

## Asystole During Airway Manipulation In Neurosurgical Patient: Causes And Management

Research Article

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## Abstract

Hemodynamic disturbances in neurosurgical patients may be attributed by various neurogenic causes mainly raised intracranial pressure (ICP); however, cardiovascular perturbations during airway management in such patients add more concern and results in a diagnostic dilemma. In this article we have highlighted a case along with review of literature on severe cardiovascular changes during airway management in neurosurgical patients

**Key Words:** Asystole; Laryngoscopy; Neurosurgery.

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## Introduction

Airway management remains one of the greatest challenges for anesthesiologist. Airway manipulation during laryngoscopy and intubation may normally produce sympathetic stimulation and in turn cause hypertension and tachycardia [1,2]. However, in certain group of patients (pediatric), these maneuvers may produce bradycardia and other catastrophic consequences [3].

Hemodynamic disturbances in neurosurgical patients may be attributed by various neurogenic causes mainly raised intracranial pressure (ICP); however, cardiovascular perturbations during airway management in such patients add more concern and results in a diagnostic dilemma. Although rare events, these may produce catastrophic consequences if not vigilantly monitored. In this article we have highlighted a case along with review of literature on severe cardiovascular changes during airway management in neurosurgical patients.

## Methods

We have performed Pub Med, Scopus, Web Science and Google

search [1 January 1970 – 30 June 2013] by using various terms including 'Bradycardia', 'Asystole', 'Laryngoscopy', 'Intubation', 'Neurosurgery' and 'Airway management'. We have included all papers (original article, case series, case reports and letters) in any language which specifically discussed the issue.

Severe cardiovascular changes- We have defined severe cardiovascular changes as any event of bradycardia (HR < 40 / min) and / or Asystole (> 10 second) for the inclusion criteria.

Exclusion criteria- Pediatric patients are not included in this review.

## Exemplary Case

A middle aged male patient with left sided hemi facial spasm was scheduled for microvascular decompression (MVD) surgery. He was otherwise healthy and not on any medications. On airway examination, patient had Mallampati grade III and short neck. Routine blood investigations were within normal range. Left radial artery was cannulated under local anesthesia. In view of a potential difficult airway, a C-MAC video-laryngoscope was immediately available. The patient was well pre-oxygenated with 100 % for 5 minutes and end tidal oxygen was achieved at 0.8. Baseline HR was 58 / min and BP 140 / 82 mm Hg. The patient was induced with remifentanyl [bolus 0.4 mcg / Kg x 3 times], propofol 2.5 mg / Kg and Suxamethonium (1.5 mg / kg with pre induction rocuronium- 5 mg). Direct laryngoscopy revealed a grade IV view, therefore immediate C-MAC blade was used and patient was successfully intubated with 8.0 mm cuffed flexometallic tube. However, during laryngoscopy and intubation, patient developed severe bradycardia (< 40 / min) and asystole (12 seconds). Due to persistence of bradycardia (for > 1 minute), intravenous atropine 0.6 mg was given and heart rate reverted back to normal and no S-T segment changes were evident. Urgent blood gas revealed no abnormalities. The remainder of the intraoperative course was uneventful.

## Review of Literature

Though there are few reports which highlighted the severe car-

diovascular changes during airway manipulation but all these were reported in non-neurosurgical procedures [4-7]. Most of the procedures were related to micro-laryngeal surgery and suspension laryngoscopy. However, only one report addressed this issue in neurosurgical patient [8]. In this report, an 18-year-old male patient, who was diagnosed as a case of obstructive hydrocephalus (suprasellar tumor), was scheduled for ventriculo-peritoneal shunt placement. Sudden severe bradycardia (HR < 35 / min) was noted at the time of laryngoscopy and the laryngoscope blade was immediately withdrawn. Similar events occurred twice, after which the author gave a 30 mg bolus of propofol and hyperventilated (PaCO<sub>2</sub> = 28 mmHg) and the patient was successfully intubated without any further significant change in the heart rate.

## Discussion

Laryngoscopy and intubation leads to an average increase in blood pressure of 40 to 50%, and a 20% increase in heart rate. These changes are due to sympathetic and adrenal stimulation, which may also result in some arrhythmias [2]. The pharyngeal mucosa from the Eustachian cushion to the middle level of aryepiglottic fold, except the laryngeal surface of epiglottis, is innervated by the glossopharyngeal sensory fibers, whereas the laryngeal sensory fibers innervate between the apex of epiglottis and the level of the first tracheal ring in the larynx and between the middle level of aryepiglottic fold and the caudal end of piriform sinus in the pharynx [9]. On the other hand, in certain group of patients, especially pediatric, who have pre-existing higher vagal tone or patients on B-blockers, may manifest bradycardia and even asystole during airway manipulation. Use of repeated doses of suxamethonium has also been linked with bradycardia and mainly reported in pediatric patients [3]. The other factors which may predispose to adverse cardiac events include hypoxemia, hypercarbia, pre-existing cardiac conduction disorders and other cardiac diseases, use of potent opioids, volatile induction and acid-base / electrolytes disturbances [10].

Neurosurgical patients - Investigators have demonstrated a rise in ICP during laryngoscopy and intubation. In a study of 12 neurosurgical patients [6-tumors, 3-metastasis, 3-aneurysm], all patients had rise in ICP; therefore, patients with subtle ICP issues or pre-existing raised ICP may experience a dramatic rise in ICP leading to a Cushing reflex [11]. This reflex may lead to severe hemodynamic changes including bradycardia and asystole. As well, during induction and periods of apnea carbon dioxide levels can rise and worsen increases in ICP. In our case, there were no signs of raised ICP; however, combination of propofol, remifentanyl and suxamethonium may cause bradycardia due to negative chronotropic effect on heart [10]. But sudden asystole during laryngoscopy and intubation is highly unlikely. Study on patients with hemi facial spasm (n=18) showed the presence of sinus bradycardia in all cases, which, were found to be neurogenic in nature and was attributed to vagal nerve compression [12]. In these patients, there was compression of both facial and vagus nerve at root entry zone (REZ) by intracranial arteries. Interestingly, there was substantial improvement in the heart rate within a

few days following the operation. Therefore, we hypothesize that in our patient, this phenomenon might have produced higher vagal tone and the use of anesthetic drugs added to this vagal tonicity and produced catastrophic events (bradycardia and asystole) during laryngoscopy and intubation.

## Management

Airway manipulation in patients with raised ICP should be managed cautiously. Adequate preoxygenation, smooth intubation and additional boluses of propofol coupled with mild to moderate hyperventilation before intubation, should be instituted [8,11]. Although transient, persistence of bradycardia warrants intravenous atropine. Premedication with anticholinergic medications may be an option for patients who have pre-existing vagal tone (HR<60 / min); however there is no substantial evidence and unwanted tachycardia, hypertension as well as arrhythmias can be precipitated.

This is the second reported case of severe cardiac perturbation during airway manipulation in neurosurgical adult patient. Pre-existing higher vagal tone seems to be most important risk factor for such an event; therefore, careful planning and vigilant monitoring is required during the airway manipulation in such cases. Intravenous anticholinergic medication should be used for persistent changes.

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