki T., *et al.* studied Fiberoptic intubation was safely performed in patients with TMJ ankylosis, and Tracheostomy was easily avoided [6,7].

Kihara S., *et al.* studied that a silicone basal wire reinforced ET produces less nasal bleeding due to hemispherical bevel and could be easily railroaded over the bronchoscope as in our study also flexometallic ET was used in all the patients [8].

Long TE., *et al.* used epidural catheter via injection port of bronchoscope to give lidocaine 2% as an alternative to translaryngeal bronchoscope/SAGO [9].

Tsubaki., *et al.* found in their study that following induction with 2% Enflurane and O₂:N₂O (50:50%) results in less tachycardia responses during fiberoptic nasotracheal intubation [10].

Thomas Mc., *et al.* studied combination of Ketamine and Propofol for sedation in emergency department to minimize advance effects such as hypotension and respiratory depression [11].

Philips., *et al.* compared Propofol versus Ketopropofol for emergency painful procedure. They found combination was rapid in onset, brief in duration and provide good sedation and analgesia without respiratory compromise. They used Ketamine and Propofol in doses 0.75 mg/kg each [12].

Shah A., *et al.* evaluated use of low dose Ketamine versus Ketopropofol for sedation in children. I/V Ketamine and propofol 0.5 mg/kg each was used as bolus and 0.25 mg/kg every 2 minutes as required [13].

Loh G., *et al.* used low dose Ketamine (1 mg/kg) and Propofol (1 mg/kg) for sedation and analgesia. They found rate of adverse reactions were too low [14].

Minor JR., *et al.* tried propofol versus Ketamine for sedation. Propofol and Ketamine followed by 0.5 mg/kg every 10 minutes till procedure ended. They suggested use of these drugs is safe and effective [15,16].

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