Hemodynamic complications during microlaryngeal surgery

Marinov Ts.¹, M. Belitova¹, T. Popov², N. Nizamova², J. Rangachev², D. Popova²

¹Department of Anesthesiology and Intensive Care;

University Hospital "Queen Giovanna"– ISUL; Medical University – Sofia

²Department of ENT Surgery; University Hospital "Queen Giovanna"– ISUL;
Medical University – Sofia

Abstract:

Introduction: Successful anesthetic management of microlaryngeal cases requires a high degree of cooperation with the surgeon, a reciprocal understanding of the potential problems, and adequate preparation on both sides to meet the anticipated challenges that may arise. The **Aim** of the study is to determine the hemodynamic complications during microlaryngeal surgery. **Materials and Methods:** A 5-year prospective cohort study of 200 patients who underwent microlaryngeal surgery in the Department of ENT Surgery; University Hospital "Queen Giovanna"– ISUL; Medical University–Sofia. All patients were monitored and recorded for: Systolic blood pressure (SBP), Diastolic blood pressure (DBP); heart rate (HR); continuous electrocardiography (ECG). The above parameters were recorded and analyzed at predetermined time intervals: 5-th minute before intubation, every 5 minutes after intubation and 5-th minute after extubation. **Results and discussion:** Mean systolic blood pressure of the patients during the operation is 147.33 mmHg, mean diastolic blood pressure is 93.5 mmHg and mean pulse rate is 57.64 beats per minute. 49% of the patients have arterial hypertension I grade during the operation, 28% of them are with isolated arterial hypertension and 23% are with normal blood pressure. 40% of the patients had pulse rate between 45-60 beats per minute during putting on the tube of Kleinsasser, 29% of them had pulse rate>60 beats per minute during putting on the tube of Kleinsasser and 31% had pulse rate<45 beats per minute during putting on the tube of Kleinsasser. **Conclusion:** Microlaryngeal surgery is specific kind of surgery which is characterized by hypertensive hemodynamic. There is a risk of severe bradycardia after putting on the tube of Kleinsasser which can cause hemodynamic instability and even cardiac arrest if not corrected immediately.

Key words: microlaryngeal surgery, hemodynamic complications, hypertensive hemodynamic, bradycardia

Introduction

Successful anesthetic management of microlaryngeal cases requires a high degree of cooperation with the surgeon, a reciprocal understanding of the potential problems, and adequate preparation on both sides to meet the anticipated challenges that may arise.^{1,2} Thorough appreciation by the anesthesiologist of the complexity of the upper airway anatomy, the pathologic process involved, and all steps of the surgical procedure is necessary for devising a rational anesthetic plan and maintaining a good working relationship with the surgeon.³ The expert ability to safely share the patient's airway with the surgeon, in conjunction with an intimate knowledge of possible immediate intraoperative and early postoperative complications of laryngeal surgery, greatly contributes to safe patient management in the perioperative period. Microlaryngeal surgery encompasses a wide range of laryngeal procedures that can be organized in two broad categories: phonosurgery (i.e., benign and malignant vocal cord lesions, laser laryngeal surgery, and vocal cord augmentation) and laryngeal framework surgery (i.e., vocal cord paralysis and motion disorders, scarring, stenosis of the glottic, subglottic, and tracheal areas, and laryngeal trauma). Patients presenting for microlaryngeal surgery may have a variety of comorbidities contributing to their voice symptoms and affecting anesthetic management. Changes in voice quality can be exag-

generated by inadequate airflow production (e.g., chronic obstructive pulmonary disease [COPD]) or vocal fatigue caused by neuromuscular disorders (e.g., myasthenia gravis, muscular dystrophy, Parkinson's disease).⁴ Various rheumatologic and musculoskeletal ailments can alter posture, impairing voice quality, and endocrine disorders, such as hypothyroidism, can cause dysphonia as a result of swelling in the Reinke's space (i.e., superficial lamina propria) of the vocal cords. Many patients presenting for laryngeal surgery have a long history of heavy smoking and drinking.⁵ Many of them are elderly and have cardiovascular disease. Appropriate diagnostic tests are indicated for them as part of the preoperative work-up. The pulmonary status of COPD patients should be optimized to decrease airway reactivity and the possibility of postoperative pulmonary complications.

Material and methods

We obtain approval from local ethical review board and informed consent from all study participants. A 5-year prospective cohort study of 200 patients who underwent microlaryngeal surgery in the Department of ENT Surgery; University Hospital "Queen Giovanna"- ISUL; Medical University-Sofia. In all patients we used quamatel 20 mg for pre-medication. For induction in general anesthesia we used propofol 2.5 mg . kg⁻¹ and succinylcholine 1 mg . kg⁻¹ as muscle relaxant. Endotracheal intubation was performed by endotracheal tube №6.0 or №6.5 from the anesthesiologist and mechanical ventilation was performed. For maintenance of general anesthesia we used sevoflurane inspiratory concentration of 2.5 vol. % and fentanyl 4-5 µg . kg⁻¹. for pain relief.

All patients were monitored and recorded for: Systolic blood pressure (SBP), Diastolic blood pressure (DBP); heart rate (HR); continuous electrocardiography (ECG). The above parameters were recorded and analyzed at predetermined time intervals: 5-th minute before intubation, every 5 minutes after intubation and 5-th minute after extubation. Descriptive statistical analysis of the results was performed.

European Society of Hypertension (ESH) and the European Society of Cardiology (ESC) classification for arterial hypertension¹⁷ (fig.1):

Results

The mean age of the patients is 59.03 years. According to anesthesia risk assessment 6% of the patients are with ASA 1 class, 24% of them are with ASA 2 class, 68% are with ASA 3 class and 2% are with ASA 4 class.

We found that 86% of the patients were men and 14% were women (fig.2)

Figure 2. Distribution according to gender.

Category	Systolic blood pressure		Diastolic blood pressure
OPTIMAL	<120 mmHg	and	<80 mmHg
Normal	120-129 mmHg	and/or	80-84 mmHg
High normal	130-139 mmHg	and/or	85-89 mmHg
Arterial hypertension I	140-159 mmHg	and/or	90-99 mmHg
Arterial hypertension II	160-179 mmHg	and/or	100-109 mmHg
Arterial hypertension III	≥180 mmHg	and/or	≥110 mmHg
Isolated systolic hypertension	≥140 mmHg	and	<90 mmHg

Figure 1. Classification for arterial hypertension.

Mean systolic blood pressure of the patients during the operation is 147.33 mmHg, mean diastolic blood pressure is 93.5 mmHg and mean pulse rate is 57.64 beats per minute (fig.3).

Figure 3. Mean parameters of hemodynamic.

49% of the patients have arterial hypertension I grade during the operation, 28% of them are with isolated arterial hypertension and 23% are with normal blood pressure (fig.4).

Figure 4. Most of the patient are with hypertensive hemodynamic.

40% of the patients had pulse rate between 45-60 beats per minute during putting on the tube of Kleinsasser, 29% of them had pulse rate >60 beats per minute during putting on the tube of Kleinsasser and 31% had pulse rate <45 beats per minute during putting on the tube of Kleinsasser (fig.5).

Figure 5. Bradycardia after putting on the tube of Kleinsasser.

Discussion

The essential requirements for precision microlaryngeal surgery and optimal preservation of function include a clear and still surgical field, absence of patient movement, and allocation of sufficient time to carefully complete the procedure in an unhurried manner. The patient's airway must be protected from blood, debris, and irrigation fluid and ventilation must be adequately controlled.⁶ The anesthesiologist must safely share the patient's airway with the surgeon, and must be prepared to skillfully and confidently switch from one ventilation technique to another during the case if needed or dictated by surgery.

Performance of conventional and operative direct laryngoscopy, supraglottic tissue distention, and laryngeal stimulation elicit intense cardiovascular responses, resulting in tachycardia, arterial and pulmonary hypertension, and arrhythmias.⁷⁻⁹ Although these responses are usually short lived, myocardial ischemia and compromise of cerebral circulation may occur in high-risk patients, resulting in adverse outcomes.¹⁰⁻¹² Anesthetic technique should ensure a stable plane of anesthesia, nonstimulating emergence from anesthesia, a rapid return of consciousness, and protective airway reflexes, and it should facilitate quick discharge of patients, because most of these surgical procedures are done on an outpatient basis.

In our study the mean age of the patients is 59.03 years which means that these are people in active working age. This kind of operation gives them chance to keep their ability to speak and work normally. On the other hand in this age group the risk of accompanying cardiovascular and respiratory

disease is higher. In this case the risk of hemodynamic complications will be higher. Most of the patients are males 86%. This may be connected with higher incidence of accompanying risk factors like smoking in male group, which is common for Bulgarian population.¹³⁻¹⁶ The anesthesia risk assessment shows that most of the patients are in ASA III class 68%. This means higher risk of accompanying cardiovascular disease and higher risk of hemodynamic complications. 49% of the patients have arterial hypertension I grade and 28% of them are with isolated arterial hypertension during operation despite of higher dosage of opioids and propofol that we used. This may be caused by the strong pain stimulus from the tube of Kleinsasser during the operation. 40% of the patients had pulse rate between 45-60 beats per minute and 31% of them had pulse rate <45 beats per minute

during putting on the tube of Kleinsasser. This is very dangerous reflex reaction of the heart, which we believe is caused by parasympathetic nervous system, because in some of the cases the pulse rate is corrected after administration of atropine. In other cases when the bradycardia is very severe administration of atropine cannot help so the tube of Kleinsasser must be removed, because there is a risk of cardiac arrest. After removing the tube and administration of atropine the pulse rate is normalized.

Conclusion

Micro-laryngeal surgery is specific kind of surgery which is characterized by hypertensive hemodynamic. There is a risk of severe bradycardia after putting on the tube of Kleinsasser which can cause hemodynamic instability and even cardiac arrest if not corrected immediately.

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Correspondence to:

Tsvetomir Marinov, MD, PhD

Department of Anesthesiology and Intensive Care

University Hospital "Queen Giovanna"- ISUL

Byalo More Str 8

Medical University-Sofia

E-mail: ts.marinov@abv.bg