A COMPARATIVE STUDY OF HAEMODYNAMIC STRESS RESPONSE TO LARYNGOSCOPY - WITH THE McCOY, THE MACINTOSH AND THE MILLER LARYNGOSCOPE BLADES.

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CHENNAI

TAMILNADU

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CERTIFICATE

This is to certify that this dissertation entitled **"A COMPARATIVE STUDY OF HAEMODYNAMIC STRESS RESPONSE TO LARYNGOSCOPY - WITH THE McCOY, THE MACINTOSH AND THE MILLER LARYNGOSCOPE BLADES."** is a bonafide record of the work done by Dr.G.Venkatesan under my supervision and guidance in the Department of Anaesthesiology at Government Hospital of Thanjavur Medical College, Thanjavur during the period of his post-graduate study from May 2005 – March 2008 for the partial fulfillment of M.D (Branch X Anaesthesiology) degree.

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CONTENTS

Introduction

INTRODUCTION

Rigid direct laryngoscopes are most commonly used to view the larynx and adjacent structures under direct vision for the purpose of endotracheal intubation.[8]

Apart from the direct trauma to the oropharynx and larynx, adverse physiological effects of cardiovascular system occur as sympathetic haemodynamic stress response to upper airway manipulation during laryngoscopy. The sympathetic haemodynamic stress response of cardiovascular system occurs as increase in the heart rate and the mean arterial pressure.[15, 19]

Although this haemodynamic stress response to laryngoscopy is transient, generally of short duration and of little consequence in healthy individuals, it is hazardous to those with systemic hypertension, coronary heart diseases, cerebrovascular diseases and the complications like tachycardia, hypertension, myocardial ischemia, left ventricular failure, cardiac dysrhythmias, cerebral haemorrhage can occur.

Shribman et al[22] has shown that laryngoscopy alone generates the same sympathetic haemodynamic stress response as laryngoscopy followed by intubation. The major cause of the haemodynamic stress response is due to stimulation of supra-glottic area by the laryngoscope blade followed by additional stimulation contributed by tracheal tube placement.

Till date, the mainstay of attenuation of the haemodynamic stress response to laryngoscopy was the pharmacological methods like local anaesthetics, vasodilators, beta blocking agents, calcium channel blockers, opioids, and volatile anaesthetic agents.

The reduction of the stimulation of the oropharynx by the design of laryngoscope blade has also reduced the magnitude of the haemodynamic stress response[8, 10, 12,16]

In this study, the haemodynamic stress response (increased heart rate and increased mean arterial pressure) before, during and after laryngoscopy with McCoy, Macintosh and Miller laryngoscope blades are compared.

Aim of the Study

AIM OF THE STUDY

To compare the haemodynamic stress response (increased heart rate and mean arterial pressure) to laryngoscopy with McCoy, Macintosh and Miller laryngoscope blades.

History of the Laryngoscope

HISTORY OF THE LARYNGOSCOPE

In the early days of anaesthesia, although blind or tactile tracheal intubation of awake patients was mastered with extensive practice, an improved technique to accomplish tracheal intubation was developed by Alfred Kirstein (1863 – 1922), Chevalier Jackson (1865 -1958) and Gustav Killian (1898 -1912), all contributors in the introduction of the hand-held laryngoscope.[11]

Before the pioneering efforts of these innovators, the only way to visualize the larynx was with indirect laryngoscopy, a technique introduced by the Spanish singing instructor Manuel Garcia (1805-1868). In 1854, Garcia read a paper before the Royal Society entitled "Observations on the Human Voice", wherein he described the use of mirrors to view his student’s and his own larynx during vocalization.

Alfred Kirstein was charting unknown territory in 1895, when he boldly suggested that the larynx could be directly visualized with instruments similar to the commonly used esophagoscope. Although he abandoned the procedure, it was revived thirteen years later by Gustav Killian whose portable laryngoscope was remarkably like the current instrument but with no light attached.[11]

Direct laryngoscopy did not gain popularity among the anaesthesiologists until Chevalier Jackson promoted the use of his hand-held laryngoscope for insertion of tracheal insufflation catheters. Even then, the technique was slow to gain acceptance but the increasing use of muscle relaxants eventually required the anaesthesiologist to be adept at rapid placement of tubes within trachea.

The first hand-held laryngoscopes, as perfected by Jackson, were U- shaped and had no curve at the tip. A light at the end of the blade was a unique contribution by Jackson that has been retained with the modification that some instruments today use a fibreoptic bundle in the blade.[11]

Anaesthesiologists soon began to design their own laryngoscopes that were more suitable for insertion of endotracheal tubes.

Robert A. Miller designed a new blade that was remarkably similar to Killian’s instrument, except for a slight curve at the distal end. Robert R. Macintosh’s (1897–1989) improved laryngoscope featured a short curved blade that elevated instead of retracting the epiglottis. This promoted a new concept in laryngoscopy specifically designed for the anaesthesiologists for the timely tracheal intubations.

By this time, a detachable joint had been placed between the blade and the handle. The batteries were located in the handle, conveniently avoiding the trailing wires attached to the distal bulb.

McCoy described his levering laryngoscope blade which has a lever attached to the proximal end of the blade. When the lever is pushed towards the handle, the tip of the blade is flexed. This McCoy laryngoscope is helpful when a difficult intubation is encountered and when minimal neck movement is desired.[8, 11]

Complications of Laryngoscopy

COMPLICATIONS OF LARYNGOSCOPY

Haemodynamic stress response to laryngoscopy

Haemodynamic stress response to laryngoscopy and intubation occurs as increase in the heart rate and the mean blood pressure due to reflex sympathetic discharge in response to laryngotracheal stimulation.[8]

Activation of sympathetic nervous system causes the increase in plasma norepinephrine and epinephrine paralleling the increase in heart rate and mean arterial pressure during laryngoscopy and intubation. The polysynaptic nature of pathways from the glossopharyngeal and the vagus nerve afferents to the sympathetic nervous system through the brainstem and the spinal cord results in the diffuse sympathetic response with widespread release of norepinephrine from the adrenergic nerve terminals and the adrenal medulla.[15, 19]

Hassan and co-workers[7] studied the laryngoscopy and haemodynamic stress response and found that there is a biphasic response with laryngoscopy sensed by proprioceptors supplied by glossopharyngeal nerve and during intubation with vocal cord contact supplied by the superior laryngeal nerve above and recurrent laryngeal nerve below the vocal cords.

Dental injury

Damage to teeth, gums or dental prostheses continue to be the most frequent complication. In addition to cosmetic disfigurement and discomfort, there may be pulmonary complications if the dislodged tooth or fragment is aspirated. Profuse bleeding may occur. A tooth or prosthetic device may be chipped, broken, loosened or avulsed. The teeth most likely to be damaged are those that have been restored or weakened by periodontal disease.

The upper incisors are most frequently involved. This usually is caused by using the teeth as a fulcrum point by the laryngoscopist while elevating the epiglottis. The condition of each patient’s teeth should be carefully assessed preoperatively to identify possible problems. Inquiry should be made concerning vulnerable dental repair work or loose or carries teeth.

Anatomical conditions of the mouth and pharynx that can cause difficulty in exposing the larynx should be noted. The patient should be advised beforehand if there is likely to be a problem. If a tooth, fragment or dental appliance is dislodged, prevention of foreign body aspiration should be of major concern. An immediate search should be conducted starting with an examination of the oral cavity and the area surrounding the patient's head. X-rays of the chest and neck must be taken if the fragment is not found.[8]

Damage to soft tissues and nerves

Reported injuries to the upper airway include abrasion, haematoma and laceration of the lips, tongue, palate, pharynx, hypopharynx, larynx and esophagus. One common occurrence is rolling of the lower lip between the teeth and the laryngoscope blade as the blade is inserted. As the blade is inserted, the right hand should retract the lower lip. Massive tongue swelling following laryngoscopy has been reported.[8]

Injury to cervical spinal cord

Aggressive positioning of the head for intubation, especially extension of the head or neck, has the potential to cause damage in the patient with an unstable cervical spine such as those with congenital weaknesses, malformations, fractures or dislocations of cervical vertebrae or other conditions such as osteoporosis, connective tissue disease or tumour. [8]

Swallowing or aspiration of a foreign body

The bulb of the laryngoscope can be aspirated during intubation. It is important to make every effort to find these foreign bodies. If they cannot be found in the oral cavity or around the patient's head, X-ray of the chest and neck should be taken.[8]

Shock and / or burn

If a laryngoscope light, which is left on, contacts the patient's skin, a burn may result. Malpositioning of the blade on the handle can produce a short circuit, which leads to rapid heating of the handle.[8]

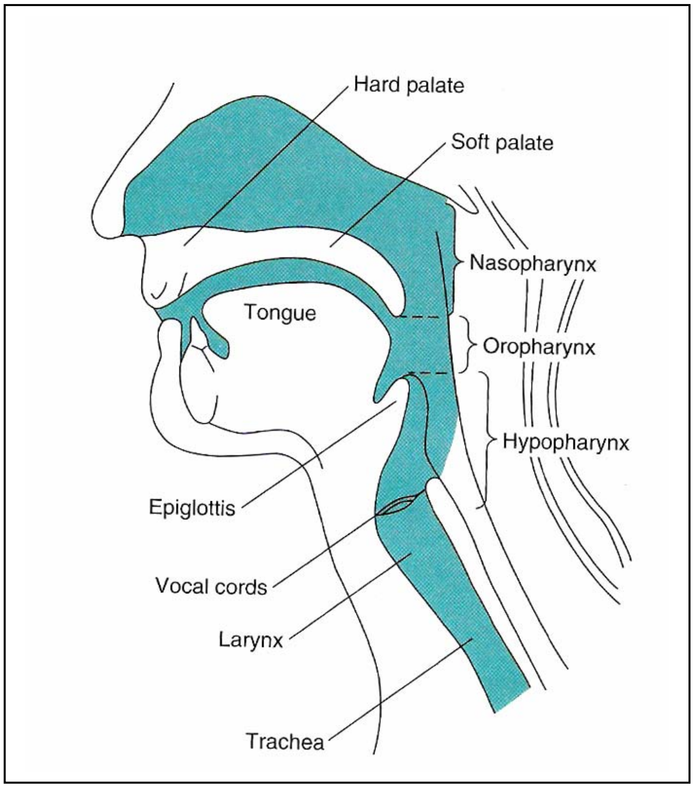
Laryngoscope malfunction

The most common malfunction of the laryngoscope is failure of the light to illuminate. This may be the result of a defective power source, lamp, socket or poor contact between the blade and handle. Checking the laryngoscope before using can detect most of the malfunction. An extra handle and blade should always be immediately available. Neglecting to observe these precautions could spell disaster, especially when a rapid sequence induction is being performed. [8]

Sensory nerve supply
of
Larynx

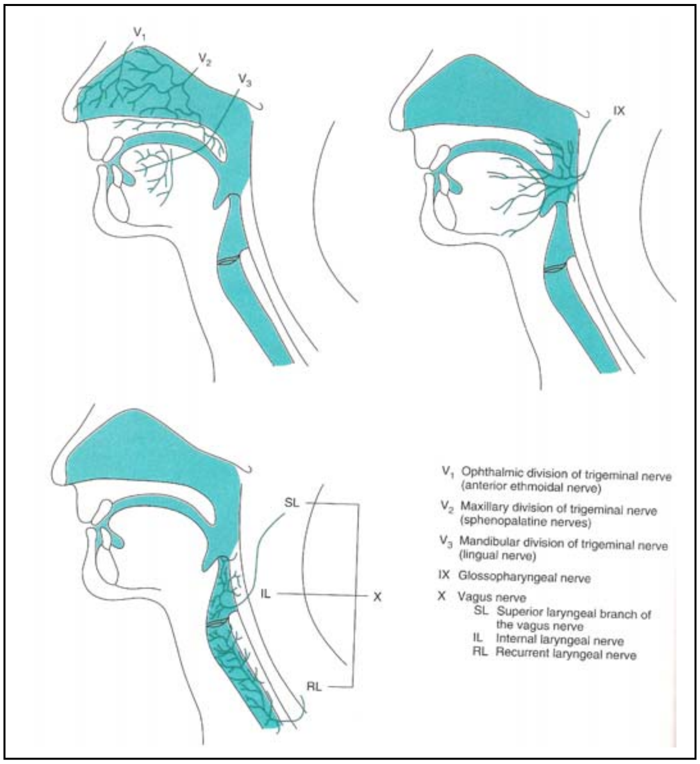
SENSORY NERVE SUPPLY OF UPPER AIRWAY

ANATOMY OF THE UPPER AIRWAY



The pharynx is 'U' shaped fibromuscular structure that extends from the base of skull to cricoid cartilage at the entrance of the esophagus. It opens anteriorly into nasal cavity, mouth and the larynx - the naso, oro and laryngopharynx respectively. At the base of tongue, the epiglottis functionally separates the oropharynx from the laryngopharynx.[4]

SENSORY NERVE SUPPLY OF THE UPPER AIRWAY



The sensory nerve supply to upper airway is derived from the cranial nerves trigeminal, glossopharyngeal, and vagus.[4]

The mucous membrane of nose is innervated by ophthalmic division of trigeminal nerve anteriorly (anterior ethmoidal nerve) and by the maxillay division posteriorly (sphenopalatine nerve).

The palatine nerve provides sensory fibres from trigeminal nerve to hard and soft palate.

The lingual nerve (a branch of mandibular division of trigeminal nerve) and glossopharyngeal nerve provides general sensation to the anterior two-third and posterior third of tongue respectively.

Branches of the facial nerve and glossopharyngeal nerve provide the sensation of taste to anterior two-third and posterior third of the tongue respectively.

The glossopharyngeal nerve also innervates the roof of pharynx, the tonsils and the undersurface of soft palate.

The pharyngeal surface of epiglottis is supplied by glossopharyngeal nerve and the laryngeal surface of epiglottis is supplied by vagus nerve.

Internal (sensory) laryngeal nerve of superior laryngeal branch of vagus provides sensory supply to larynx between the epiglottis and the vocal cords. Another branch of the vagus, recurrent laryngeal nerve innervates the larynx below the vocal cords and trachea.

Design
of
Laryngoscope Blade

DESIGN OF LARYNGOSCOPE BLADE

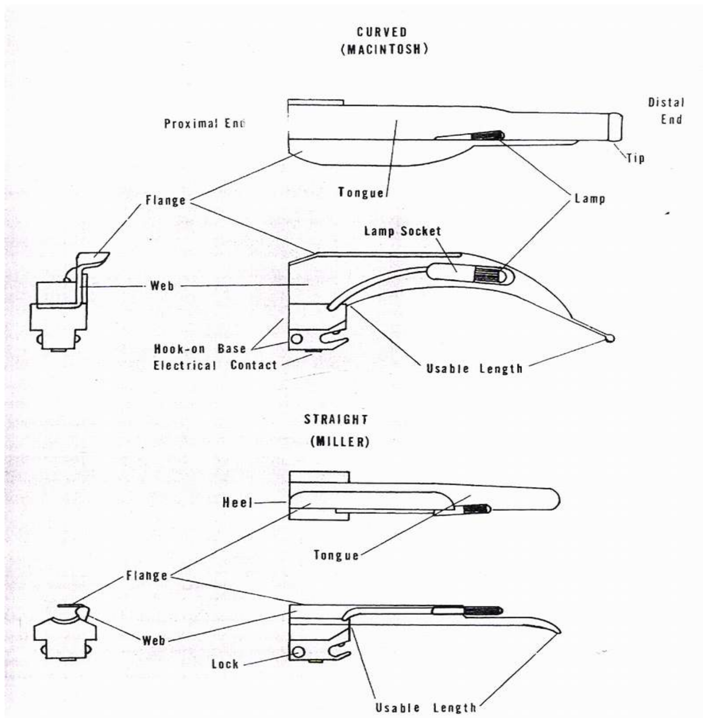
The laryngoscope consists of a handle and a detachable blade. The light source is energized when the blade and the handle are locked in the working position.

The handle provides the power source for the light. A hook-on [hinged folding] connection between the handle and blade is most commonly used. The handle is fitted with a hinge pin that fits a slot in the base of the blade. This allows quick and easy attachment and detachment of the blade from the handle.[8]

Handles designed to accept blades that have a light bulb have a metallic contact, which completes an electrical circuit when the handle and blade are in the working position. When the handle and blade are locked in the working position, an activator switch is depressed. This provides a connection between the bulb and the batteries.

The laryngoscope blade is the rigid component that is inserted into the mouth.

The laryngoscope blade is composed of several parts including the base, heel, tongue, flange, web, tip and light source.



The base of the blade is the part that attaches to the handle. It has a slot for engaging the hinge pin of the handle. The proximal end of the base is called the heel.

The tongue (spatula) of the blade is the main shaft of the blade. It serves to compress and manipulate the soft tissue (especially the tongue) and lower jaw. Blades are commonly referred to as curved or straight depending on the predominant shape of the spatula.

The flange projects off the side of the spatula and is connected to it by the web. It serves to guide the instrumentation and deflect the tissues out of the line of vision. The flange determines the cross-sectional shape of the blade. The vertical height of the cross-sectional shape of a blade is referred as Step.

The tip (beak) of the blade contacts either the epiglottis or vallecula and directly or indirectly elevates the epiglottis respectively. It is usually blunt and thickened to decrease trauma.

The blade has a lamp (bulb). The bulb screws in to a socket that has a metallic contact.

Technique of use

The optimal position for laryngoscopy in most patients is flexion of the lower cervical spine and extension of the head at the atlanto-occipital level, the so-called sniffing position. The lower portion of the cervical spine can be maintained in a position of flexion by use of a small pillow under the head. Extension of atlanto-occipital joint is achieved by pressure on the top of the head and/or upward traction on the upper teeth or gums by the laryngoscopist's hand.

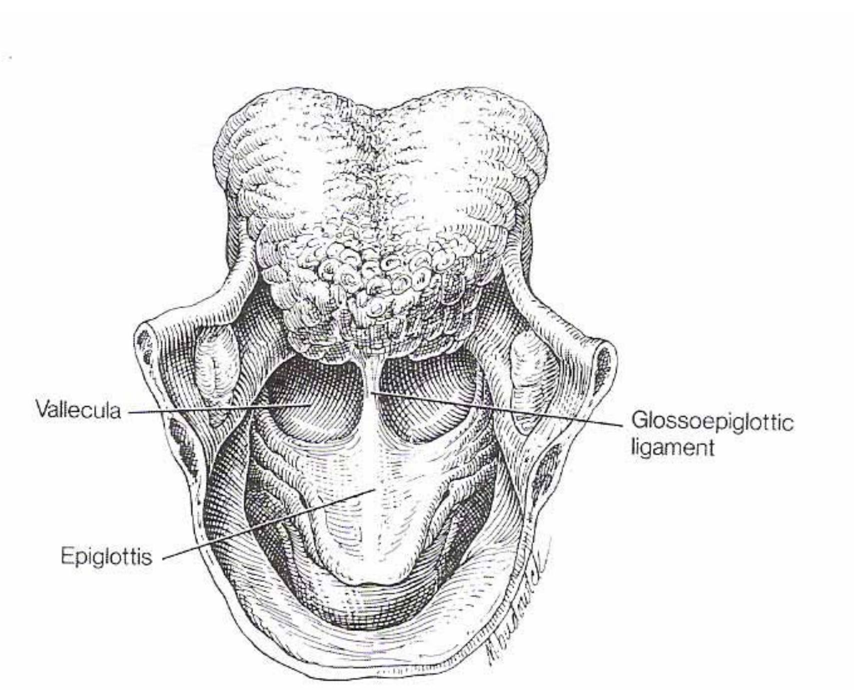
The laryngoscope handle is held in the left hand. Moistening or lubricating the blade will facilitate insertion if the mouth is dry. The fingers of the right hand are used to open the mouth and spread the lips. In patients with dentition, the optimum opening of the mouth is often achieved with a thumb over index finger approach, with the index finger on the maxillary dentition as far to the right as possible and the thumb placed on the lower teeth.[1, 8]

The blade is inserted at the right side of the mouth. This reduces the likelihood that the incisor teeth will be damaged and helps push the tongue to the left. The blade is advanced on the side of the tongue towards the right tonsillar fossa so that the tongue lies on the left side of the blade. The right hand keeps the lips from getting caught between the teeth or gums and the blade.

When the right tonsillar fossa is visualized, the tip of the blade is moved towards the midline. The blade is then advanced behind the base of the tongue, elevating it, until the epiglottis comes into view.[1, 8,20,21]

There are two methods for elevating the epiglottis depending on the design of the blade. If the blade is curved, the tip of the blade is kept in the vallecula[4, 8,11,18,23] (space between the base of the tongue and pharyngeal surface of the epiglottis) and lifted which elevates the epiglottis indirectly. If the blade is straight, the tip of the blade includes the epiglottis and lifted compressing the epiglottis on the base of the tongue, which elevates the epiglottis directly.[1, 8,20,21,23]

BASE OF TONGUE, VALLECULA, PHARYNGEAL SURFACE OF EPIGLOTTIS



LARYNGOSCOPE BLADES

MILLER

MACINTOSH

McCOY

MACINTOSH LARYNGOSCOPE

MILLER LARYNGOSCOPE

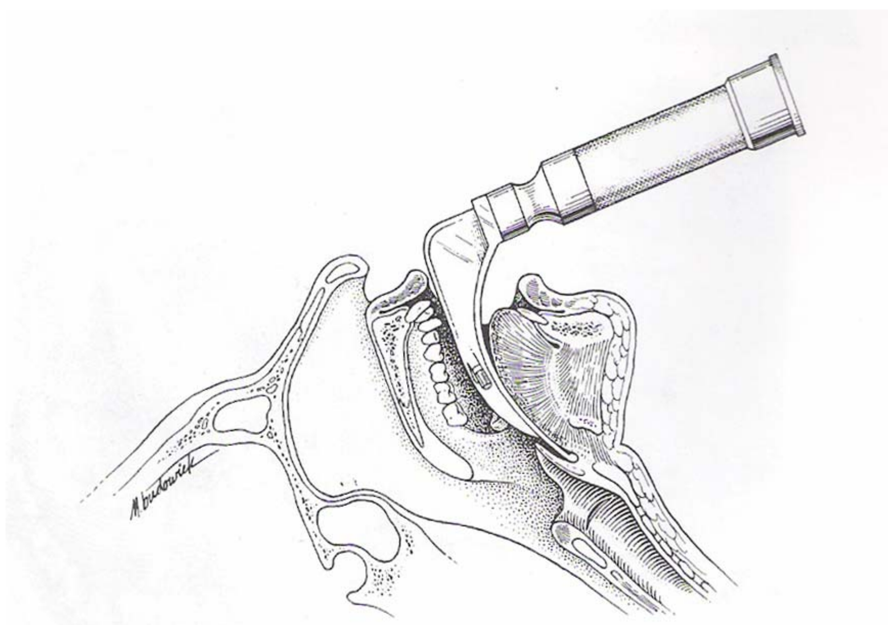
McCOY LARYNGOSCOPE – NORMAL POSITION

McCOY LARYNGOSCOPE – LEVER PRESSED AND TIP ELEVATED

Macintosh laryngoscope blade:

The spatula has a smooth gentle curve that extends to the tip. There is a flange at the left to push the tongue out of the way. In cross-section, the spatula, web and flange from a reverse Z. The tip of the blade is placed in vallecula and by lifting the laryngoscope upward and forward, the epiglottis is indirectly lifted exposing the underlying larynx.[8, 14]

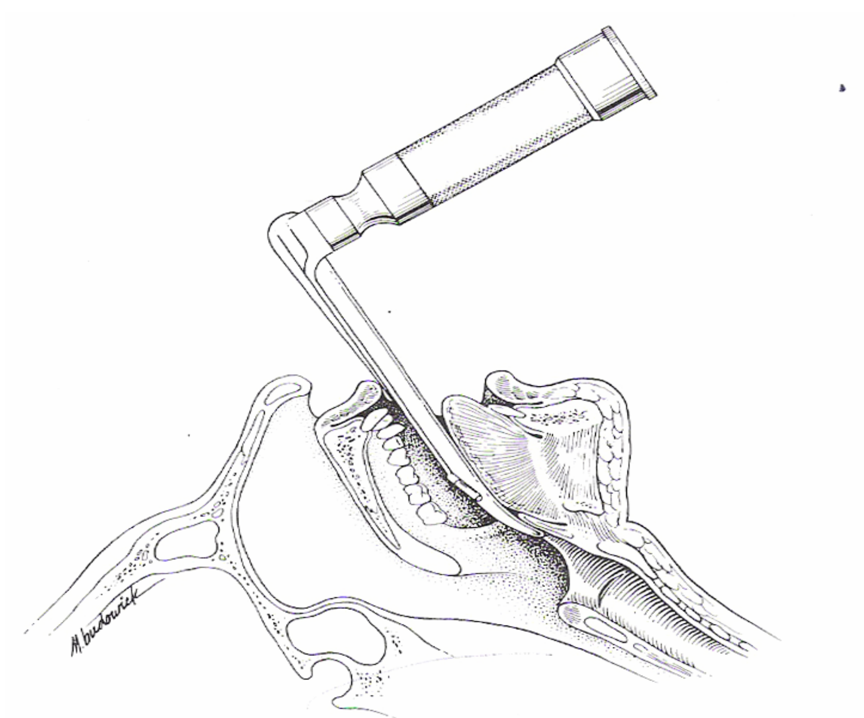
MACINTOSH LARYNGOSCOPE



Miller laryngoscope blade:

The spatula is straight with the slight upward curve near the tip. In cross- section, the flange, web and spatula form a C with the top flattened. The tip of the blade passes over the laryngeal surface of the epiglottis and the epiglottis is included under the tip of the blade so that the tip lies just at the laryngeal inlet. The laryngoscope is lifted upward and forward with the tip of the blade compressing the epiglottis on the base of the tongue. The epiglottis is lifted directly to expose the underlying larynx.[8, 14]

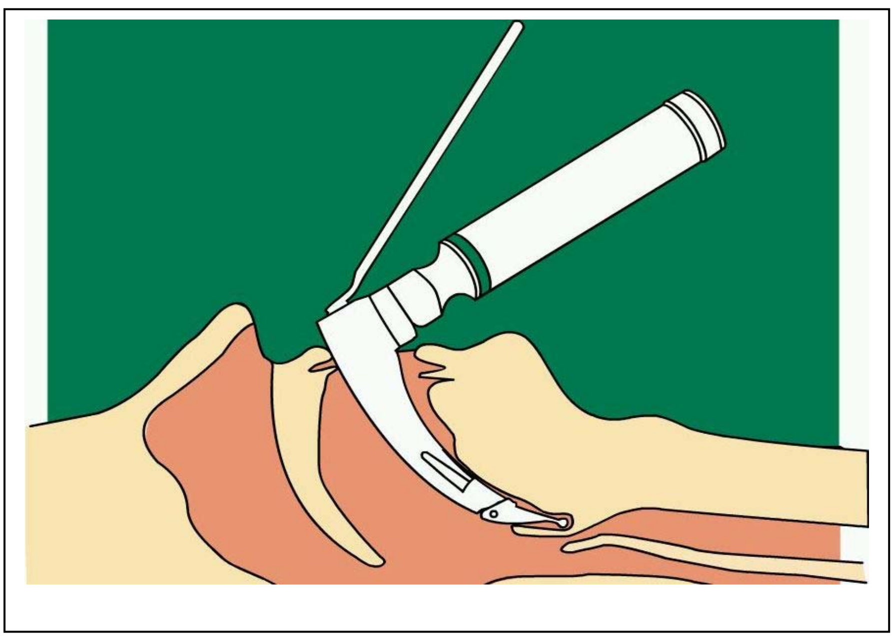
MILLER LARYNGOSCOPE



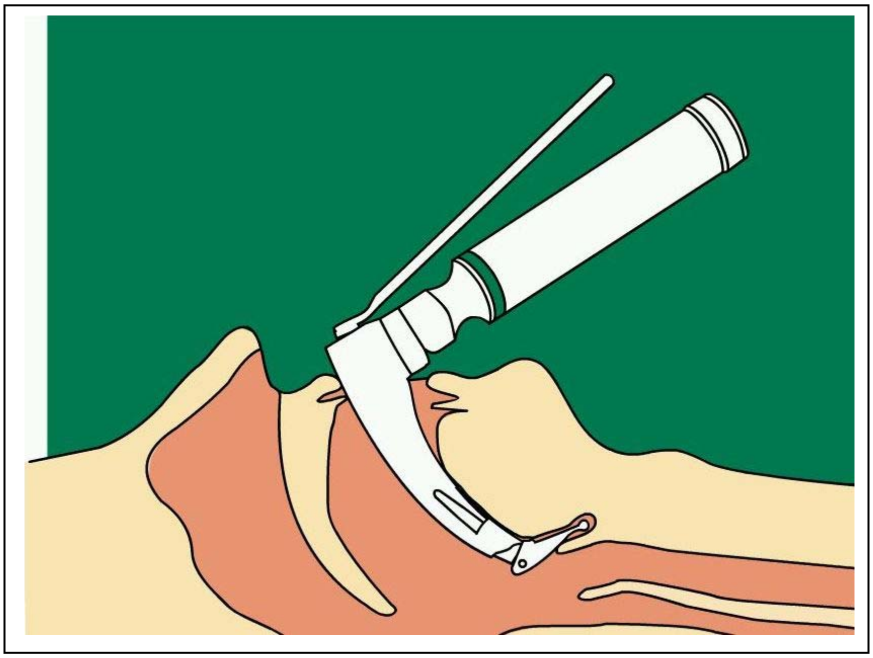
Mc Coy laryngoscope blade:

This is based on standard Macintosh blade with the addition of adjustable tip that is operated by a lever on the handle. The tip of the blade is placed in the vallecula. The epiglottis is indirectly elevated by the hinged tip rather than the upward and forward displacement of tongue and lower jaw.[8]

McCOY LARYNGOSCOPE – NORMAL POSITION



McCOY LARYNGOSCOPE – LEVER PRESSED AND TIP ELEVATED



Description of McCoy laryngoscope blade:

The levering laryngoscope blade differs from the Macintosh blade in four aspects.[6, 13,24]

1. Hinged tip
2. Lever at the proximal end.
3. Spring loaded drum.
4. Connecting shaft.

Hinged tip

The blade has been cut 25mm proximal to tip and a hinge placed between the two parts. The flange has been cut in a curved manner so that the adjustable tip locks with the rest of the blade in the resting position. Therefore the pressure exerted on the tip will be transmitted down the long axis of the flange and not exerted at the hinge.

Proximal lever

A lever 15.5cm in length and 1cm wide is attached to the proximal end of the blade. It is connected to a spring loaded drum on the proximal end of blade by a pin through the flange.

Spring loaded drum

An enclosed spring loaded drum lies on the left side of flange, the spring acting in a clockwise manner when viewed from the left side.

Connecting shaft

A connecting shaft links the spring loaded drum to hinged tip. It is 10cm long concave upwards and cut so as not to impinge on the bulb. At the distal end, it is linked to the hinged tip by way of a 1.5 cm wire and soldered to the connecting shaft proximally, bent to 90^o distally and inserted through a hole in the flange of hinge. Proximally the connecting shaft joins the spring loaded drum via a second hinge.

Mechanism of McCoy laryngoscope blade

The blade is attached to the standard laryngoscope handle. The handle is grasped in normal manner with the lever lying posterior to the thumb and the thumb may be moved posterior to the lever to lie along its long axis.

Compression of the lever towards the handle will cause the spring loaded drum to rotate anti-clockwise, the rotational movement of which causes the connecting shaft to move forward along the blade.

At the tip, the forward motion of the connecting shaft will push the 1.5 cm wire forwards resulting in elevation of the hinged tip.

Release of the lever at the handle allows the spring loaded drum to return the connecting shaft and therefore the hinged tip to the resting position.[6, 13,24]

The tip of the McCoy laryngoscope blade is kept in the vallecula and the operator then move his thumb from the laryngoscope handle to behind the lever and exerts gentle pressure on lever. Approximately 20^{o} movement of lever towards the handle causes the tip to elevate 70^{o} upwards, lifting the epiglottis indirectly, which exposes the underlying larynx. If the lever is released, the blade tip is returned to resting position and the blade is withdrawn normally.

Materials and Methods

MATERIALS AND METHODS

This study was conducted to compare the haemodynamic stress response (increased heart rate and mean arterial pressure) to the laryngoscopy with the three laryngoscope blades - McCoy, Macintosh and Miller in patients posted for elective surgeries under general anaesthesia requiring endotracheal intubation.

After getting the approval from the hospital ethical committee, this study was conducted in the Government Hospital of Thanjavur Medical College, Thanjavur.

This study comprised of sixty patients in the age group of 20-50 years, of both sexes, posted for elective surgeries under general anaesthesia requiring endotracheal intubation.

All the patients were informed of this study and prior written informed consent was obtained.

Patients were assessed by a detailed history and physical examination, supported by routine investigations. (Hb, TC, DC, ESR, Blood glucose, Blood urea, Serum creatinine, ECG, X-ray chest PA view)

Inclusion criteria:

ASA PS Grade I

MP Grade I

Laryngoscopy time < 15 seconds

Exclusion criteria:

ASA PS Grade > I

MP Grade > I

Laryngoscopy time > 15 seconds

Predicted difficult airway

Obese patients

Systemic hypertension

Coronary artery disease

Diabetes Mellitus

H/o cerebrovascular accidents

Valvular heart disease

On anti - hypertensive or cardiac drugs.

In this study, sixty patients were randomly allocated into twenty patients each in the three groups.

GROUP	LARYNGOSCOPE	NUMBER OF PATIENTS
Group I	McCoy Laryngoscope	20
Group II	Macintosh Laryngoscope	20
Group III	Miller Laryngoscope	20
	TOTAL	**60**

All patients were premedicated with Inj.Glycopyrrolate 5μg / kg i.m. Forty - five minutes before surgery.

Patients were shifted to the operation theatre and connected to the standard multimonitor, monitoring the ECG, SpO_2, non-invasive automated blood pressure and heart rate.

Intravenous access was obtained using 18G IV canula

Patients were pre-oxygenated with 100% O_2 for three minutes.

Induction was done with inj.fentanyl 2μg / kg, inj.thiopentone sodium 5mg / kg and inj.vecuronium 0.08 mg / kg iv.

Patients were ventilated by facemask with 100% O_2

After three minutes of vecuronium administration, the heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure was noted as baseline value (**B**).

Laryngoscopy was then performed (with either McCoy or Macintosh or Miller laryngoscope blade) enabling a clear view of the vocal cords for duration of less than 15 seconds.

With McCoy laryngoscope, the laryngoscope blade was gently introduced and the tip of the blade was placed in the vallecula. By just pressing the lever of the laryngoscope, the epiglottis is lifted indirectly exposing the larynx.

With Macintosh laryngoscope, the laryngoscope blade was gently introduced and the tip of the blade was placed in the vallecula. By lifting the laryngoscope upward and forward, the epiglottis is lifted indirectly exposing the larynx.

With Miller laryngoscope, the laryngoscope blade was gently introduced and the epiglottis was included under the tip of the blade. By lifting the laryngoscope upward and forward with the tip of the blade compressing the epiglottis on the base of the tongue, the epiglottis is lifted directly exposing the larynx.

The heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure were measured at the end of insertion of laryngoscope (**L**). Then the laryngoscope was then removed and the patients were ventilated for 5 minutes with N_2O:O_2 (66%: 33%). Heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure were recorded at 1st minute (**L+1**), 3rd minute (**L+3**) and 5th minute (**L+5**) after laryngoscopy. Then the patients were intubated and anaesthesia was continued.

The baseline (**B**), laryngoscopy (**L**), one minute after laryngoscopy (**L+1**), three minutes after laryngoscopy (**L+3**), five minutes after laryngoscopy (**L+5**) values of the heart rate and the mean arterial pressure were noted. In each group, changes in the values of the heart rate and the mean arterial pressure were based on the difference between the baseline value (**B**) and the values obtained at **L**, **L+1**, **L+3**, **L+5**.

The **B**, **L**, **L+1**, **L+3**, **L+5** values of the heart rate and mean blood pressure were compared among the three groups.

All results were expressed as mean ± SD.

Data were analysed by using Anova and Paired t test.

A **P value of** < **0.05** was considered statistically significant.

Observation and Results

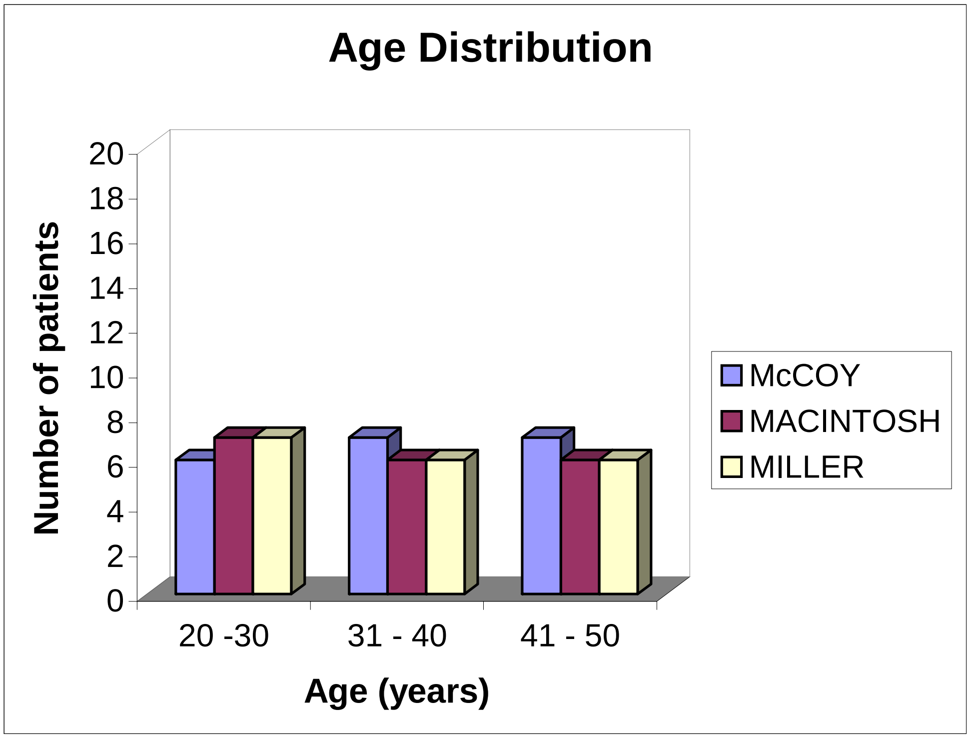
OBSERVATION AND RESULTS

GROUP	LARYNGOSCOPE	NUMBER OF PATIENTS
Group I	McCoy Laryngoscope	20
Group II	Macintosh Laryngoscope	20
Group III	Miller Laryngoscope	20
	TOTAL	60

The demographic profile as follows:

AGE DISTRIBUTION

Age	Group I	Group II	Group III
20-30	6	7	7
31-40	7	6	6
41-50	7	6	6



Age	Group I	Group II	Group III	F
Mean ± SD	35.55±7.9874	34.25±9.7538	35.2±8.1890	0.11595

p=0.8907

(p value > 0.05)

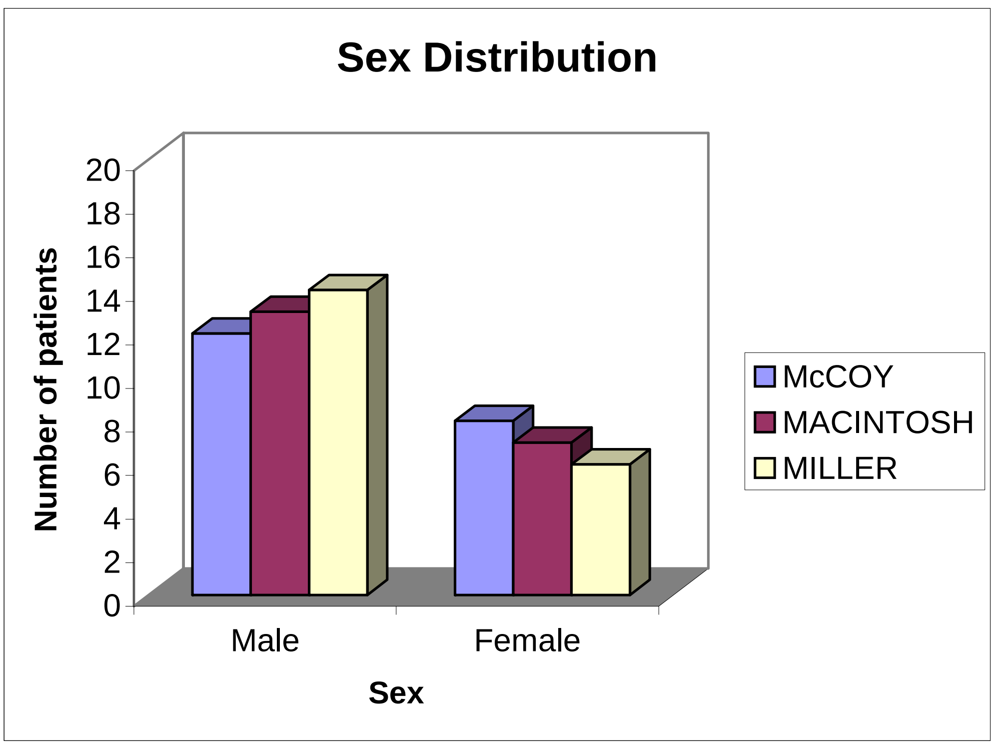
As the p value of age is >0.05, there is no statistically significant difference in the age distribution in the three groups.

SEX DISTRIBUTION

Sex	Group I	Group II	Group III
Male	12	13	14
Female	8	7	6

p = 0.8027

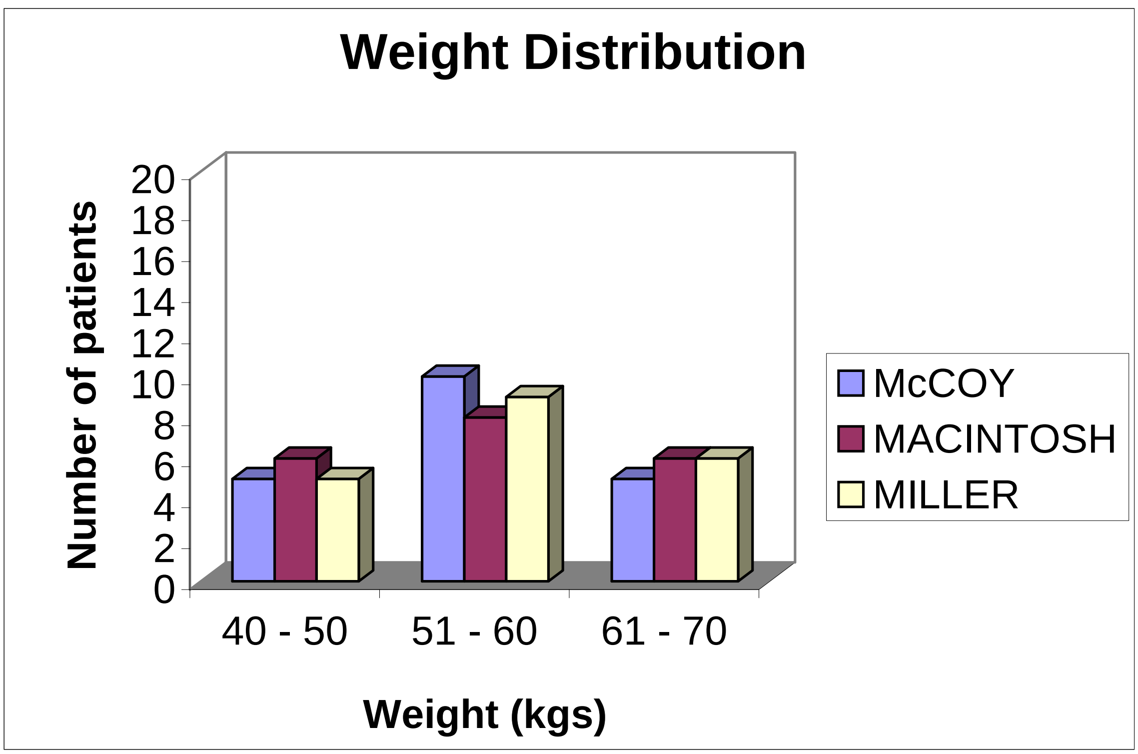
(p value > 0.05)



As the p value of sex is >0.05, there is no statistically significant difference in the sex distribution in the three groups.

WEIGHT DISTRIBUTION

Weight (Kg)	Group I	Group II	Group III
40-50	5	6	5
51-60	10	8	9
61-70	5	6	6



Weight	Group I	Group II	Group III	F
Mean ± SD	54.5±5.7140	54.85±6.6698	55.25±6.1308	0.4209

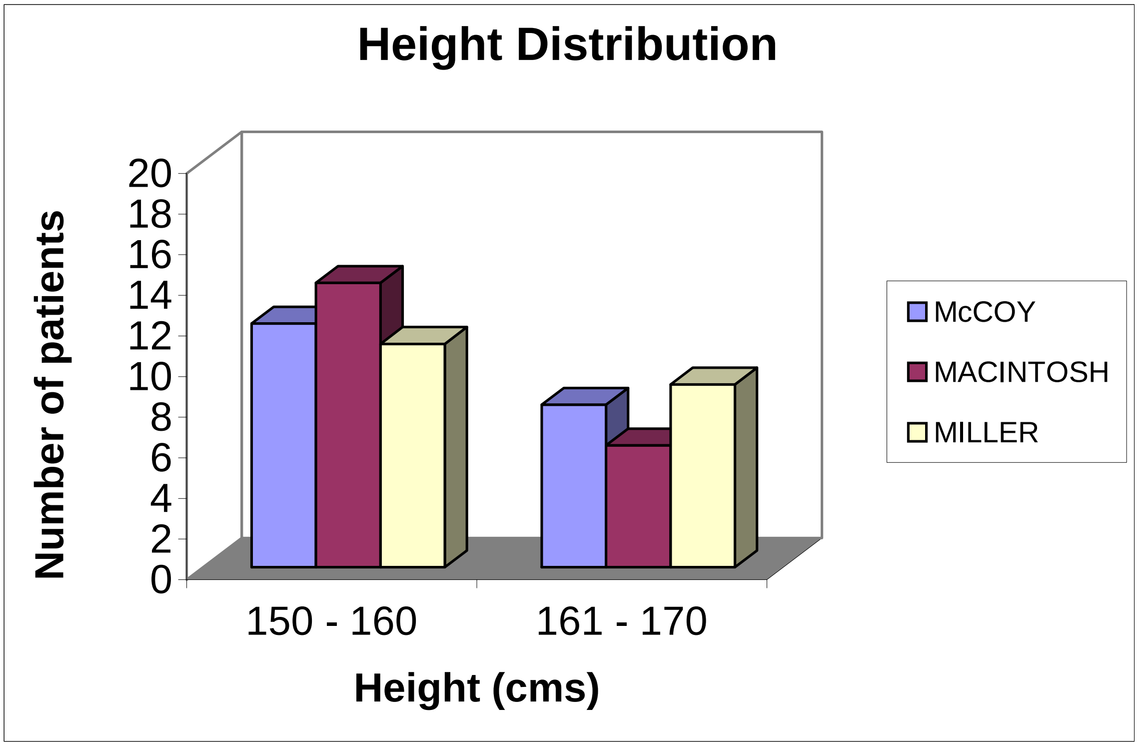
p=0.6585

(p value >0.05)

As the p value of weight is >0.05, there is no statistically significant difference in the weight distribution in the three groups.

HEIGHT DISTRIBUTION

Height (cms)	Group I	Group II	Group III
150-160	12	14	11
161-170	8	6	9



Height	Group I	Group II	Group III	F
Mean ± SD	158.35±5.5702	156.85±4.3275	159.25±5.2045	1.0905

p = 0.3430

(p value > 0.05)

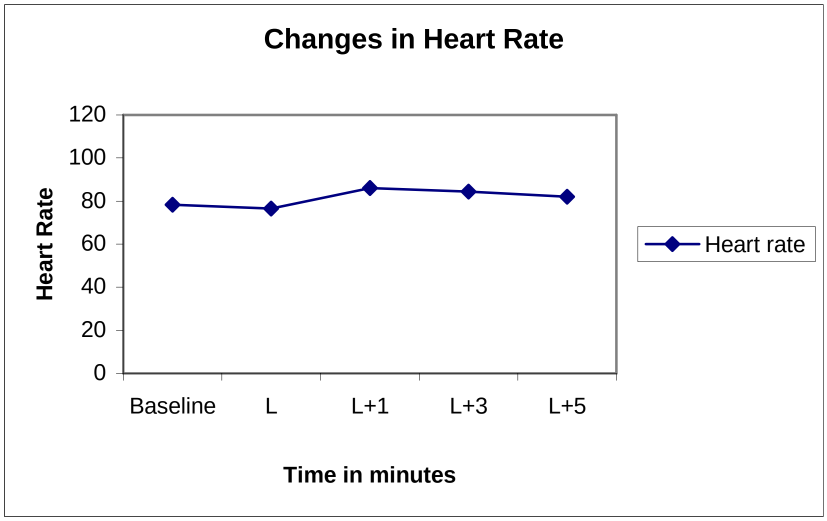
As the p value of height is > 0.05, there is no statistically significant difference in the height distribution in the three groups.

The mean ± SD of the heart rate and the mean arterial pressure of the three groups are:

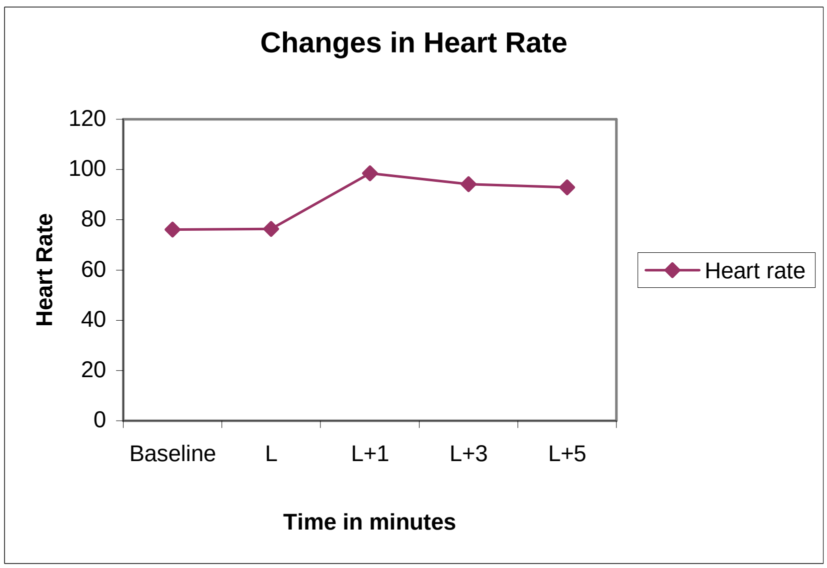
Heart Rate	Group I	Group II	Group III
Baseline	78.3±3.4510	76.1±4.8363	77.9±5.3094
L	76.5±5.2488	76.3±4.9839	78.0±5.3291
L+1	86.1±5.8137	98.5±5.5452	112.6±4.4989
L+3	84.4±5.6685	94.2±4.7916	110.8±4.4974
L+5	82.11±5.3716	92.9±4.5376	106.1±3.7013

Mean Arterial Pressure	Group I	Group II	Group III
Baseline	92.8±5.1536	91.5±9.6695	92.05±5.0544
L	95.15±4.9927	92.55±3.3387	92.10±2.8089
L+1	101.45±4.8731	108.85±3.6506	122.45±12.4977
L+3	98.35±4.7146	104.8±3.7629	116.80±4.6624
L+5	96.35±4.1746	102.05±3.7346	110.35±4.1385

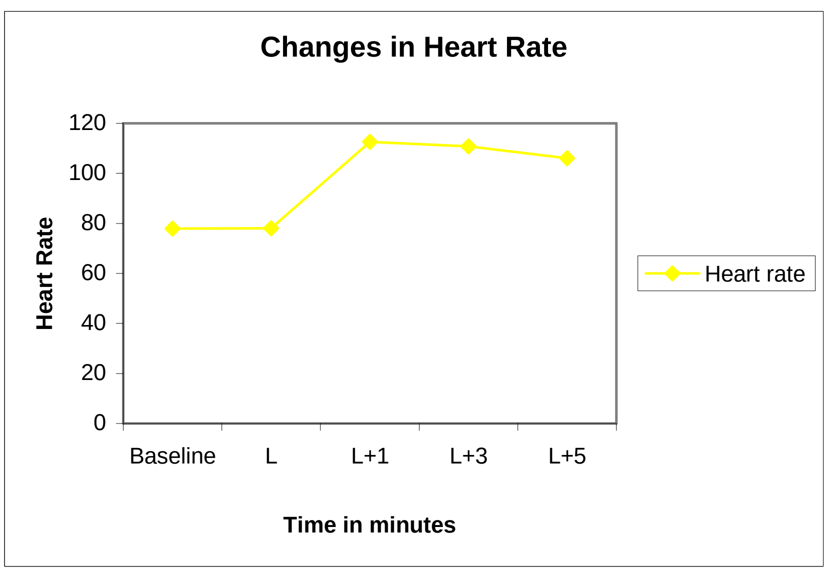
Group I **CHANGES IN HEART RATE**



Group II

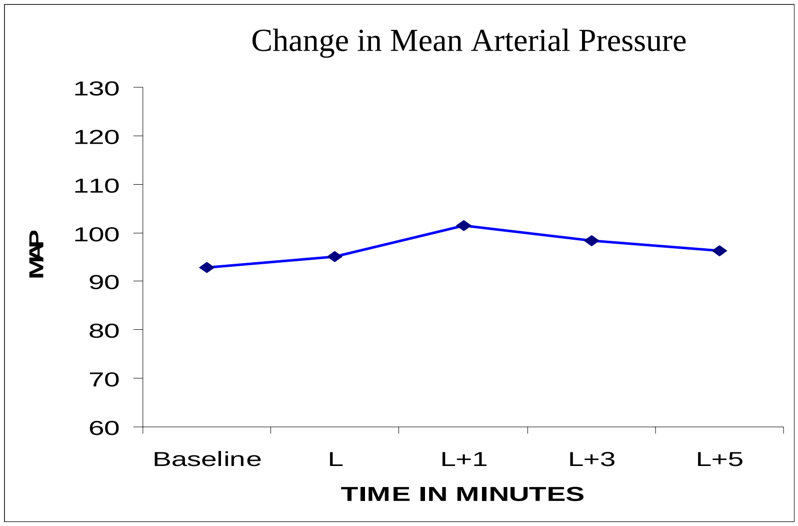


Group III

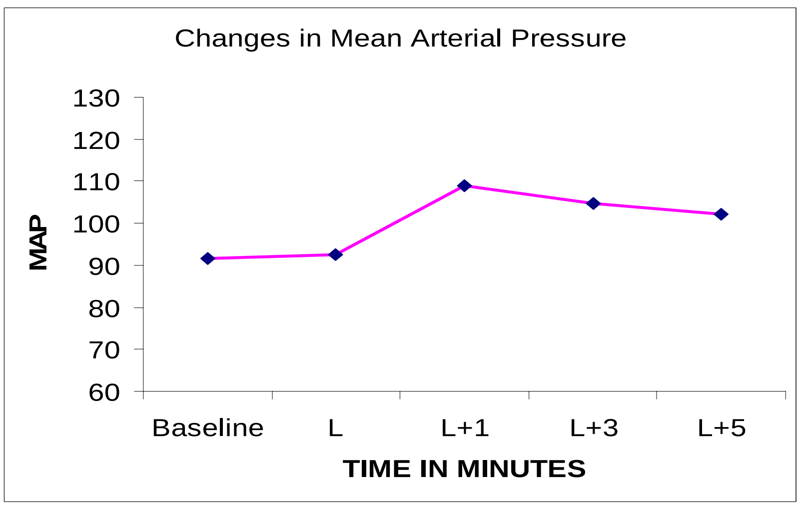


CHANGES IN MEAN ARTERIAL PRESSURE

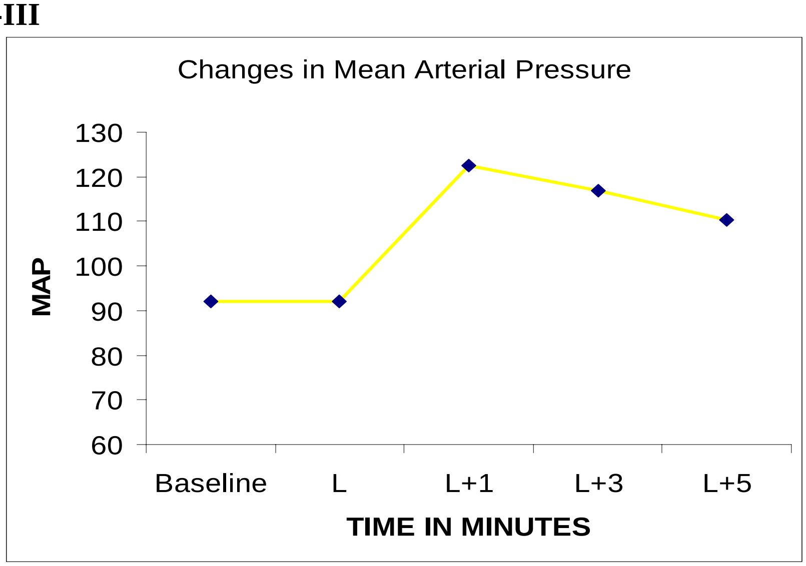
GROUP-I



GROUP-II



GROUP-III



The mean values of the heart rate and the mean arterial pressure of L, L+1, L+3, L+5 were compared with the baseline value in each group.

Group I	**Heart Rate**			**Mean Arterial Pressure**		
	t	**p**	**p value**	**t**	**p**	**p value**
B and L	1.18	0.1263	>0.05	0.51	1.8315	>0.05
B and L+1	26.8147	<0.0001	<0.05	25.9478	<0.0001	<0.05
B and L+3	19.5005	<0.001	<0.05	11.8991	<0.0001	<0.05
B and L+5	9.0378	<0.001	<0.05	8.0645	<0.0001	<0.05

In Group I, the mean value of heart rate of **B** is 78.3±3.4510, of **L** is 76.5±5.2488, of **L+1** is 86.1±5.8137, of **L+3** is 84.4±5.6685 and of **L+5** is 82.11±5.3716. There is no statistically significant difference in the mean value of heart rate between the **B** and **L** value (p value >0.05). But there is statistically significant increase in the mean value of heart rate of **L+1**, **L+3**, **L+5** from that of the baseline (**B**)(p value of < 0.05).

In Group I, the mean value of mean arterial pressure of **B** is 92.8±5.1536, of **L** is 95.15±4.9927, of **L+1** is 101.45±4.8731, of **L+3** is 98.35±4.7146 and of **L+5** is 96.35±4.1746. There is no statistically significant difference in the mean value of mean arterial pressure between the **B** and **L** value (p value >0.05). But there is statistically significant increase in the mean value of mean arterial pressure of **L+1**, **L+3**, **L+5** from that of the baseline (**B**) (p value of < 0.05).

Group II	**Heart Rate**			**Mean Arterial Pressure**		
	t	**p**	**p value**	**t**	**p**	**p value**
B and L	1.4534	0.0812	>0.05	1.8315	0.0596	>0.05
B and L+1	41.011	<0.0001	<0.05	18.0657	<0.0001	<0.05
B and L+3	30.1003	<0.0001	<0.05	35.28	<0.0001	<0.05
B and L+5	11.3097	<0.0001	<0.05	23.79	<0.0001	<0.05

In Group II, the mean value of heart rate of B is 76.1±4.8363, of **L** is 76.3±4.9839, of **L+1** is 98.5±5.5452, of L**+3** is 94.2+-4.7916 and of **L+5** is 92.9±4.5376. There is no statistically significant difference in the mean value of heart rate between the **B** and **L** value (p value >0.05). But there is statistically significant increase in the mean value of heart rate of **L+1**, **L+3**, **L+5** from that of the baseline (**B**) (p value of < 0.05).

In Group II, the mean value of mean arterial pressure of **B** is 91.5±9.6695, of **L** is 92.55±3.3387, of **L+1** is 108.85±3.6506, of **L+3** is 104.8±3.7629 and of **L+5** is 102.05±3.7346. There is no statistically significant difference in the mean value of mean arterial pressure between the **B** and **L** value (p value >0.05). But there is statistically significant increase in the mean value of mean arterial pressure of **L+1**, **L+3**, **L+5** from that of the baseline (**B**) (p value of < 0.05).

Group III	**Heart Rate**			**Mean Arterial Pressure**		
	t	**p**	**p value**	**t**	**p**	**p value**
B and L	1.7108	0.0517	>0.05	1.4534	0.0812	>0.05
B and L+1	61.99	0.0001	<0.05	32.66	<0.0001	<0.05
B and L+3	14.39	<0.001	<0.05	27.31	<0.0001	<0.05
B and L+5	22.4552	<0.0001	<0.05	21.5159	<0.0001	<0.05

In Group III, the mean value of heart rate of **B** is 77.9±5.3094, of **L** is 78.0±5.3291, of **L+1** is 112.6±4.4989, of **L+3** is 110.8±4.4974 and of **L+5** is 106.1±3.7013. There is no statistically significant difference in the mean value of heart rate between the **B** and **L** value (p value >0.05). But there is statistically significant increase in the mean value of heart rate of **L+1**, **L+3**, **L+5** from that of the baseline (**B**) (p value of < 0.05).

In Group III, the mean value of mean arterial pressure of **B** is 92.05±5.0544, of **L** is 92.10±2.8089, of **L+1** is 122.45±12.4977, of **L+3** is 116.8±4.6624 and of **L+5** is 110.35±4.1385. There is no statistically significant difference in the mean value of mean arterial pressure between the **B** and **L** value (p value >0.05). But there is statistically significant increase in the mean value of mean arterial pressure of **L+1**, **L+3**, **L+5** from that of the baseline (**B**) (p value of < 0.05).

The baseline (B), L values of the heart rate and the mean arterial pressure were compared among the three groups.

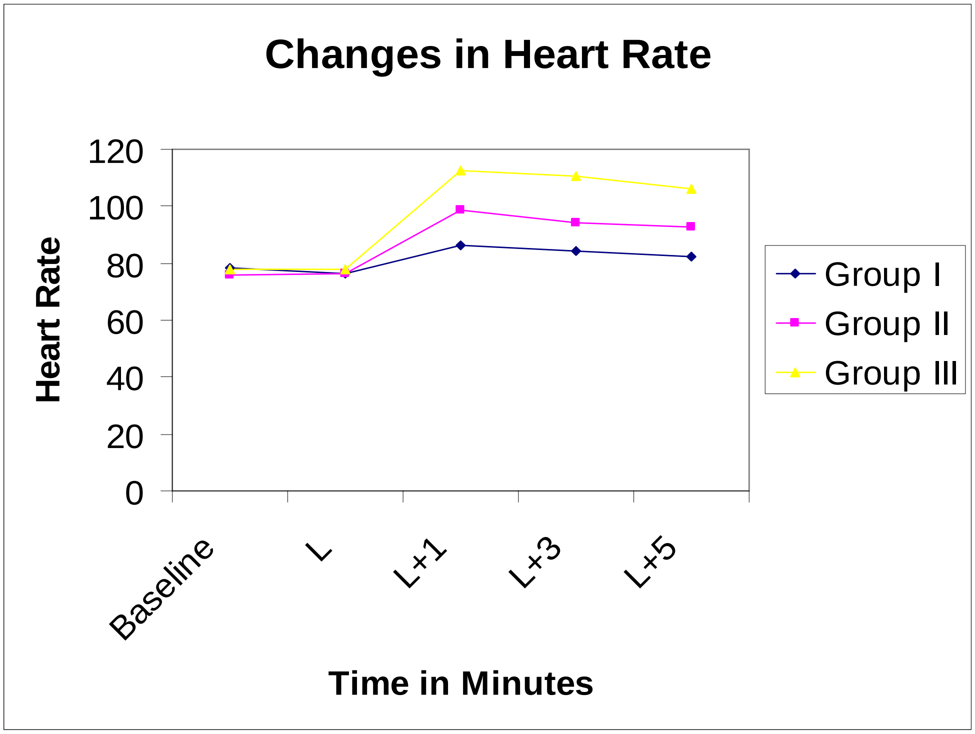
	Heart Rate			Mean Arterial Pressure		
	f	p	p value	f	p	p value
Baseline	2.3102	0.1085	>0.05	0.1950	0.8234	>0.05
L	1.1535	0.3225	>0.05	2.9310	0.0614	>0.05

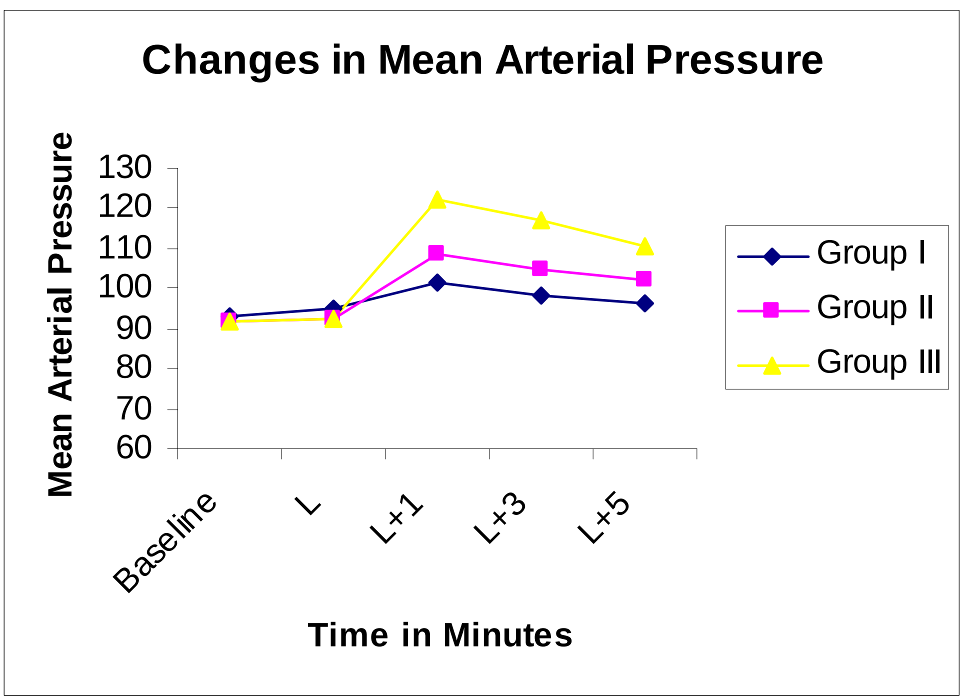
There was no statistically significant difference in the baseline (**B**) and **L** values of heart rate and mean arterial pressure among the three groups. (p value > 0.05)

The L+1, L+3, L+5 values of the heart rate were compared among the three groups.

Heart Rate	**I and II**			**II and III**			**I and III**		
L +1	t	p	p value	t	p	p value	t	p	p value
	2.6272	0.0084	<0.05	5.4084	<0.0001	<0.05	15.2529	<0.0001	<0.05
L + 3	0.8741	0.1965	<0.05	5.2094	<0.0001	<0.05	3.9574	0.0004	<0.05
L + 5	0.874	0.1965	<0.05	4.3902	0.0002	<0.05	7.4246	<0.0001	<0.05

There was statistically significant difference in the **L+1**, **L+3**, **L+5** values of heart rate among the three groups. When the mean values of heart rate were compared among the three groups, the values were least with Group I [McCoy], most with Group III [Miller] and in-between with Group II [Macintosh].


Changes in Heart Rate
Heart Rate
120
100
80
60
40
20
0
Baseline
L
L+1
L+3
L+5
Time in Minutes
Group I
Group II
Group III


Changes in Mean Arterial Pressure
Mean Arterial Pressure
130
120
110
100
90
80
70
60
Baseline
L
L+1
L+3
L+5
Time in Minutes
Group I
Group II
Group III

The L+1, L+3, L+5 values of the mean arterial pressure were compared among the three groups

Mean arterial Pressure	I and II			II and III			I and III		
L +1	t	p	p value	t	p	p value	t	p	p value
	4.2117	0.0002	<0.05	5.4449	<0.0001	<0.05	6.1875	<0.0001	<0.05
L + 3	4.2826	0.0002	<0.05	4.1184	0.0003	<0.05	8.5020	<0.0001	<0.05
L + 5	2.3362	0.0154	<0.05	5.1945	<0.0001	<0.05	4.2196	0.0002	<0.05

There was statistically significant difference in the **L+1**, **L+3**, **L+5** values of mean arterial pressure among the three groups. When the mean values of mean arterial pressure were compared among the three groups, the values were least with Group I [McCoy], most with Group III [Miller] and in-between with Group II [Macintosh].

Review of Literature

REVIEW OF LITERATURE

B.D.King, L.C. Harris et al [9]:

Documented myocardial ischemic changes due to the reflex sympathoadrenal response immediately following the laryngoscopy and intubation with the increase in the heart rate and the mean arterial pressure even in the normotensive patients.

Roberts, C. Green et al [17]:

Showed exaggerated form of increase in the heart rate and the mean arterial pressure in systemic hypertension patients during the laryngoscopy and intubation.

A.M.Forbes, F.G. Dally et al [5]:

Observed that the laryngoscopy and intubation is immediately associated with the increase in the heart rate and the mean arterial pressure in all the twenty-two normotensive patients.

E.P. McCoy, R.K. Mirakhur et al [12]:

Studied the forces exerted at the laryngoscopy with the McCoy and the Macintosh laryngoscope blades in forty patients. Variables measured were the duration of the laryngoscopy, the three maximally applied forces and the mean force.

They concluded that the use of the McCoy laryngoscope blade results in significantly less force being applied during laryngoscopy and this might be the reason for the reduction in haemodynamic stress response (increased heart rate and the mean arterial pressure) when compared to that of Macintosh laryngoscope blade.

E.P. McCoy, B.V. McCloskey et al [10]:

Studied the haemodynamic stress response (increased heart rate and mean arterial pressure) and plasma catecholamine concentration in twenty patients before, during and 1 minute, 3 minutes and 5 minutes after laryngoscopy with either the McCoy or the Macintosh laryngoscope blades.

It is concluded that the haemodynamic stress response (increased heart rate and mean arterial pressure) is less with the use of McCoy laryngoscopy than the Macintosh laryngoscopy and it is probably due to the reduction in the force necessary to obtain a clear view of larynx with the McCoy laryngoscope blade.

J.Castillo, J.Castano et al [2]:

Studied the cardiocirculatory responses of the laryngoscopy performed with the Macintosh laryngoscope blade and the McCoy laryngoscope blade. They observed that the McCoy laryngoscopy was associated with significantly lower heart rate and mean arterial pressure than the Macintosh laryngoscopy.

T.Nishiyama, Higashizawat et al [16]:

They studied the haemodynamic stress response (increased heart rate and mean arterial pressure) during the laryngoscopy with McCoy, Macintosh and Miller laryngoscope blades. Mean arterial pressure, heart rate and plasma concentration of catecholamines were measured during and after laryngoscopy without tracheal intubation.

This study results suggested that the haemodynamic stress response (increased heart rate and mean arterial pressure) during the laryngoscopy without intubation is most with the Miller laryngoscopy and least with the McCoy laryngoscopy and in-between with the Macintosh laryngoscopy.

A.J.Shribman, G.Smith et al [22]:

Studied the haemodynamic stress response (increased heart rate and mean arterial pressure) to the laryngoscopy alone and laryngoscopy followed by intubation in twenty four patients assessing the heart rate, mean arterial pressure and plasma catecholamines before laryngoscopy and at first, third and fifth minute after laryngoscopy. There was a significant increase in the heart rate, mean arterial pressure and plasma catecholamines concentration following laryngoscopy with or without intubation.

H.G.Hassan, T.Y. Sharkawy et al [7]:

Analysed forty patients regarding the haemodynamic stress response to laryngoscopy and intubation. They found that there is a biphasic haemodynamic stress response with the laryngoscopy sensed by the proprioceptors supplied by the glossopharyngeal nerve and an additional response with vocal cord contact supplied by the superior laryngeal nerve above and the recurrent laryngeal nerve below the vocal cords, as the trachea is intubated.

Paul G.Barash, Bruce F. Cullen, Robert K.Stoelting [18]:

As the tip of the Miller laryngoscope blade includes the epiglottis and the epiglottis is lifted directly to view the larynx, stimulation of the soft tissues of oropharynx and epiglottis causes more haemodynamic stress response.

A.Dorch and E. Dorsch [8]:

Studies have shown that use of the McCoy laryngoscope blade results in significantly less force being applied and a reduction in the haemodynamic stress response compared to the Macintosh blade.

Discussion

DISCUSSION

Since the first description of the sympathetic haemodynamic stress response to the laryngoscopy and intubation, there have been numerous studies concerning both the haemodynamic stress response and the various ways by which it can be attenuated. It is found that the major stimulus to sympathetic haemodynamic stress response during laryngoscopy is the force exerted by the laryngoscope blade upon the structures of oropharynx (tongue, epiglottis). [12] Reduction in the force applied on the structures of oropharynx has attenuated the magnitude of the haemodynamic stress response.[10, 12]

With the McCoy laryngoscopy, the epiglottis is elevated indirectly by the hinged tip of the blade by just pressing the lever rather than upward and forward displacement of structure of the entire lower jaw. Hence the force exerted on the structure of oropharynx is limited to area of the vallecula and the adjacent base of the tongue in contact with distal movable part of blade (distal to the hinge of the blade). Hence the magnitude of haemodynamic stress response (increased heart rate and mean arterial pressure) elicited by McCoy laryngoscopy is least when compared to that of Macintosh and Miller laryngoscopy.

With the Macintosh laryngoscopy, the laryngoscope blade is lifted upward and forward with the force applied on the entire curvature of the spatula of the blade lifting the entire lower jaw. The area of oropharynx upon which the force exerted is on the entire inner aspect of the lower jaw with the tip of the blade in the vallecula. This causes more haemodynamic stress response than that of McCoy laryngoscopy. But as the epiglottis is not stimulated directly as seen with the use of Miller laryngoscope blade, the haemodynamic stress response is less than that of Miller laryngoscopy.

With the Miller laryngoscope blade, the blade is introduced into the oropharynx and the tip of the blade is passed over the posterior surface of the epiglottis. The epiglottis is included under the tip of the blade and the blade is lifted upward and forward with the force applied on the entire inner aspect of lower jaw and compressing the epiglottis on the base of the tongue. The epiglottis is lifted directly to view the larynx. Hence the haemodynamic stress response with the

Miller laryngoscopy is more than that of McCoy and Macintosh laryngoscopy.

The haemodynamic stress response (increased heart rate and mean arterial pressure) is least with McCoy laryngoscopy, most with Miller laryngoscopy and in-between with Macintosh laryngoscopy, when the haemodynamic stress response (increased heart rate and mean arterial pressure) is compared among these three laryngoscope blades.

Summary

SUMMARY

This study was conducted to compare the haemodynamic stress response (increased heart rate and mean arterial pressure) to laryngoscopy with the three laryngoscope blades - McCoy, Macintosh and Miller.

Sixty patients of both sexes in the age group of 20-50 years, posted for elective surgeries under the general anaesthesia requiring endotracheal intubation were randomly allocated into three groups.

In Group I, McCoy laryngoscopy was performed.

In Group II, Macintosh laryngoscopy was performed.

In Group III, Miller laryngoscopy was performed.

After induction, the heart rate and the mean arterial pressure were noted as baseline value (**B**). Then the laryngoscopy was performed with a clear view of vocal cords for duration of less than 15 seconds. The heart rate and the mean arterial pressure at the end of the laryngoscopy (**L**) were noted. Then the laryngoscope was removed

and the patients were ventilated for five minutes. The heart rate and the mean arterial pressure at one minute (**L+1**), three minutes (**L+3**) and five minutes (**L+5**) after laryngoscopy were noted. Then the patients were intubated and the anaesthesia was continued.

The values of heart rate and mean arterial pressure of **L**, **L+1**, **L+3** and **L+5** were compared with that of baseline value (**B**) within each group.

The values of heart rate and mean arterial pressure of **B**, **L**, **L+1**, **L+3** and **L+5** were compared among the three groups.

There was increase in the values of heart rate and mean arterial pressure in **L+1**, **L+3**, **L+5** from that of baseline value (**B**) in all groups.

When the increase in the values of the heart rate and the mean arterial pressure of **L+1**, **L+3**, **L+5** were compared among the three groups, the values were least in the GroupI (McCoy), most in the GroupIII (Miller) and in-between with the GroupII (Macintosh).

With the McCoy laryngoscopy, the epiglottis is elevated indirectly by the hinged movable part of the blade by pressing the lever of the blade rather than the upward and forward displacement of the lower jaw. Thus the minimal oropharyngeal stimulation causes least haemodynamic stress response when compared to that of the Macintosh and the Miller laryngoscopy.

With the Miller laryngoscopy, the epiglottis is elevated directly with the tip of the blade along with the upward and forward displacement of the lower jaw causing the most haemodynamic stress response when compared to that of the McCoy and Macintosh laryngoscopy.

With the Macintosh laryngoscopy, the epiglottis is elevated indirectly by the upward and forward displacement of the lower jaw causing more haemodynamic stress response than that of the McCoy laryngoscopy. But as the epiglottis is not stimulated directly as seen with the Miller laryngoscopy, the haemodynamic stress response is less than that of the Miller laryngoscopy.

Conclusion

CONCLUSION

The sympathetic haemodynamic stress response (increased heart rate and mean arterial pressure) to laryngoscopy is compared with McCoy, Macintosh and Miller laryngoscope blades. It is concluded that the haemodynamic stress response (increased heart rate and mean arterial pressure) to laryngoscopy is least with McCoy laryngoscope and most with Miller laryngoscope and in-between with Macintosh laryngoscope.

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Proforma

PROFORMA

A COMPARATIVE STUDY OF THE HAEMODYNAMIC STRESS RESPONSE TO THE LARYNGOSCOPY – WITH THE McCOY, THE MACINTOSH AND THE MILLER LARYNGOSCOPE BLADES.

DEPARTMENT OF ANAESTHESIOLOGY,

THANJAVUR MEDICAL COLLEGE.

Name: Age: Sex: Weight:

Height:

IP No: Random Number:

Diagnosis:

Surgery:

Pre Operative Evaluation

PR: CVS: Airway: MP

Grade:

BP: RS:

Investigations:

HB: TC: DC: ESR: Urine Albumin,

Sugar:

Blood Glucose: ECG:

Blood Urea: X-Ray Chest PA

View :

Serum Creatinine:

Blood Gp/Typ:

ASA PS Grade:

Study Group:

GROUP	LARYNGOSCOPE
Group I	McCoy Laryngoscope
Group II	Macintosh Laryngoscope
Group III	Miller Laryngoscope

Inclusion criteria:

ASA PS Grade I

MP Grade I

Laryngoscopy time < 15 seconds

Exclusion criteria:

ASA PS Grade > I

MP Grade > I

Laryngoscopy time >15 seconds

Predicted difficult airway

Obese patients

Systemic hypertension

Coronary heart disease

Diabetes mellitus

H/o cerebrovascular accidents

Valvular heart disease

On anti-hypertensive or cardiac drugs

Premedication:

Induction:

Drug	Dose	Time

Parameters:

Variables	HR (/mt)	SAP (mmHg)	DAP (mmHg)	MAP (mmHg)
Baseline				
L				
L+1				
L+3				
L+5				

HEART RATE (per minute)

Group I

S.No.	Name	Age (Yrs)	Sex	Weight (Kg)	Baseline	L	L+1	L+3	L+5

Group II

S.No.	Name	Age (Yrs)	Sex	Weight (Kg)	Baseline	L	L+1	L+3	L+5

Group III

S.No.	Name	Age (Yrs)	Sex	Weight (Kg)	Baseline	L	L+1	L+3	L+5

MEAN ARTERIAL PRESSURE (mmHg)

Group I

S.No.	Name	Age (Yrs)	Sex	Weight (Kg)	Baseline	L	L+1	L+3	L+5

Group II

S.No.	Name	Age (Yrs)	Sex	Weight (Kg)	Baseline	L	L+1	L+3	L+5

Group III

S.No.	Name	Age (Yrs)	Sex	Weight (Kg)	Baseline	L	L+1	L+3	L+5

POST OPERATIVE CONDITION:

Group I - McCOY						Heart Rate					Systolic Blood Pressure			
S.NO	**Name**	**Sex**	**Age**	**Weight**	**Height**	**B**	**L**	**L+1**	**L+3**	**L+5**	**B**	**L**	**L+1**	**L+3**
1	MALA	FEMALE	22	46	152	72	74	82	82	80	110	114	122	120
2	KODI	FEMALE	24	48	153	76	78	86	86	80	120	122	130	126
3	MEKALA	FEMALE	26	47	154	82	88	96	96	92	126	126	134	130
4	KALPANA	FEMALE	27	48	155	82	86	95	92	88	130	132	140	136
5	KARPU	FEMALE	27	46	156	80	82	90	90	86	126	130	138	136
6	KALA	FEMALE	28	52	152	86	90	98	92	98	132	134	140	138
7	MULLAI	FEMALE	33	50	158	82	84	90	88	84	120	122	130	134
8	PARVATHY	FEMALE	34	54	152	86	88	96	96	90	130	132	140	138
9	MURUGAN	MALE	35	55	154	80	82	90	86	84	110	112	120	120
10	KUMAR	MALE	33	56	155	90	92	100	98	94	136	136	142	136
11	MUTHUPANDI	MALE	36	52	156	82	80	88	86	84	126	126	134	132
12	MURALI	MALE	37	55	152	86	88	96	94	92	118	120	128	130
13	SARAVANAN	MALE	38	58	164	88	86	93	90	92	132	130	138	136
14	SAI	MALE	42	56	162	72	74	80	82	78	126	126	134	134
15	MANIKANDAN	MALE	44	55	166	86	88	96	94	90	116	118	126	128
16	NARAYANAN	MALE	46	62	162	80	82	90	88	84	126	126	134	134
17	MARAN	MALE	47	64	164	72	76	84	80	78	136	138	145	142
18	MAKESH	MALE	43	62	166	72	74	80	78	80	130	132	140	140
19	MUNUSAMY	MALE	44	61	162	88	90	98	96	90	126	126	130	130
20	MUTHUPANDI	MALE	45	63	164	90	92	98	96	92	116	118	126	126

Group II - MACINTOSH						Heart Rate					Systolic Blood Pressure			
S.NO	Name	Sex	Age	Weight	Height	B	L	L+1	L+3	L+5	B	L	L+1	L+3
1	SRIDEVI	FEMALE	21	46	152	72	74	90	92	90	120	122	136	136
2	MALAR	FEMALE	24	44	154	70	70	84	88	90	110	112	126	124
3	STELLA	FEMALE	26	46	152	80	80	96	94	92	122	122	138	140
4	BABY	FEMALE	24	48	155	82	82	98	96	94	116	116	132	130
5	MALARVIZHI	FEMALE	28	46	154	72	72	88	92	92	132	132	148	146
6	MANGALYAM	FEMALE	24	48	156	80	80	96	94	90	126	126	140	136
7	KRISHNAVENI	FEMALE	22	52	152	78	78	94	94	90	132	134	148	146

8	MUKESH	MALE	32	54	156	76	78	96	94	92	116	118	134	134
9	KRISHNA	MALE	34	55	154	82	82	98	96	94	132	132	148	146
10	KANNAN	MALE	34	56	158	72	70	86	84	80	122	124	140	136
11	MADASAMY	MALE	35	54	154	86	88	106	102	98	118	120	136	132
12	MUTHUSAMY	MALE	36	58	156	72	72	88	86	84	132	132	148	146
13	MURUKAVEL	MALE	37	58	152	76	76	90	88	86	122	122	136	134
14	PANDIYAN	MALE	42	52	154	72	72	88	86	84	110	110	126	124
15	PARITHI	MALE	42	62	162	78	78	94	92	90	120	122	138	136
16	BALAN	MALE	46	64	162	80	82	98	94	90	132	132	148	146
17	BALAKRISHNAN	MALE	44	62	164	70	72	88	86	84	122	122	138	136
18	KANTHASAMY	MALE	45	64	164	72	72	86	84	82	116	116	132	130
19	KANNU	MALE	46	64	162	70	72	88	86	84	120	120	136	134
20	MAYAN	MALE	48	62	164	82	82	98	96	92	122	122	138	136

Group III - MILLER						**Heart Rate**					**Systolic Blood Pressu**		
S.NO	Name	Sex	Age	Weight	Height	B	L	L+1	L+3	L+5	B	L	L+
1	BEGUM	FEMALE	22	46	154	70	70	98	94	92	110	110	13
2	LAKSHMI	FEMALE	24	44	155	72	72	98	96	94	112	112	13
3	REKHA	FEMALE	25	46	156	76	76	100	98	96	116	116	14
4	KUYIL	FEMALE	26	48	157	80	80	106	102	100	120	120	14
5	MAHADEVI	FEMALE	27	48	152	82	82	108	106	102	122	124	14
6	MEGHALA	FEMALE	28	52	154	86	86	112	110	106	126	124	15
7	MOHAN	MALE	29	54	152	84	84	110	108	106	130	128	15
8	KUMAR	MALE	32	55	155	70	72	100	98	96	132	130	15
9	KALIDAS	MALE	33	56	156	72	72	98	94	92	136	136	16
10	DEEPAN	MALE	36	58	155	76	76	102	96	94	120	118	15
11	PRABHU	MALE	37	55	157	82	84	110	108	104	122	120	14
12	MAHESHWARAN	MALE	38	56	162	84	86	110	106	100	116	114	14
13	MUGIL	MALE	34	58	164	86	86	110	106	102	118	116	14
14	CHITTIBABU	MALE	42	54	166	84	84	110	102	100	120	122	14
15	BALU	MALE	44	62	164	72	72	98	92	90	122	122	15
16	RENGAN	MALE	46	62	166	76	78	106	104	100	130	132	16
17	VENKATESHWARAN	MALE	47	63	168	78	78	108	106	102	122	124	15

18	KANGARAJAN	MALE	48	62	162	80	80	108	106	102	126	128	15
19	SAMY	MALE	44	64	162	72	72	100	98	96	116	116	14
20	SRINIVASAN	MALE	42	62	164	76	76	106	102	100	110	110	13