Research Article

Controlling hemodynamic response to laryngoscopy and intubation using bispectral index monitoring

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Abstract
Introduction: Hemodynamic stability is one of the main goals of any anesthesiologist. **Aim of the work:** The aim of this study is to evaluate the effect of two different adjuvants (fentanyl and magnesium sulphate) on hemodynamic response and arousal reactions as indicated by BIS values following laryngoscopy and endotracheal intubation, and to detect the related side effects. **Patient and methods:** After approval of the university ethical committee and obtaining informed consent from all patients, this prospective randomized double-blind controlled study was conducted in El-Minia university hospital during the period form may 2017 to December 2017. A total of 60 adult female patients, between 20 and 60 years, American society of anesthesiologists grade I and II patient scheduled to undergo elective surgery under general anesthesia with endotracheal intubation were included in the study. **Results:** Demographic data of the three studied groups were comparable. **Discussion:** Endotracheal tube remains the gold standard airway device for securing the airway during general anesthesia . however, laryngoscopy and intubation is associated with hemodynamic stress response manifested as tachycardia, hypertension and a variety of cardiac arrhythmias in addition to those hemodynamic changes, arousal reactions as indicated by increase the BIS values also occur with laryngoscopy and intubation. **Summary and conclusion:** This prospective randomized controlled study was conducted in El-Minia university hospital during the period from May 2017 to December 2017.
Key words: Fast fourier transform, Fibreoptic bronchoscope, Glidescope video laryngoscope

Introduction
Hemodynamic stability is one of the main goals of any anesthesiologist. The main cause of transient hemodynamic instability and interruption of airway reflexes is laryngoscopy and intubation (Koju and dongol, 2014).

Pressor response can include a 40-50% increase in blood pressure, a 20% incurease in heart rate, and an elevation of both epinephrine and norepinephrine levels. These effects usually occur within thirty seconds of intubation and last less than ten minutes (Channaiah et al., 2014)

The magnitude of the response is with increasing force and duration of laryngoscopy. The elevation in arterial pressure typically starts within five seconds of laryngoscopy, peaks in 1-2 min and returns to control levels within 5 min (Sajith et al., 2012).

The rise in heart rate and boold pressure in usually transient, variabke,, and unpre-dictable average increase in heart rate has been reported to be 23 beats and increase in boold pressure by 53/54 mmHg and decrease in the left ventricular ejection fraction by approximately 20% although such a response would likely be tolerated by healthly patients, these changes may be associated with myocardial ischemia and cerebral haemorrhage in those with a significant coronary artery or cerebro-vascular diseases. Arousal reactions as indicated by increase in the BIS values also occur with laryngoscopy and intubation (Kumar et al., 2016).

As regard hemodynamic reponse, variouse pharmacological agents were used to abolish the pressor response associated with laryngoscopy and endotracheal intubation such as lignocaine, fentanyl (Malade and

sarode, 2007) alfentanil, remifentanil (Habib et al., 2002), nifidipine (Kumar et al.,1993), beta-blockers (Ugure et al., 2007), gabapentin (Kumair and pathania, 2009), magnesium sulphate (Ashton et al., 1991) or a 2 agonists as dexmedetomidine (Sulaiman et al., 2012), with varying effects.

As regard arousal reactions, little study has been performed on how adjuvants for blunting the tracheal response might be influential on the change in BIS or not. One of these adjuvants is esmolol (Menigaux et al., 2002). Shin et al., (2007) has compared the effect of lidocaine, fentanyl, nicardipine and esmolol on bispectral index responses after intubation.

Magnesium sulphate produces hemodynamic effects on normal human heart where magnesium (Mg) as a calcium antagonist reduces myocardial contractile force. Magnesium also produces vasodilatation by directly acting on the blood vessels and by interfering with a wide range of vasoconstrictor substances (Vigorito et al., 1919). An important study by James and his colleagues (1989) revealed that intravenous magnesium sulphate inhibits catecholamine release associated with tracheal intubation.

Fentanyl, the short acting opioid analgesic is also very effective in attenuating the cardiovascular, hormonal and metabolic responses and inhibiting the catecholamine release to stress response like surgical stimuli, laryngoscopy and intubation (Dahlgren and Messeter, 1981).

Aim of the work

The aim of this study is to evaluate the effect of two different adjuvants (fentanyl and magnesium sulphate) on hemodynamic response and arousal reactions as indicated by BIS values following laryngoscopy and endotracheal intubation, and to detect the related side effects.

Patient and methods

After approval of the university ethical committee and obtaining informed consent form all patients, this prospective randomized double-blind controlled study was conducted in El-minia university hospital during the period from May 2017 to December 2017. A total of 60 adult female patients, between 20 and 60 years, American society of Anesthesiologists grade I and II patients scheduled to undergo elective surgery under general anesthesia with endotracheal intubation were included in the study.

Exclusion criteria:

Patient with suspected difficult airway
Cardiovascular diseases such as coronary artery disease, congestive heart failure, arrhythmias or atrio ventricular block of any degree.
Morbid obesity (body mass index >35 kg/m2).
Known drug allergy to the study drugs.
Renal failure of any degree.
On beta blockers or calcium channel blockers.

Preoperative assessment and preparation:

A careful medical history was taken from the patients. Then, general examination including (heart rate, blood pressure and respiratory rate) and physical examination including (chest, heart and abdomen) were done and routine and relevant special laboratory investigations (complete blood count (CBC); prothrombin time and concentration (PT&PC); partial thromboplastin time (PTT); bleeding time (BT); clotting time (CT) and liver function tests) were carried out. In addition, airway assessment was performed to exclude suspected difficult intubation. Patients were instructed to fast for 6 hours for solid foods and 2 hours for water and clear liquids.

Results

Demographic data (table 1).
Demographic data of the three studied groups were comparable.

Table (1):demographic data of the studied groups

variables	**Fentanyl group N=20**	**Magnesium Sulfate group N=20**	**Control group n=20**	**p-value**
Age (years) mean±SD	5.6±30.1	28.1±5.9	28.2±5.5	0.480
Weight (kg) Mean ±SD	81.5±6.7	77.2±81	77.7±8.3	0.178
ASA				
Grade I	17(85%)	18(90%)	19(95%)	0.547
Grade II	3(15%)	2(10%)	1(5%)	

Discussion

Endotracheal tube remains the gold standard airway device for securing the airway during general anesthesia. However, laryngoscopy and intubation is associated with hemodynamic stress response manifested as tachycardia, hypertension and a variety of cardiac arrhythmias in addition to those hemodynamic changes, arousal reac-tions as indicated by increase the BIS values also occur with laryngoscopy and intubation (Sebastian et al., 2017).

As regard the hemodynamic response, it is usually transient, variable, and well tolerated by most patients. However, in patients with cardiovascular or cerebral diseases, these hemodynamic changes may have detrimental effects such as left ventricular failure, pulmonary oedema, myocardial infarction or cerebral haemo-rrhage (Sebastian et al., 2017).

Many pharmacological agents have been tried to obtund the sympathetic response to laryngoscopy and intubation such as intravenous magnesium sulphate (Saroi et al., 2016), lidocaine (Gulabani et al., 2015), opioids (Habib et al., 2002), nitroglycerine (Sharma and Singh, 2015), calcium channel blockers such as nifedipine and diltiazem (Kumar et al., 2003) , β blockers as esmolol (Koju and Dongol, 2014), and α2 receptor agonists as dexmedetomidine (Selvaraj and Manoharan, 2016).

Topical lidocaine anaesthesia, as in a study by stoelting (1978) is contraindicated in patients with full stomach, while intra-venous lidocaine is found to reduce the incidence of dysrhythmias only with minimal effect on blood pressure response to tracheal intubation as seen in study by Mounir et al., (1997).

Antihpertensive agents like sodium nitroprusside are potent agents and require continuous intra-arterial blood pressure monitoring (Stoelting, 1980).

Recommendation

We recommend that either magnesium sulphate or fentanyl can be used to attenuate hemodunamic response to larynx-goscopy and intubation. Magnesium sulphate can be used more widely as it is available and its procurement is easier than fentanyl due to rigid narcotic regulation. However, we recommend use of fentanyl in patients with ischemic heart disease, hypertension, cardiac valvular diseases or cerebrovascular disease as fentanyl gives more tight hemodynamic control after intubation than magnesium sulphate.

We encourage further studies to find the correlation between the changes in hemo-dynamics and BIS values after intubation in special high risk groups.

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