

Airway Block for Interventional Rigid Bronchoscopy..... Pros and Cons

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Abstract: *Introduction:* The patients presented for airway surgery either an elderly patients with coexisting disease or young children for foreign body removal. Multiple challenges for safe anaesthesia in that patient population are available. Block of the superior laryngeal nerves bilaterally, along with translaryngeal injection of local anaesthetic, provides anaesthesia of the airway from the infraglottic area to the epiglottis. Additional topical application of local anesthetic to the oral, along with appropriate sedation, by fentanyl and propofol provides satisfactory analgesia for endoscopic procedures. The glossopharyngeal nerve (i.e., cranial nerve IX) supplies sensation to the posterior third of the tongue, the pharynx, and the superior surface of the epiglottism. *Methods:* The level of sedation was recorded using Ramsay sedation score. The time of the block, duration of the procedure were also recorded. Arterial blood gases (ABG) was withdrawn after the beginning of the procedure and by the end of the procedure and recorded, event of desaturation as well, The operator and the patients' satisfaction were also assessed. After the end of the procedure the patients were admitted to recovery room till gag and cough reflexes regained and by the time the patients were reporting that they became no more feeling numbness, clear fluid were started. *Results:* The mean Duration of procedure, Time of block and Amount of sedation was 44.7 ± 24.06 min, 15.2 ± 3.05 min, and 18.9 ± 10.2 ml respectively. tracheal biopsy was the most common procedure done (40%). In all the patients the Ventilation were Spontaneous and Stable all through the procedure. Arterial blood gases were normal in all the cases. no statistical significance between the depth of the sedation and patients satisfaction but there was statistical significance between the level of the sedation and the operator satisfaction. The mean recovery time from the end of the procedures till the patients fully awake, and hospital stay was 3.5 ± 2.6 min, and 2.2 ± 0.42 hr respectively. No Postoperative complications were recorded. 90% of the Patients were satisfied, while operator satisfaction was 60%. *Conclusion:* Airway block with sedation is a safe and reliable practice for high risks patients scheduled for interventional bronchoscopic procedures on a day case basis.

Keywords: Airway, Local, Block, Complications, Rigid, Bronchoscopy

1. Introduction

Airway manipulation is challenging. It requires high communication skills between the operators and the anesthetists. The anesthetists role doesn't only facilitate the surgery but also to carry oxygen and anesthesia, eliminate carbon dioxide and guarantee a rapid return of consciousness and airway reflexes after surgery [1].

The patients presented for airway surgery either an elderly patients with coexisting disease and malignant lesion with complications of its treatment or young children which may

be with abnormal mentation for foreign body removal. Those patients or their relative usually come with psychosocial burdens because of fear of choking, death and many return for multiple procedures.

Multiple challenges for safe anaesthesia in that patient population with complex co morbidities and marginal pulmonary status include: unavailability and lack of familiarity with specialized equipment, and the need for rapid onset and offset of the effects of anesthetic agents. These challenges occur with each ventilation strategy; however, specific modification of anaesthetic approaches depending on

which strategy is selected [2].

Postoperative care for those patients is crucial as there are multiple risks including laryngeal spasm, aspiration and airway obstruction due to oedema or haematoma formation, those risks necessitate that the equipment for emergency airway access should be available and anaesthetic as well as surgical teams must remain nearby until the patient is ready for discharge.

Difficult airway trolleys should be readily available and it is recommended that one be present in the recovery area and that all the staff be familiar with its contents [1].

Rigid bronchoscopy is almost performed under deep sedation or general anesthesia and requires a standard preoperative assessment; particular attention should be paid not only to the oral cavity, jaw, and neck mobility but to the location, size, extent, mobility of the lesion, the effects on laryngeal function and airway patency. [1]. Basic laboratory tests such as complete blood count, metabolic profile, chest imaging and electrocardiogram should be done before the procedure. Additional testing may be necessary, depending on the patient's medical history [3].

A variety of options are available for ventilating the patient, and selection of an approach should be determined by local expertise, equipment availability, and patient factors that may make one approach more advantageous over another [2].

Several options are available for ventilating the patients including Apneic oxygenation, Spontaneous assisted ventilation, Controlled ventilation (closed system), Manual jet ventilation and high-frequency jet ventilation (HFJV). The selection of the approach should be dependent on the anaesthetist experience, equipment availability and patient factors as well [2].

Supraglottic airway device insertion, direct laryngoscopy and intubation, rigid indirect optical devices. Intubation, tracheotomy and cricothyrotomy are all techniques that can be performed under topical anaesthesia in awake patients [4].

Block of the superior laryngeal nerves bilaterally, along with translaryngeal injection of local anaesthetic, provides anaesthesia of the airway from the infraglottic area to the epiglottis. Additional topical application of local anesthetic to the oral and nasal mucosa, along with appropriate sedation, provides satisfactory analgesia for endoscopic procedures [4].

Nerve blocks produce more profound and longer-lasting anaesthesia than topical anaesthesia. superior laryngeal nerve block created by injection through the thyrohyoid membrane is the least invasive and block the area between the vocal cords and the epiglottis [5].

A translaryngeal block is simple to perform and results in anaesthesia of the trachea below the vocal cords [6]. However, local anaesthetic usually stimulates the cough reflex, and should be avoided when coughing is undesirable [7].

The glossopharyngeal nerve (i.e., cranial nerve IX) supplies sensation to the posterior third of the tongue, the pharynx, and the superior surface of the epiglottis. Careful

aspiration because of proximity of the carotid artery [8].

2. Aim of the Work

This study is to evaluate the efficacy of the airway block as a safe modality for anaesthesia for rigid bronchoscopy as well as the effect on patients discharge.

Sample size and statistics

The study is a Single arm intervention descriptive study. Sample size was calculated using PASS® version 11 program, setting the type-1 error (α) at 0.05, power ($1-\beta$) at 0.8 and confidence width level at 0.1. Results from a previous pilot study showed that the complication rate among cases was 0%. Calculation according to these values produced a minimal sample size of 43 cases.

3. Patient and Methods

The study is a single armed clinical trial descriptive study that was conducted in Ain shams university hospital on 50 patients that were scheduled for rigid bronchoscopy after approval of the ethical committee and informed written consent from the patients in the period from April 2013 to November 2018.

3.1. Inclusion Criteria

1. Age 30- 70
2. BW 70- 100
3. Height 160 – 190 cm
4. ASA II- IV

3.2. Exclusion Criteria

1. Patient refusal to participate in the study
2. Patient refusing the blocks
3. Known hypersensitivity to lidocaine
4. Failure of the block

During the Preoperative visit, the patients were clinically evaluated, laboratory finding was requested, ECG were revised as well as the imaging studies. The Laboratory works were including CBC, liver function, renal function and coagulation profiles. Imaging studies include CXR, CT neck/chest and echocardiography.

The procedure was explained to the patients, the consent was signed and intravenous access was secured.

ASA standard monitors were attached to the patients including 5 leads ECG, NIBP and pulse oximetry.

The patients gargled 5 ml of lidocaine 10% (Rx Debocaine 10%) diluted in 5 ml of distilled water to a total volume of 10 ml for 3 min., after then they spilt out the lidocaine and lay down in a supine position. A 25-gauge, spinal needle bent 1 cm from the distal end is directed laterally into the submucosa along the caudal aspect of the PTP (palatopharyngeal fold). After careful aspiration for blood and cerebrospinal fluid, 2 mL of lidocaine was injected [9].

The patients were sedated by fentanyl 1ug/kg and propofol 0.5 mg/kg. The neck was extended and rotated to the other

side, the hyoid bone displaced laterally toward the other side, and a 25-gauge, 2.5-cm needle is walked off the greater cornu of the hyoid bone inferiorly and advanced 2 to 3 mm. As the needle passes through the thyrohyoid membrane and where a slight loss of resistance was felt, 3 mL of local anesthetic solution (Rx Debocaine 10%) is injected superficial and deep to this structure by this way Superior laryngeal nerve were blocked The block was then repeated on the opposite side. After then 5 ml of lidocaine 2% (Rx Debocaine 10%) were injected through cricothyroid membrane through a 20 G cannula.

With the patient in the supine position, the cricothyroid membrane is located, and a 20-gauge cannula was introduced in the midline. The trocar was withdrawn with the plastic catheter held firmly in place; aspiration of air confirms correct catheter placement. Between 3 and 5 mL of a 5% lidocaine solution is injected rapidly and usually results in a vigorous cough, which aids in spread of the solution within the trachea

The level of sedation was recorded using Ramsay sedation score Table 1. The time of the block, duration of the procedure were also recorded.

Table 1. Ramsay sedation scale.

	Response
1	Anxious or restless or both
2	Cooperative, orientated and tranquil
3	Responding to commands
4	Brisk response to stimulus
5	Sluggish response to stimulus
6	No response to stimulus

Arterial blood gases (ABG) was checked 10 min. after the beginning of the procedure and by the end of the procedure, PH, PaCO₂, PaO₂ were all recorded, event of desaturation as well; The operator satisfaction was assessed by Yes/ No questions.

The oxygen saturation was graded in 3 grades; grade I: 94-100%, grade II: 85- <94%, grade III: <85 and recorded as well

After the procedure, the patients were discharged to the

recovery room till gag and cough reflexes regained. humidified oxygen was administered to all patients to reduce the dryness of the oral mucosa and the inspissations of secretions.

During this period any mishaps were reported including but not limited to aspiration, laryngospasm, airway oedema, local anesthetic toxicity, respiratory distress and bleeding.

4. Results

The mean age was 49.4±14.73 with a range of 32-72 year, 50% were males (table 3). 50% of cases were ASA II and 40% were ASA III (figure 1).

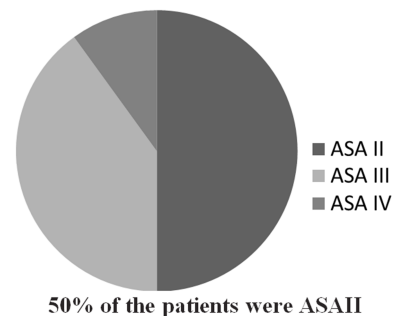


Figure 1. Description of the ASA distribution among the patients population.

The mean duration of procedure, time of block was 44.7±24.06 min, 15.2±3.05 min, respectively as in table 4. 40% of the cases were tracheal biopsy, others were tumor debulking, tracheal stent insertion and tracheal dilatation (20% for each).

The Ventilation was Spontaneous and Stable with a normal arterial blood gases in all of the cases. The oxygen saturation was grade I in 90% of the patients, 8% of the patients were grade II and 2% were grade III.

There was no significant statistical difference between the depth of the sedation and patients satisfaction, but as the depth of the sedation increased the operator satisfaction does (table 2).

Table 2. The relation between the level of sedation and the satisfaction level regarding the patients as well as the operator.

		RSS						P	Sig
		RSS 4		RSS 5		RSS 6			
		N	%	N	%	N	%		
Patient satisfaction	No	0	.0%	0	.0%	5	14.3%	0.598**	NS
	Yes	5	100.0%	10	100.0%	30	85.7%		
Operator satisfaction	No	0	.0%	0	.0%	20	57.1%	0.001*	HS
	Yes	5	100.0%	10	100.0%	15	42.9%		

The mean recovery time (from the end of the procedures till the patients became fully awake), and hospital stay was 3.5±2.6 min, and 2.2±0.42 hr respectively (table 3).

No Postoperative complications were recorded. 90% of the Patients were satisfied, while operator satisfaction was 60%.

Table 3. Description of the post-operative data among cases.

		Mean	±SD	Minimum	Maximum
Recovery time (min.)		3.50	2.64	1.00	10.00
Hospital stay (hr)		2.20	.42	2.00	3.00
Postoperative complication	No (n%)	50	100.0%		
Patient satisfaction	Satisfied (n%)	45	90.0%		

		Mean	±SD	Minimum	Maximum
Operator satisfaction	Not satisfied (n%)	5	10.0%		
	Satisfied (n%)	30	60.0%		
	Not satisfied (n%)	20	40.0%		
Cause of operator dissatisfaction (n=15)	Frequent coughing (n%)	10	20.0%		
	Upward movement of bronchus (n%)	5	10.0%		

Table 4. Description of operative data among cases.

		Mean	±SD	Minimum	Maximum
Duration of procedure (min)		44.70	24.06	17.00	90.00
Time of block(min.)		15.20	3.05	10.00	20.00
Procedure	Biopsy (n %)	20	40.0%		
	Debulking (n %)	10	20.0%		
	Stent (n %)	10	20.0%		
	Tracheal dilatation (n %)	10	20.0%		
Ventilation	Spontaneous and regular (n %)	50	100.0%		
	VD	50	100.0%		
Saturation	I (n %)	45	90.0%		
	II (n %)	4	8%		
	III (n %)	1	2%		
ABG	Normal (n %)	50	100.0%		

5. Discussion

Airway block with sedation is a common practice for flexible fiberoptic bronchoscopy by variable anesthetic agent with a constant oxygen delivery.

This was to ensure a safer practice than the traditional approach by using general anesthesia and the associated airway management that is considered as a true challenge for the anesthetist, especially with the type of the patients scheduled for such a procedure.

A further step toward the patient safety, airway block was examined in our study for rigid bronchoscopy aiming to decrease the ventilatory management as well as airway management.

The study was extended beyond the patient safety to the team safety by decreasing the room pollution that was reported by Paul & Jeremi on using inhalational anesthetic.

The current study could increase the patient satisfaction by decreasing the use of TIVA and the reported increase in the patient awareness during anesthesia with this technique [9].

In positive pressure ventilation, the bronchoscopist has to cover the proximal end each time the anesthetist generate positive pressure with hand ventilation, this impair the ability to go through the procedure and necessitate frequent interruption of the ventilation and subsequent apnea with the associated hypercapnia that couldn't be detected even with the use of end-tidal CO₂ due to excessive leak [10].

Jet ventilation if ever available with the sophisticated setting and the especial need for connection like luer lok connection "to avoid too much slippage" and sampling catheter to frequently measure airway pressure or alternatively use of manual jet ventilation with the high risk for barotraumas and associated pneumothorax or pneumomediastinum and hemodynamic collapse [9, 10].

Painless, comfortable, and peaceful procedures are common targets for both the patients and pulmonologist, several studies are held with a conclusion that sedation

results in less problems compared to procedures that run without sedation [12, 14, 16, 17].

Conscious sedation markedly improves the tolerability of bronchoscopy, but, it does not totally abort cough, choking, pain, and anxiety [15, 18, 19]. In addition, it does not improve the patient cooperation [13, 14], the corresponding association with hypoxic events and bronchoscopy-related mortality (50%) [12, 14]. Positive-pressure ventilation was used to overcome hypoxic event in bronchoscopy [22] as this event of de-saturation, in combination with tachycardia, may result in myocardial ischemia, especially in lengthy procedures [23].

This study was conducted to test the efficiency of airway block with deep sedation as a safe alternative for patients undergoing interventional rigid bronchoscopy. Perrin and colleagues [24] explained their experiment on 124 rigid bronchoscopies in which ventilation was done by using the spontaneous assisted technique. After 3 minutes duration of preoxygenation by mask, anaesthesia was induced by intravenous administration of propofol, phenoperidine, and diazepam or midazolam. Afterwards, ventilation was done manually using high-flow oxygen (FIO₂, 0.6–1.0) through the ventilation port of the bronchoscopy. Anaesthesia was maintained by repeated injections of intravenous anaesthetics, and ventilation was assisted manually in case of prolonged apnea or de-saturation. Perrin and colleagues reported complications in 22 procedures and included severe pre-operative as well as postoperative hypoxemia, bronchospasm, and laryngospasm [24]. In comparison to our study, we found that the arterial blood gases were not changed in almost all of the cases and the oxygen saturation was maintained in 90% of the patients.

In the presented study, the mean time required to block the airway was 15.20 min. and it was covering a procedure lasting up to a mean time 44.70 min. the patients are sedated by using fentanyl and propofol with no evidence of respiratory depression nor haemodynamic instability. The results are against what concluded by the Crawford et al in

the comparison of midazolam and propofol for sedation during rigid bronchoscopy. Crawford et al, reported that propofol is more vulnerable to exceed the desired level of moderate sedation [26]. Moreover, midazolam was found to induce reduction in the mean blood pressure, the respiratory rate, and O₂ saturation especially in elderly patients [27, 28]. This de-saturation event is associated with myocardial insult [22]. Propofol maintain O₂ saturation in elderly patients above 70 years of age [23].

The present study revealed that, the ventilation and the oxygenation were almost unchanged and the patients' satisfaction was 90% in the selected population. The presented approach could provide a safe alternative especially when alternate apnea technique could present a true risk for the patients, as the presented approach was examined on patients ASA II (50%), III (40%) and IV (10%).

On the other side, the presented study showed a lower satisfaction index for operators that is estimated as 60%, that was mainly attributed to the frequent coughing of the patients especially on examining the left main bronchus as well as its tributaries, which could be explained by the poor spread of the local anesthetic in the left bronchus.

The efficiency of the presented approach is extended to the postoperative periods as well, whereas the mean recovery time where 3.5 min. whereas the mean time of the patients' discharge was 2.20 hr with no complication in the population of the patients selected. These results go with the approach as a day case surgery. This in contrast to the study by Ayers & Beamis who found that the Patients requiring high levels of supplemental O₂ and those with baseline hypercarbia and hemodynamic instability are at increased risk for intra- and post procedural complications, and they concluded that risk and benefit of the procedure should be weighed carefully

6. Conclusion

Airway blocks are simple procedure, have a high success rate, and offer significant potential advantages to patients with a high satisfaction. Airway block for rigid bronchoscopy are associated with a low rate of complications. The likelihood of significant long-term morbidity is low.

Airway block with sedation is a safe and reliable practice for high risks patients scheduled for interventional bronchoscopic procedures on a day case basis.

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