

Attenuation of the cardiovascular response during rigid bronchoscope a comparative study using intravenous lidocaine and sublingual glyceryl trinitrate

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Summary:

Background: one of the complications of rigid bronchoscope is the cardiovascular responses that may carry a dangerous drawback during and after the procedure. Prevention and control of these events will be crucial, especially for the old and cardiovascular debilitated patients.

Objective: The study aims to control and attenuate the unwanted hemodynamic responses to the rigid bronchoscope using intravenous lidocaine and GTN.

Method: a study was performed on three groups of patients undergone a diagnostic procedure of bronchoscope. Each group consists of 20 patients at the same age and relatively similar pathology. The three groups (group one, two and three) received lidocaine, glyceryltrinitrate and no drug respectively. The changes in mean arterial pressure, heart rate and rhythm were taken and monitored. Several readings were taken through a five to ten minutes interval and at recovery. The doses are calculated equally for all patients.

Results: marked changes were noticed in mean arterial pressure which has been increased especially during the introduction of the instrument through the trachea. The same were happened for the heart rate, which increased tremendously at the same intervals. The same was applied for the rhythm. Lidocaine has attenuate the change in the rhythm, while the glyceryl trinitrate prevented the high elevation in mean arterial blood pressure more than the other drug did.

Conclusion: Hemodynamic responses to the rigid bronchoscope, can be attenuated and blunted by the usage of anti-arrhythmic drug (lidocaine) and the vasodilator glyceryl-trinitrate, intravenously and sublingual respectively. Lidocaine I.V given 3 – 5 minutes prior to the procedure will protect the heart from grand changes in its rhythm. And to a lesser extent control the high elevation in mean arterial pressure. Glyceryl-trinitrate (GTN). The two drugs successfully attenuate the hemodynamic responses to the tracheal instrumentation by the rigid bronchoscope.

Key words: Hemodynamic responses, rigid bronchoscope.

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Introduction:

Bronchoscope is performed for both diagnostic and therapeutic reason in patient with pulmonary pathology. Diagnostic procedures include not only the direct inspection of the larynx, trachea & bronchus. It also includes the removal of tissues, secretions, brushing & washing for histopathological, viral or cytological studies. Therapeutic bronchoscope includes removal of foreign materials & control of massive bleedings. [1] Indications: The most common indications for performing a diagnostic bronchoscope are the suspicion of bronchogenic carcinoma. Radiological findings suggest the presence of pulmonary tumor or bronchial obstruction as well as cough & hemoptysis. [2] Instruments: A complete set of endoscope instruments is essential. The correct size is one that enters the larynx without causing trauma & yet provides good visibility & working place. In infants & children the subglottic space is narrow and

its tissues tend to well. [1] Ventilation during bronchoscope: Rigid bronchoscope is better performed under general anesthesia.

Ventilation is complicated by the need to share the airway with the surgeon. [17] Fortunately they are often short duration (10 – 15 minutes). One of three techniques can be used; apneic oxygenation with a small catheter alongside the bronchoscope, conventional ventilation through the side arm of a ventilating Bronchoscope & artificial ventilation using an injector which produces a high pressure jet of gas down the tube. [3], [17]

Material & methods:

The place is 9th floor, in the bronchoscope unit at Medical city hospital. Sixty male patients were chosen to undergo diagnostic rigid bronchoscope under general anesthesia. They were 45-65 years of age & classified as ASA1-ASA2, according to the American society of anesthesiologists. The average weight of the patients, (60-80kg) and been presented to the unit with no premedication. Patient criteria of anesthetic

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procedure Preparation: Fully investigated (chest X-ray, ECG, etc.) Previous medical treatment must be continued. Examination of dental status &/or airway assessment for difficult intubations. left sided wide bore cannula, an emergency set of drugs & instrument are available. Premedications: Midazolam (0.05 mg/kg) I.V Pre-induction: Pre-oxygenation with 100% oxygen No medication were given for the first group, lidocaine 1mg/kg I.V & 0.5 mg S/L of GTN was given to the 2nd & 3rd groups respectively. Induction: 5 mg/kg I.V thiopentone with 0.5 % halothane. Intubation of bronchoscope: Suxamethonium 1-1.5mg/kg I.V Maintenance of anesthesia: Manual ventilation with Mapleson A circuit. 1% - 1.5% halothane & repeated doses of Suxamethonium (one tenth of the initial dose). Time of the procedure: 10 – 15 minutes & was performed by the same surgical team. Patients were divided into three groups, each group consists of (20) patients. The first group received no medications and has considered as a control group. The other group received lidocaine 1 mg/kg intravenously 2-minutes before induction. A third group has been considered a GTN group & received 0.5 mg sublingual glyceryl trinitrate (GTN) five minute before induction. All patients have been examined before being presented to the Bronchoscope unit & a base line of their clinical values were taken.

Anesthetic management: Preoxygenation was performed before induction for five minutes with 100% oxygen using Mapleson A circuit & spontaneous mask ventilation. By this time 0.05 mg/kg of midazolam I.V was given as a pre-induction & to insure sedation. Induction of anesthesia: Intravenous induction using sodium thiopental 5mg/kg, with halothane 0.5% through a Drager vaporizer. After being asleep the patient received 1 – 1.5 mg/kg of depolarizing muscle relaxant Suxamethonium to facilitate intubation of the bronchoscope. Once the instrument being inside the trachea, manual ventilation was initiated by attaching the breathing circuit (Mapleson A) to the bronchoscope side arm. Anesthetic machine was delivering a flow rate of gases at 30 l/min. tidal volume was achieved at 10 ml/kg as it was monitored via a spirometer attached to the expiratory limb of the anesthetic circuit. Minute ventilation was calculated to be 7 – 9 ml/kg. Maintenance of anesthesia was continued with halothane 1% - 1.5% & repeated doses of Suxamethonium (one tenth the initial dose for each added dose). Rarely more than two added doses were needed for each procedure. Monitoring: ECG monitoring using three leads system (CM5), heart rate, rhythm or ischemic changes can be detected immediately. Strips of recorded ECG were taken to document every change appeared on the monitor screen.

Oxygen saturation (SpO₂) monitors using pulse oximeter, to keep it above 95% & to detect any hypoxia that may arise during the apneic intervals of the procedure. Adequacy of ventilation was monitored by the capnograph to maintain CO₂ level around 35 – 45 end-tidal mmHg. Non-invasive blood pressure measurement was undertaken with pneumatic automatically inflating cuff & the readings were recorded at intervals. Each reading consists of systole, diastole & mean BP as well as heart rate & rhythm. Recovery from anesthesia was carried on the lateral position; the patients were observed & checked till they have regained their full consciousness. 10 – 15 minutes were needed for each procedure, rarely more than 20 minutes. All were performed by the same surgical team. Statistical analysis was performed using Microsoft Excel XP edition (2002) with interpretations according to the references at the end of the project.

Table1: Patient's data & their base line values

DATA	CONTROL	LIDOCAINE	GTN
Number of patients	20	20	20
Gender	Male	Male	Male
Weight	70 – 85 kg	70 – 85 kg	70 – 85 kg
Age	40 – 50 yr	52 – 60 yr	55 – 65 yr
Heart rate	85 +/- 5 bpm	72 – 85 bpm	90 – 93 bpm
BP.(mean)	104 mmHg	119 mmHg	110 mmHg
Rhythm	Sinus	Sinus	Sinus

Results:

As the data that been collected from the control group it is obvious that there were a lot of responses in blood pressure, heart rate & rhythm have been noticed (shape 1). There was a decrease in mean blood pressure precisely after induction of anesthesia, which represents the sedative & hypnotic effects of anesthesia & pre-induction midazolam. After intubation the pressure starts to elevate reaching maximum level after two minutes & continued elevated till the bronchoscope got extubated. Normal or base line readings of blood pressure were gained 5 – 10 minutes later. Heart rate behaved the same manner, as there was a slight decrease after induction, but it increased abruptly after introduction of the instrument. This tachycardia sometimes stayed also through out the procedure. Arrhythmias ranging from ventricular ectopic beats to ventricular bigemini have been recorded in 17 patients (about 85%) out of 20. those ectopics recorded mainly after 1 – 2 minutes of

intubation, they have been disappeared after that for a while as anesthesia got deeper level & to be recurred again when the patient has been awoken after 10 – 15 minutes.

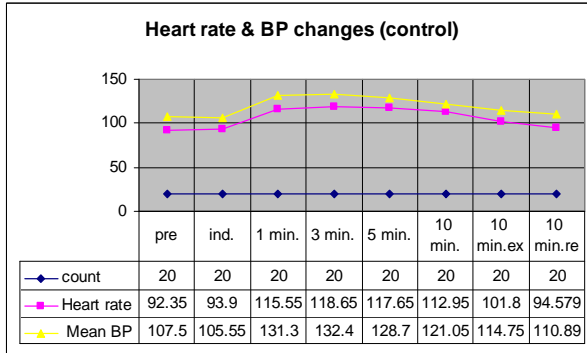


Figure 1: Studying the data from the second group revealed the effect of lidocaine on blood pressure, which has no much control on it.

After induction the pressure has decreased because of same reasons as the control group. Still there was an elevation in the pressure immediately after introducing the bronchoscope, although to less extent than the control group as it is shown in figure 2.

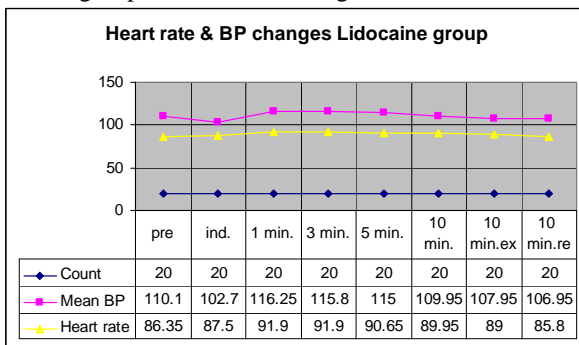


Figure 2: GTN possessed a much control on the pressure than lidocaine; it has blunted the presser response to the bronchoscope keeping it within normal levels.

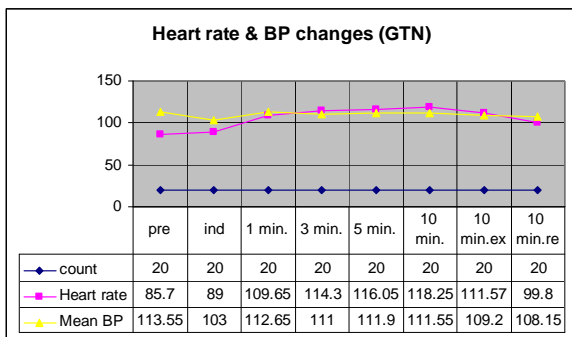


Figure 3: demonstrates the responses of heart rate & BP when using GTN.

In figure 3 as it is clear, the heart rate increased tremendously reaching its peak 3 minutes after introducing the scope among the control group. The same happened with the GTN group, as it couldn't attenuate the response. Lidocaine showed marked stabilization of heart rate keeping it near the base line levels. These results indicate a superior control of lidocaine on heart rate to GTN. Regarding the rhythm, shape 4 demonstrates the ability of lidocaine to control arrhythmia. It showed that three patients out of 20 (85%), had arrhythmia during induction and intubation (1 – 2 min after intubation). There were 10 – 13 patients out of 20(50% - 65%), who manifested arrhythmia in the GTN group. This also indicates the superior action of lidocaine to that of GTN in controlling cardiac arrhythmia during tracheal instrumentation.

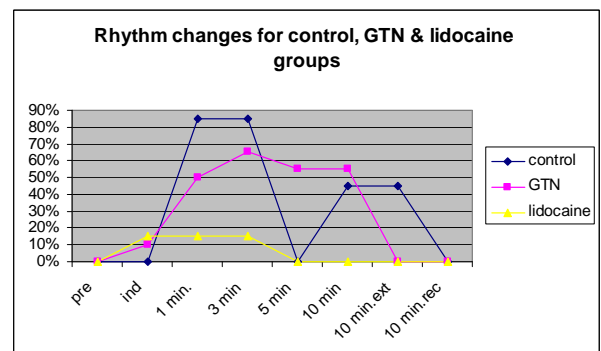


Figure 4:

Statistics:

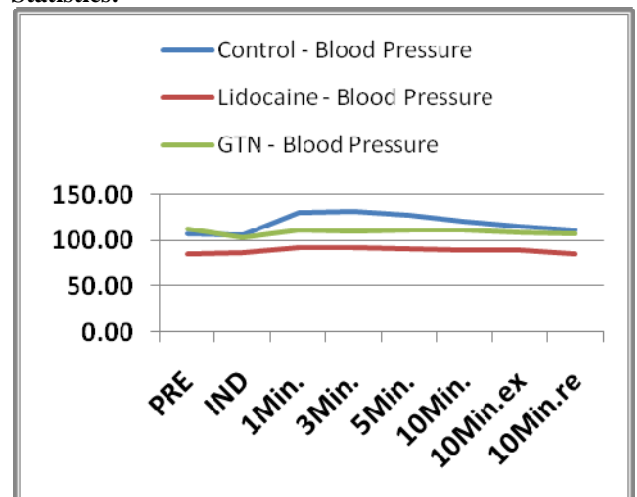


Figure (5): Line – chart of Blood Pressure for different of the studied groups along several periods

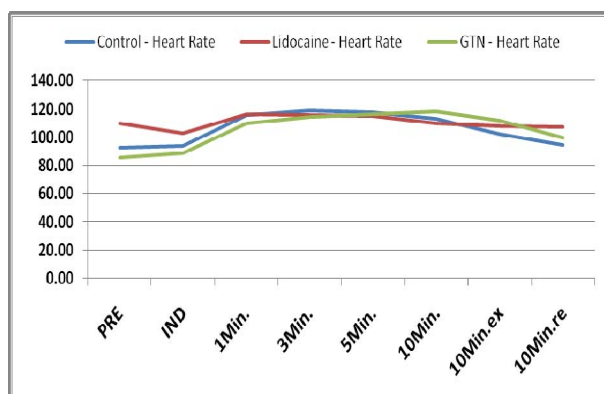


Figure (6): Line – chart of Heart Rates for different of the studied groups along several periods

Graphical presentation through line – chart for the Blood pressure along the studied periods in figure (1) showed that the three groups (Control , Lidocaine , and GTN treatments) had been represents a non coincidental responding specially with those treated by Lidocaine wherefrom the beginning period of (pre time) up to the final period at (10 Min. re) of the final continuation observance of the studied cases which recorded clarity down points along the whole periods . In addition to that, GTN group showed slow deviation compared with control group with a positive /or successes responding registered with GTN group. According to the obvious discussion, we concluded that the behavior of those having /or treated by Lidocaine got a beast result compared with the two others different groups which recorded the same reaction approximately. Graphical presentation through line – chart for the Heart Rates along the studied periods in figure (2) showed that the three groups (Control, Lidocaine, and GTN treatments) had been represents coincidental responding specially from the period of 1Min. to the final continuation observance of the studied cases. According to the obvious discussion, we concluded that the behavior of the three different groups recorded the same reaction approximately.

Table (2): Summary Statistics for of Blood Pressure readings for the studied groups along several periods

HR	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control Heart Rate	119.02	3.84	109.94	128.10
Lidocaine - Heart Rate	89.13	0.84	87.14	91.13
GTN Heart Rate	110.13	1.19	107.31	112.94

In table (2) the compact form for the several periods of censored individuals of the Blood Pressure indicator according to some summary statistics had been represented for the three studied groups. The results showed that the best responding were pointed with those of treated with Lidocaine which full inside normal interval, then followed with those of treated with GTN and finally the control group recorded too highly bad grade of the studied indicator.

Table (3): Multiple comparison among different groups of Blood Pressure indicator

HS: Highly Significant at $P < 0.01$; S: Significant at $P < 0.05$

GTN	Lidocaine	Control
	(0.000) HS	
(0.033) S		
(0.000) HS		

In order to take our decision about testing the statistical hypothesis which says that a non statistical differences among the three groups through the Blood Pressure criteria would be , multiple comparison by LSD of repeated measurement method applied , which indicating that a highly significant at $P < 0.01$ was obtained between Control and Lidocaine groups , then followed with a significant at $P < 0.05$ was recorded between control and GTN groups and finally a highly significant at $P < 0.01$ was pointed between those of having Lidocaine treated and GTN group with a successful treated with the first group .

Table (4) Summary Statistics for of Heart Rates readings for the studied groups along several periods

HR	Me an	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Control Blood Pressure	105.93	4.04	96.37	115.49
Lidocaine Blood Pressure	110.59	1.70	106.57	114.61
GTN Blood Pressure	105.54	4.44	95.05	116.03

In table (4) the compact form for the several periods of censored individuals of the Heart Rates indicator according to some summary statistics had been represented for the three studied groups. The results showed that the three groups (Control , Lidocaine , and GTN treatments) had been represents coincidental responding specially with those of treated with Control and GTN groups which full inside the same interval , then followed with those of treated with Lidocaine .

Table (5): Multiple comparison among different groups of Heart Rates indicator

GTN	Lidocaine	Control
	(0.138) NS	
(0.866) NS		
(0.213) NS		

NS: Non Significant at $P > 0.05$

And in order to take our decision about testing the statistical hypothesis which says that a non statistical differences among the three groups through the Heart Rates indicator /or criteria would be , multiple comparison by LSD of repeated measurement method applied , which indicating that a non significant at $P > 0.05$ was obtained between Control and Lidocaine groups , then followed with a non significant at $P > 0.05$ was recorded between control and GTN groups and finally a non significant at $P > 0.05$ was pointed between those of having Lidocaine treated and GTN group with a non advantage of treated with any group compared with others .

Discussion:

The frequent occurrence of the cardiovascular reactions to the tracheal intubation or instrumentation (in our concern, bronchoscope) has to be watched & monitored. The reason behind that are the occasional reports of sudden deaths that. [4] follow immediately after intubation & the increase awareness that the common appearance of hypertension & arrhythmia after the routine procedure may be potentially dangerous (Prys. R C). This is especially true in hypertensive patients & in those with coronary or cerebral vascular insufficiency as (Prys.) studies. [1] These studies have shown excessive swing of blood

pressure in hypertensive patients accompanied by ECG evidence of prolonged ischemia in some. In a study from St.Save hospital, about cardiovascular & metabolic responses to tracheal intubation, in 24 unpremedicated patients & free from cardiovascular diseases. The study has shown marked increase in oxygen consumption & CO₂ production accompanied with an increased in heart rate and systolic blood pressure. A relatively deep level of anesthesia must be established to block the cardiovascular responses. Since this may not be tolerated by many patients, drugs that tend to attenuate these responses to airway instrumentation of anti-hypertensive's or anti-arrhythmics are to be used (Miller). Lidocaine I.V in a bolus of 1.5mg/kg that is minimally depressive to the cardiovascular system, a variety of anti-hypertensive agents have also been used to diminish blood pressure & heart rate response to intubation. These include Beta-adrenergic blockers, clonidine, captopril & nitroglycerine (Miller). Abou – madi MN, kaszler – H yacoub studied the efficacy of (0.5mg/kg & 1.5mg/kg) lidocaine I.V to attenuate the cardiovascular reflexes associated with laryngoscope & tracheal instrumentation. They have shown that 1.0mg/kg does afforded complete protection against cardiac arrhythmias of all types. [9] The small dose was ineffective in this respect. Larger doses cause borderline protection against hypertension & tachycardia; the smaller doses prevent only the rise in blood pressure (C.A Soc J 1977). While in a study done by Miller – CD in 1990 on (45) patients of ASA₁ & ASA₂ showed that I.V lidocaine failed to attenuate the cardiovascular responses to the direct laryngoscope and tracheal intubation (BJA, 1990 Aug). [9] Gallagher – JD, Moor – RA, has shown the effect of prophylactic usage of GTN infusion, in attenuation of cardiac responses to tracheal intubation and sternotomy. Mean arterial pressure was significantly lower after intubation in the group of patient receiving GTN (Gallagher – JD). [9] Regarding our study, two drugs were used to attenuate the cardiovascular reflexes to rigid bronchoscope, lidocaine & GTN (using the same anesthetic techniques & medications). Their effects have been compared with each other and with the control group. Lidocaine has shown significant control of both blood pressure and cardiac rhythm. A close look to the lidocaine group shows moderate control of blood pressure (as some high readings can be noticed obviously).While it has optimum control to the heart rate & rhythm. Shape 3 in the previous pages demonstrates the maximum appearance of arrhythmia during intubation being higher among the control group, next to it was the GTN & the least incidence of arrhythmia in the lidocaine group. On the other hand GTN preserved the level of BP within its baseline readings which indicates a complete stability, reflecting its action

mainly upon the vascular bed. Still there was a more descend in the pressure after induction and before intubation, this is most probably due to potentiation of hypotensive effect of the drug and the sedative action of anesthesia. Reflex tachycardia has been manifested with the action of GTN, figure 2 revealed the increasing rate after induction that had stayed even after extubation. Both drugs were proven to attenuate the hemodynamic responses with varying degrees, but it seems that lidocaine possessed more pronounced control than GTN.

Conclusion:

Both drugs have succeeded in the attenuation of the cardiovascular reflexes to the rigid bronchoscope with

varying degrees: lidocaine had attenuated responses of blood pressure & cardiac rhythm when was used in a dose of (1mg – 1.5mg/kg) I.V given one minute before induction. Heart rate & rhythm were kept stable with the pressure was prevented from being elevated to dangerous levels. GTN had attenuated the presser responses to a great extent maintaining a normal blood pressure through out the procedure when it has been used in a dose of (0.5mg) sublingual five minutes before. There was no significant control of heart rate & rhythm. lidocaine was proved to have better controlling effects on the hemodynamic responses than GTN.

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