VOLUME-8, ISSUE-10, OCTOBER-2019 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper Anaesthesiology

HEMODYNAMIC STRESS RESPONSE: ROLE OF AIRWAY NERVE BLOCK IN MICROLARYNGEAL SURGERIES

Dr. Ranabir Chanda M.D., Associate Professor, Department of Anaesthesiology, Burdwan Medical College, Burdwan.

Dr. Auditi Gupta* M.D., Senior Resident, Asansol District Hospital, Asansol. *Corresponding Author

ABSTRACT

Background: Microlaryngeal surgeries produce hemodynamic stress response which is manifested as rise of blood pressure and heart rateleading to harmful consequences, particularly in patientssuffering from significant cardiovascular disorders. These hemodynamic changes can be attenuated by various drugs. No single drug is solely effective for this purpose.
Aims: To observe the efficacy of airway nerve block in reducing hemodynamic stress response and postoperative complications following microlaryngeal surgery.
Materials and methods: After obtaining approval from the Institutional Ethics Committee and written informed consent, 60 patients of either sex aged between 25 to 65 years of ASA physical status I undergoing microlaryngeal surgery were randomly allocated into two equal groups (group B and group C) with 30 patients in each group. Airway nerve block was performed in group B patients whereas airway nerve block was not administered in Group C patients. Subsequently microlaryngeal surgery was performed under general anaesthesia with controlled ventilation. Baseline and intraoperative heart rate, mean arterial pressure and postoperative complications were recorded.
Results: Heart rate at 5,10 and 15 minutes was lower in block group but not statistically significant. However, heart rate at 30 and 45 minutes was significantly lower in block group. Mean arterial pressure was significantly lower in block group than control group at all time intervals. No postoperative laryngospasm, bronchospasm and desaturation were found in block group.
Conclusion: Air way nerve block may be effective to prevent hemodynamic stress response and postoperative complications following microlaryngeal surgery.

KEYWORDS : air way nerve block, general anaesthesia, microlaryngeal surgery

1. INTRODUCTION:

Microlaryngeal surgery (MLS) is the commonest endoscopic laryngeal procedure. Rise of blood pressure and heart rate is frequently observed during MLS, as sustained insertion of laryngoscope may lead to severe hemodynamic stress response. This hemodynamic instability may produce myocardial ischemia and infarction,arrhythmias, rise of intraocular and intracranial pressure, cerebrovascular accident particularly in the elderly patients and those with underlying cardiovascular disorders.[1]These effects can be minimized by administration of esmolol, fentanyl or other opioids, preservative-free lignocaine,or increasing the depth of anaesthesia by inhalational or intravenous anaesthetic agents.However,no single agent is useful to prevent this stress response. They have all been used with varying results. Bolus injection of fentanyl and esmolol do not provide protection against elevation of both the heart rate and blood pressure equally[2]. Inhalational agents and opioids may produce sedation, respiratory depression, which are not wanted at the end of surgery. To avoid these problems, this study was performed to compare hemodynamic parameters (mean arterial pressure, heart rate including perioperative arrhythmias) and post operative complications (laryngospasm,bronchospasm,desaturation) between those who received and who did not receive airway nerve block during MLS.

2. MATERIALS AND METHODS:

After obtaining approval from the Institutional Ethics Committee and written informed consent, this prospective randomized, observational study was conducted from January 2016 to December 2017 in the otorhinolaryngology (ENT) OT of a tertiary hospital among 60 patients of both sex aged between 25 to 65 years of American Society of Anaesthesiologists Physical Status I(ASA-PS I) having vocal nodule, polyp, cyst, granuloma, vocal cord dysfunction, recurrent respiratory papillomatosis were scheduled for MLS. Considering 20% increase in mean arterial pressure (MAP) from baseline and increase in heart rate (HR) of 20 beats/ min, to obtain a power of 80% and alpha error of 5%, 60 pts were therefore enrolled. Patients were randomly allocated (sealed envelope method) into two equal groups (group B and group C) with 30 patients in each. Group B patients were informed and explained about the procedure of airway nerve block. The patients who refused, those having stridor, severe narrowing of vocal cord where tracheostomy was required, bleeding diathesis or patients on anti-coagulant therapy and suffering from any cardiovascular , neurological, respiratory and endocrinal disorders were excluded from this study. ASA fasting guidelines were followed and patients were premedicated with ranitidine(150mg) and domperidone(10mg) orally 2hours before surgery. Standard monitors were attached and baseline parameters like heart rate (HR), mean arterial pressure (MAP) and oxygen saturation (Spo2) were recorded. Intravenous(i.v) infusion of Ringer's Lactate was started at 6 ml/kg. Glycopyrrolate (0.2mg), midazolam(1mg) and fentanyl(2mcg/kg) were given i.v. In group B (block group) patients received airway nerve block and for group C (control group) did not receive nerve block.

Technique of nerve block: Airway block was achieved by blocking glossopharyngeal (GLN), superior laryngeal nerve (SLN) and recurrent laryngeal nerve(RLN). GLN block was performed with a 25 gauge spinal needle at the base of the anterior tonsillar pillar, just lateral to the base of the tongue to a depth of 5mm. After negative aspiration for blood or air, 2ml of 2% lignocaine was injected bilaterally.[3] SLN block was performed by bilateral injections at the level of the greater cornu of the hyoid bone. The patient was placed supine with the head extended. The cornu of the hyoid bone was located below the angle of the mandible. Then non-dominant hand was used to displace the hyoid bone with contralateral pressure, bringing the ipsilateral cornu and the internal branch of the superior laryngeal nerve towards the performer. After aseptic skin preparation,a 1 inch., 24-gauge needle was inserted in an anteroinferomedial direction until the lateral aspect of the greater cornu was contacted. Then the needle was walked (1-2 mm) downward toward the midline off the inferior border of the greater cornu and the internal branch of superior laryngeal nerve was blocked with 2 mL of 2% lidocaine after negative aspiration for air and blood.[4] The sensory input of the RLN was inhibited by the transtracheal block. After sterile skin preparation, a 1.5 inch 22-gauge needle passed perpendicular to the axis of the trachea and after piercing the cricothyroid membrane and aspiration of air 4mL of 4% lidocaine was administered. Group C patients did not receive airway nerve block.

All patients received general anaesthesia. Preoxygenation was done for 5 minutes. Patients were induced with propofol(2mg/kg) iv. After assessing bag mask ventilation, intubation was performed with rocuronium(1.2mg/kg) and endotracheal tube position was checked and secured properly. Patients were maintained in supine position with neck extended. Anaesthesia was maintained with oxygen(40%), nitrous oxide(60%) and Isoflurane(exhaled 1 MAC). At the end of the procedure patients were reversed with glycopyrrolate(0.008mg/kg) and neostigmine(0.07mg/kg) and extubated after assessing signs of reversal. Intraoperative HR and MAP were recorded at an interval of 5, 10, 15, 30 and 45minutes. If MAP was more than 20% of baseline value and or HR was more than 20 beats over the baseline, esmolol was administered at a rate of 500mcg per kg bolus over 5 minutes(mins) followed by 100 mcg per kg per min infusion. Hypotension (MAP less than 20% of baseline value) and bradycardia (HR less than 50 over the baseline the rate) would be managed with a bolus of i.v fluids and atropine respectively. If postoperative complications like laryngospasm, bronchospasm, desaturation would be observed, they would be managed accordingly.

Data were analyzed using Microsoft excel 2007 and IBM SPSS software version 20. Parametrical numerical data between groups was analyzed using the unpaired Student's t-test.

3. RESULTS:

The study groups were comparable with respect to age, body weight and duration of surgery (Table 1). There was no significant statistical difference in baseline HR and MAP in between the two groups (Table 2). There was no statistically significant difference in HR at 5 ,10 and 15 mins among the studied groups but it was lower in group B (block group) than group C (control group) at 30 mins (group B: 81.97 ± 7.73 vs group C: 90.97 ± 14.30 , p-value .004) and 45 mins (group B: 81.48 ± 8.48 vs group C: 92.86 ± 12.39,p-value .001) which was statistically significant(Table 3, fig 2.). The MAP at 5 mins (group B: group C- 85.37± 3.48 : 90.90± 4.80), 10mins (group B: group C- 86.90± 3.92 : 95.47 ±4.71), 15mins (group B: group C - 87.40±4.23 : 99.73 ± 4.92), 30 mins (group B: group C- 86.10± 4.13 : 102.30 ± 5.14) and 45 mins (group B: group C- 84.95± 3.80 : 104.62±3.61) were significantly lower in group B(block group) than group C(control group) with statistically significant p value .000 (Table 3,fig.3). There was no incidence of hypotension and bradycardia. 12 patients of group C required esmolol to control MAP and HR. Esmolol was not required in group B. Post operative complications were found in control group(group C) like laryngospasm (6 out of 30) and desaturation (3 out of 30). No such complications were found in block group (group B) (table 4).

4. DISCUSSION:

In this study, the values of MAP during intraoperative period were significantly lower in airway nerve block group than the control group. The heart rate at 5 mins,10mins and 15 mins were also lower in block group but not statistically significant. However, the HR at 30mins and 45mins were significantly lower in block group than control group. The insertion of suspensory laryngoscope causes stretching of the oropharyngeal tissues which may produce pain and trigger stress response. Rise of blood pressure and heart rate are the major manifestations of hemodynamic stress response. The magnitude of cardiovascular response is directly related to the force and duration of laryngoscopy.During MLS enough force is needed to keep the suspension laryngoscope in proper position and the duration of laryngoscopy is always more than the conventional laryngoscopy for intubation technique. So hemodynamic changes are frequently observed duringthis surgery.Airway instrumentation leads to an intense noxious stimulus via vagus and glossopharyngeal afferents resulting in reflex autonomic activation. This is manifested as hypertension and tachycardia or bradycardia. Administration of nerve block prevents transmission of noxious stimulus through this pathway and probably responsible for minimum hemodynamic changes during intraoperative period. Intraoperative HR were also lower in airway nerve block group but values were statistically significant at30 and 45 mins. These results were most likely due to synergistic action of rocuronium and fentanyl during initial part of the intra operative period. Other studies also observed that nerve block is helpful in suppressing the rise of MAP and HR following insertion of direct laryngoscope.[6,7] The haemodynamic stress response following laryngoscopy and intubation was also less in block group in comparison to control group(HR5 and MAP5 in Gr B vs. Gr C : 80.53±7.65 : 82.23±11.18 and 85.37±3.48 : 90.90±4.80 respectively). Hypotension was not found in both groupsprobably because ASA fasting guidelines were followed and drug induced myocardial depression was not significant in ASA-PS I patients. Prior administration of glycopyrrolate probably prevented intraoperative bradycardia in the both groups.

Postoperative complications like laryngospasm and desaturation were observed in the control group. Laryngospasm following MLS may be due to airway instrumentation or vocal cord irritation either by blood, secretions or vomitus or other noxious stimuli. These complications were not found in airway nerve block group (Group B), probably due to inhibition of sensory transmission from glottis and subglottic area. Other studies also supported this finding.[8] These complications were managed by removal of blood and secretions from oropharynx ,administration of 100% oxygen.

Lidocaine is the most commonly used local anaesthetic for airway management because of its rapid onset, high therapeutic index and available as various concentrations.[9] Antisialagogue was administered before airway nerve block for better visualization and improved, effectiveness of LAs, otherwise LA may be washed away from the effective sites due to secretions. Lignocaine may be used in different concentrations and combinations up to the maximum dose of LAs. The maximum dose of lignocaine for airway block is not well established. Various studies suggest total dose should be in the range of 4-9 mg/ kg.[10,11] Lidocaine without epinephrine was used in this study for both nerve block(160mg) and topical administration (160 mg) which was well within the maximum recommended dose limits. The duration of action of lidocaine is 30-45mins. The duration of surgery was 40.50±6.98 mins in both groups. There was no incidence of aspiration in the post operative period as airway block cuts down the sensory component only. However, the motor functions of the muscles of larynx and pharynx are not impaired.

GLN block can be achieved by intraoral and peristyloid approach. Peristyloid approach may lead to concomitant block of the hypoglossal nerve and the vagal nerve, proximal to the origin of the recurrent laryngeal nerve which is associated with an increased risk of upper airway obstruction and hoarseness of voice.[8] It is technically difficult to locate the styloid process and inject the drug behind it.So peristyloidapproach for GLN was not performed.The internal branch of the superior laryngeal nerve, at its proximity to the hyoid bone should be blocked. If LAs is injected outside the thyrohyoid membrane, it is likely to block the external branch of the superior laryngeal nerve which may result in cricothyroid muscle weakness resulting in respiratory distress due to loss of abduction of vocal cord. In this study, no such incidence was noted.RLN contributes both sensory and motorinnervation of larynx. The motor input of RLN is spared during the transtracheal instillation.

General anaesthesia with positive pressure ventilation was applied through a small diameter endotracheal tube for better oxygenation, ventilation, prevention of aspiration and with minimum interference of the surgical field during MLS. Airway block was performed under conscious sedation before administration of GA as it provides patient comfort, easy identification of bony landmarks by asking the patients to swallow and to enhance the trans tracheal spread of LA by coughing. Nebulization with lidocaine may be used to anesthetize the airway.[12] Studies have demonstrated that airway nerve block provides better topical airway anaesthesia than using nebulized lignocaine.[14] So nerve block technique was used to anaesthetize the airway.

There were several limitations of this study. Plasma levels of lignocaine and catecholamines were also not measured due to logistic reasons. Plasma levels of catecholamines indicate neuroendocrine stress response whereas only haemodynamic variables were studied here. Only clinical signs and symptoms of local anesthetic systemic toxicity (LAST) were looked for in block group (Group B).

5. CONCLUSION:

It has been found in this study that airway nerve block has definitive role for prevention of hemodynamic stress response and postoperative complications like laryngospasm and desaturation during microlaryngeal surgery. So it can be used safely along with general anaesthesia during this surgical procedures.

Table1: Demographic characteristics of study population and duration of surgery (mean ±SD):

	GroupB	Group C	P value
Age(yrs)	48.90 ± 6.70	47.90 ± 6.98	0.574
Body weight(kg)	60.43 ± 8.68	57.40 ± 5.78	0 .117
Duration of surgery(mins)	40.50±6.98	40.50±6.99	1.000

Table 2: Baseline heart rate (HR) and mean arterial pressure (MAP) (mean±SD):

	GroupB	Group C	P value
HR (beats /min)	71.67±4.452	73.07±5.051	0.259
MAP (mmHg)	86.00±5.446	84.27±7.404	0.306

Table 3: Heart Rate (HR) and Mean Arterial Pressure(MAP) at 5,10,15,30 and 45 minutes (mean±SD):

	Group B	GroupC	P value
HR5 (beats/min)	80.53±7.65	82.23±11.18	0.495
MAP5 (mm Hg)	85.37±3.48	90.90±4.80	0.000
HR10 (beats/min)	82.50±7.78	87.10±14.46	0.130
MAP10 (mm Hg)	86.90±3.92	95.47±4.71	0.000
HR15 (beats/min)	83.57±7.75	88.83±15.21	0.097
MAP15 (mm Hg)	87.40±4.23	99.73±4.92	0.000
HR30 (beats/min)	81.97±7.73	90.97±14.30	0.004
MAP30 (mm Hg)	86.10±4.13	102.30±5.14	0.000
HR45 (beats/min)	81.48±8.48	92.86±12.39	0.001
MAP45 (mm Hg)	84.95±3.80	104.62±3.61	0.000

Table 4:Post operative complications(no of cases):

Complications	Group B	Group C
laryngospasm	nil	6
desaturation	nil	3

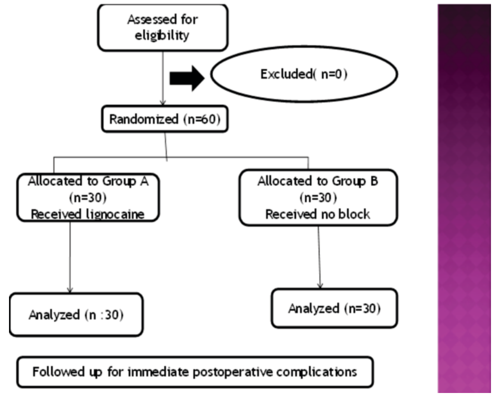

Figure 1: Consort flow chart

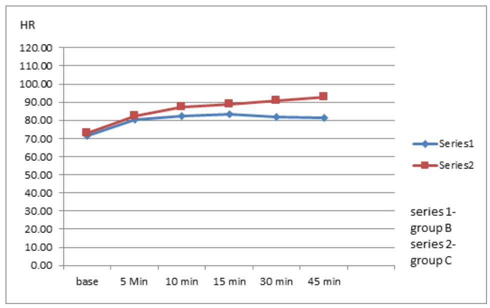

Fig 2: Variation of heart rate (HR) with time

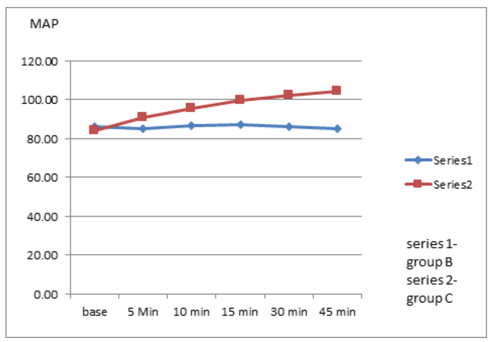

Fig 3 : Variation of Mean Arterial Pressure (MAP) with time

REFERENCES:

1. Kitamura T, Yamada Y, Chinzei M, Du HL, Hanaoka K. Attenuation of haemodynamic responses to tracheal intubation by the Stylet Scope. Br J Anaesth. 2001; 86:275–7.
2. Hussain AM, Sultan ST. Efficacy of fentanyl and esmolol in the prevention of haemodynamic response to laryngoscopy and endotracheal intubation. J Coll Physicians Surg Pak 2005 ;15:454-7.
3. Benumof JL. Management of the difficult adult airway with special emphasis on awake tracheal intubation.Anesthesiology.1991;75:1087–110.
4. Simmons ST, Schleich AR. Airway regional anesthesiaforawake fiberoptic intubation. RegAnesth Pain Med 2002:27:180–92.
5. Hagberg.A.C, ArtimeA.C`.Airway management in the adult.In: Miller RD, Cohen NH, Eriksson LI, Fleisher LA., Wiener-Kronish J P, Young WL,editors. Miller's Anesthesia. 8th ed. Philadelphia: Elsevier saunders;2015.p.1658.
6. Trivedi V, Sharma G. Evaluation of airway blocks versus general anaesthesia for diagnostic direct laryngoscopy and biopsy for carcinoma larynx. J Indian Med Assoc.2012 :110:78-83.
7. Ahmed A, Saad D, Youness A.R.Superior laryngeal nerve block as an adjuvant to General Anesthesia during endoscopic laryngeal surgeries: A randomized controlled trial .Egyptian Journal of Anaesthesia .2015; 31: 167–74.
9. Pani N, Rath KS.Regional & Topical Anaesthesia of Upper Airways
10. Bekhit MH: Lidocaine for neural blockadeIn:SinataraRS,Jahr JS, Watkins-Pitchford JM, editors:, The essence of analgesia and analgesics. New York : Cambridge University Press; 2010.p279.
11. Williams KA, Barker G. L., Harwood R. J. and Woodall N. M.:Combined nebulization and spray-as-you-go topical local anaesthesia of the airway Br J Anaesth 2005;95:549.

12. British Thoracic society Bronchoscopy Guidelines Committee: a Subcommittee of Standards of Care Committee of British Thoracic Society guidelines on diagnostic flexible bronchoscopy, Thorax 2001;56:1-21.
13. Techanivate A, Leelanukrom R, Prapongsena P, Terachinda D. Effectiveness of mouthpiece nebulisation and nasal swab stick packing for topical anesthesia in awake fiberopticnasotracheal intubation. J Med Assoc Thai 2007 90:2063–71.
14. Gupta B, Kohli S, Farooque K, Jalwal G, Gupta D, Sinha S, ChandralekhaTopical airway anesthesia for awakefiberoptic intubation: Comparison between airway nerve blocks and nebulized lignocaine by ultrasonic nebulizer Saudi J Anaesth. 2014; 8: 15–9.