ORIGINAL RESEARCH PAPER

Anaesthesiology

COMPARISON OF DEXMEDETOMIDINE AND ESMOLOL IN INDUCED HYPOTENSION DURING HEAD AND NECK SURGERIES DONE IN TERTIARY CARE CENTER

KEY WORDS:

Dr. Kumaran Post-graduate, Department of anaesthsiology, Karpaga Vinayaga medical college and research centre, Tamilnadu Dr.MGR medical university, Tamilnadu

Dr. Muralimanoj Associate professor, Department of anesthesiology, Karpaga Vinayaga medical college and research centre,Tamilnadu Dr.MGR medical university,

Dr. Santha Pathiban Professor and Head, Department of anaesthesiology, Karpaga Vinayaga medical college and research centre,Tamilnadu Dr.MGR medical

ABSTRACT

Introduction: During the time of surgery hypotension is required to have blood less field with reduced detrimental effects on vital organs.There are several drugs used to achieve hypotensive anaesthesia Esmolol and dexmedetomidine are some among them. **Objective:** The study was done to compare the efficacy of Dexmedetomidine and esmolol in achieving hypotension during head and neck surgery. **Methodology:** The study population included 60 subjects who were randomly divided into 2 groups. Group E received esmolol infusion 1mg/kg bolus over 10 minutes before induction followed by maintenance infusion of 0.5mg/kg/hr after induction. Group D received Dexmedetomidine loading dose of 1mcg/kg over 10 minutes before induction followed by maintenance infusion of 0.5mcg/kg/hr after induction. In both groups diastolic and systolic blood pressure, mean arterial pressure, heart rate, SpO2 before and immediately after drug administration, before induction of anaesthesia, after intubation, then every 15mins in 1 hour and subsequently every 30 mins until end of surgery were measured. The blood loss and recovery time were measured. The data was entered into Microsoft Excel and analysed using SPSS 22. **Result** The mean values of MAP showed Dexmedetomidine group had sustained reduction of MAP compared to esmolol. It shows the duration of surgery(hrs) for dexmedetomidine is 2.43 hrs and esmolol is 3.14 hrs and total anaesthesia time(hrs) of dexmedetomidine is 3.18 hrs and esmolol is 2.56hrs. **Conclusion** Both Dexmedetomidine and esmolol reduced mean arterial pressure but Dexmedetomidine showed lesser blood loss where as esmolol has lesser recovery time

INTRODUCTION

Hypotensive anaesthesia is recommended technique in surgical procedures involving increased bleeding which includes ENT, head and neck surgeries. The hypotensive state during this technique maintains vital organ perfusion.

In hypotensive anaesthesia, the subject's resting mean arterial pressure (MAP) is brought down to 30%. As result systolic falls to 80 to 90 mmHg and MAP will be 50 to 65mmHg in normotensive patient[1,2]. The fall will decrease the bleeding during the surgery. Since the flow of blood to surgical field decreased the operating field will be improved.[3]

There are several studies which showed controlled hypotension could induce bloodless surgical field particularly in head and neck surgeries. There are two method for hypotensive anaesthesia. One is by deepening the plane of anaesthesia and other is use of hypotensive agents.

Dexmedetomidine is an highly selective alpha 2 -adrenergic receptor agonist which has sedative, analgesic and sympatholytic property. It has a greater efficacy in terms of hypotensive anaesthesia and is useful in inducing bloodless field for surgeries5,10-19. The central and peripheral sympatholytic action is mediated by alpha 2 adrenergic receptor and is manifested by dose dependent decrease in arterial blood pressure, heart rate, cardiac output and norepinephrine release.

Esmolol is an ultra short acting selective beta 1 adrenergic antagonist that reduces the heart rate and blood pressure. It has rapid onset of action i.v bolus injection and infusion. Upon termination of infusion gradual recovery of arterial blood pressure to pre infusion level occurred without development of rebound hypertension.

A study by Sukhminder Jit Singh to compare esmolol and dexmedetomidine on various hemodynamic in subjects enduring Functional endoscopic surgery showed Dexmedetomidine had better performance than esmolol in decreasing the systolic and diastolic blood pressure as well as mean arterial pressure. In study by Zeynel Abdin Erbesler to evaluate the effects of Dexmedetomidine and esmolol regarding perioperative blood loss and condition of surgical field in ENT surgeries, it was concluded that extubation and recovery time was less in esmolol group and patients without bleeding was more in esmolol group. Due to this mixed result , we aimed to assess their efficacy in hypotensive anaesthesia among patients undergoing ear, nose and throat surgeries.

Figure : Methods in hypotensive anaesthesia4,5-8

AIM AND OBJECTIVE

To compare the efficacy of efficacy of dexmedetomidine and Esmolol as hypotensive agent in head and neck surgeries and study is to compare the total blood loss occurring during surgery between study drug and to compare the recovery time in adult patient and to improve the surgical field.

METHODOLOGY

The study involved patient undergoing ear,nose and throat surgery in Karpaga vinayaga Insitute of medical science and research center and study is randomized comparative observational study and the study was done in Karpaga Vinayaga Insitute of Medical Science and research centre, Maduranthagam. The study was conducted eight months duration from July 2021 to march 2021.

Total seventy six patients, 30 in each group Dexmedetomidine(D) and Esmolol (E) , aged between 18 to 50 years of either sex, scheduled for elective Head and Neck Surgeries will be considered for this study. Written informed consent will be taken from all patients. GROUP D: Those who received loading dose 1 microgram/Kg and maintenance of dose 0.5 microgram/kg/hr. GROUP E: Those who received loading dose 1mg/Kg and maintenance dose 0.5mg/kg/hr.

Data Collection:

After obtaining ethical clearance, informed consent will be collected from patients those who are willing to participate in the study .Primary data will be collected by principal investigator by interview method and written informed consent from patient before enrolment and patient subjected to preanaesthetic evaluation. As per standard protocol patient is kept nil per oral and premedication should be given. Loading doses of dexmedetomidine given to group D before induction of anaesthesia followed by infusion at constant rate and loading doses of esmolol given to group E before induction of anaesthesia followed by infusion at constant rate and heart rate, MAP,SpO2,EtCo2 where monitored and recorded after loading dose of study drug, after induction, after intubation, at the interval of 5mins intra operatively, after extubation and 5 min after extubation and bleeding score, post operative sedation scoring analysed. Both groups were compared and analysed by analysis that was carried out by frequency and proportion for categorical variables & Mean and Standard deviation for continuous variable. Data was also represented using appropriate diagrams like pie diagram, bar chart.Chi-square was performed to find out association between two categorical variables. For normally distributed Quantitative parameters the mean values were compared between study groups using independent sample t-test (2 groups) or paired t test. P value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

Patient aged between 18-50 years and patient scheduled for elective head and neck surgeries and patients belonging to American Society of anaesthesiologist status I and II were included in the study.

Patients with uncontrolled hypertension, renal or hepatic dysfunction with coagulation defect and on patients on medication affecting coagulating system and anaemic patients were excluded from the study

Result

Table: Descriptive analysis of group in the study population (N=60)

Group	Frequency	Percentages
Dexmedetomidine	30	50.00%
Esmolol	30	50.00%

The table shows the study population among the two groups.Both groups are equally distributed.

Table : Descriptive analysis of age and sex in the study population (N=60)

Parameter	Mean ± SD	Median	Minimum	Maximum
Age	35.4 ± 10.17	35.00	17.00	53.00

Sex	Frequency	Percentages
Female	34	56.67%
Male	26	43.33%

The table shows the gender distribution among these two groups. Both groups had majority of males, 56.67% and 43.33% of female. These differences were not statistically significant The above table age distribution among the population of both the groups. The minimum age was 17 years among both the groups. The mean standard deviation was 35.4.

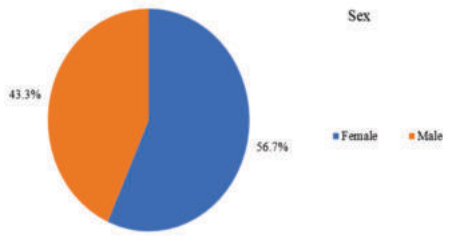


Figure : Pie chart of sex in the study population (N=60)

Table : Descriptive analysis of surgery in the study population (N=60)

Surgery	Frequency	Percentages
LT.CORTICAL MASTOIDECTOMY	4	6.67%
ENDOSCOPIC POLYPECTOMY	1	1.67%
FESS	13	21.67%
FESS with septal correction	2	3.33%
HEMITHYROIDECTOMY	1	1.67%
RT CORTICAL MASTOIDECTOMY	1	1.67%
RT MYRINGOPLASTY	3	5.00%
TONSILLECTOMY	11	20.00%
RT TOTTAL PAROTIDECTOMY	1	1.67%
RT.STAPEDECTOMY	1	1.67%
SEPTOPLASY	17	28.00%
SUBTOTAL THROIDECTOMY	2	3.33%
TOTAL THYROIDECTOMY	1	1.67%
TRANSORAL B/L STYLOIDECTOMY	1	1.67%

The above table shows the list of procedure done for both the groups. Septoplasty was the most common procedure for both the groups

Table: Descriptive analysis of duration of surgery(hrs), total anaestheisa time (hrs) in study population (N=60)

Parameter	Mean ± SD	Median	Minimum	Maximum
Duration Of Surgery (Hrs)	2.57 ± 0.6	2.50	1.50	4.00
Total Anaesthesia Time (Hrs)	3.06 ± 0.6	3.00	2.00	4.50

The above table shows the duration of surgery in hrs, total anaesthesia time hrs among the study population.The result shows there is no stastically significant difference between two groups.

Table: Descriptive analysis of map(pre op), map(intra op), map(post op) in study population (N=60)

Parameter	Mean ± SD	Median	Minimum	Maximum
Map (Pre Op)	80.07 ± 5.71	80.00	65.00	90.00
Map (Intra Op)	63 ± 5.04	62.50	52.00	78.00
Map (Post Op)	78.47 ± 5.92	78.00	60.00	90.00

The table shows the association of MAP between the groups based on difference time periods. The mean values of MAP showed Dexmedetomidine group had sustained reduction of MAP compared to others.

Table: Descriptive analysis of bleeding score, post operative sedation score in study population (N=60)

Parameter	Mean ± SD	Median	Minimum	Maximum
Bleeding Score	1.53 ± 0.57	2.00	0.00	2.00
Post Operative Sedation Score	2.92 ± 0.93	3.00	1.00	5.00

The above table shows the amount of blood loss and postop operative sedation score per group during the procedure.

Descriptive analysis of side effects in the study population (N=60)

Side Effects	Frequency	Percentages
Nausea	1	1.67%
NIL	46	76.67%
Vomiting	13	21.67%

The above table shows side effects such as nausea and vomiting as per the group during the procedure.

Table: Comparison of mean of map(pre op) between group(N=60)

Parameter	Group (Mean± SD)		P value
	Dexmedetomidine (N=30)	Esmolol (N=30)	
MAP(PRE OP)	80.47 ± 6.81	79.67 ± 4.43	0.592
MAP(INTRA OP)	62.3 ± 5.69	63.7 ± 4.28	0.286
MAP(POST OP)	77.73 ± 7.57	79.2 ± 3.6	0.342

Table shows the association of MAP between group based on different time period. The result showed there is no statistically significant between two groups and it shows dexmedetomidine had mild reduction in MAP compare to esmolol group.

Table: Comparison of mean of bleeding score between group(N=60)

Parameter	Group (Mean± SD)		P value
	Dexmedetomidine (N=30)	Esmolol (N=30)	
BLEEDING SCORE	1.5 ± 0.57	1.57 ± 0.57	0.652
POST OPERATIVE SEDATION SCORE	2.7 ± 0.94	3.13± 0.88	0.070

The table shows bleeding score and post operative sedation score among the two groups. It shows there is no significant difference between bleeding score among the group but post operative sedation score was 2.7 in esmolol group and 3.13 group in dexmedetomidine group.

Table: Comparison of mean of duration of surgery(hrs) between group(N=60)

Parameter	Group (Mean± SD)		P value
	Dexmedetomidine (N=30)	Esmolol (N=30)	
DURATION OF SURGERY (hrs)	2.43 ± 0.64	3.14 ± 0.54	0.076
Total anaesthesia time (hrs)	3.18± 0.65	2.56 ± 0.54	0.110

The table shows duration of surgery and total anaesthesia time (hrs) in both the groups. It shows the duration of surgery(hrs) for dexmedetomidine is 2.43 hrs and esmolol is 3.14 hrs and total anaesthesia time(hrs) of dexmedetomidine is 3.18 hrs and esmolol is 2.56hrs.

Table: Comparison of side effects between group (N=60)

Side Effects	Group		Chi square value	P value
	Dexmedetomidine (N=30)	Esmolol (N=30)		
Nausea	1 (3.33%)	0 (0%)	1.077	0.999
Nil	23 (76.67%)	23 (76.67%)		
Vomiting	6 (20%)	7 (23.33%)		

The table shows side effects such as nauses and vomiting in both groups and there is no stastical difference between two groups.

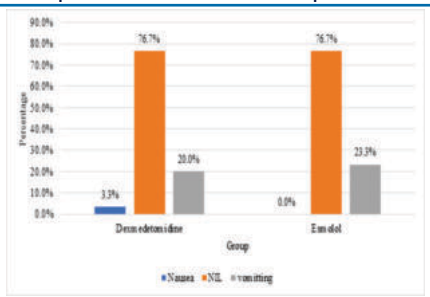
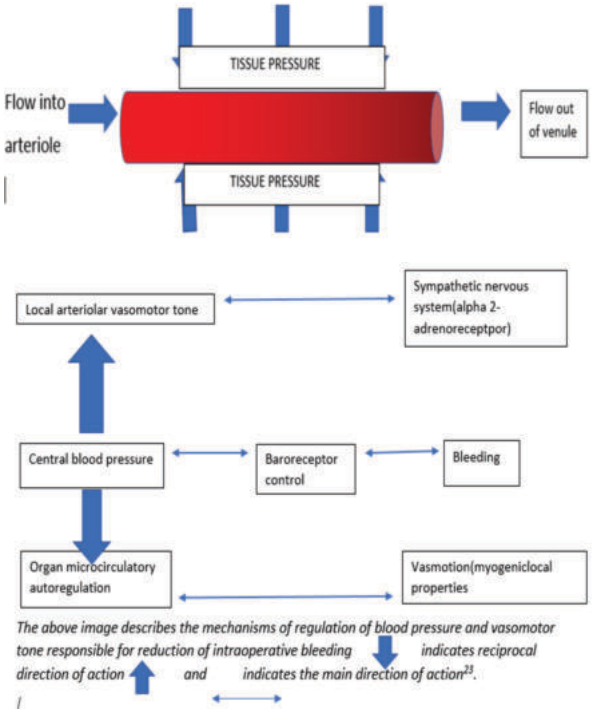


Figure: Cluster bar chart of comparison of side effects between group (N=60)

DISCUSSION

Hypotensive anaesthesia is a technique of reducing the blood pressure of patient throughout the surgery to achieve a reduction in amount of blood loss. A two to four fold decrease in intraoperative blood loss happens if mean arterial pressure is decreased to 50mmHg during surgery [normal 70 – 110mmhg]. Due to reduction in bleeding and intra-operative blood loss, surgical time is reduced. The physiological concept which drives hypotensive anaesthesia is when fall in blood pressure decreases bleeding and which enhances the surgical field[19].

Hypotensive anaesthesia is accepted as mode of anaesthesia for those undergoing surgery involving spine, hip or knee arthro-plasty, robotic surgery, cranio-synostosis and major maxilla-facial procedures[20,21]. However the implementation of hypotensive anaesthesia is associated with risk of decreased perfusion to major vital organs and tissues. In hypotensive anaesthesia patient's mean arterial pressure(MAP) is brought down by 30%. As result systolic value comes down to 80-90mmHg and MAP will be low as 50-60mmHg[22].



The above image describes the mechanisms of regulation of blood pressure and vasomotor tone responsible for reduction of intraoperative bleeding indicates reciprocal direction of action and indicates the main direction of action[23].

The two major methods for attaining hypotensive anaesthesia are

I) Deeping anaesthesia and supplement heavy analgesia
ii) Standard anaesthesia with simultaneous administration of hy potensive drugs

By deepening the plane of anaesthesia and using higher doses of analgesics such as opioids, the time to recovery can be prolonged.

The volatile aneathetic agents commonly used in practice sevoflurane, isoflurane and desflurane has vasodilating effect, only limitation is to be used in heavy concentration. Opiods with its shorter onset and lesser post operative effects can be used. Commonly used drugs are Sodium nitro-prusside, Nitro-glycerin, calcium channel blockers such as Nicardipine, beta blockers like Esmolol, Propanolol, Angiotensin converting enzyme and alpha 2 adrenoreceptor agonists(clonidine and dexmedetomidine)

The other non pharmacological means like positioning patient in headup and another method is to withdraw one or two units of patient's blood store it immediately before initiating anaesthesia and at same time replace it with colloid solution[24]. Dexmedetomidine is agonist of transmembrane G-protein coupled alpha 2 adrenoceptor. Activation of this receptor inhibits adenylyl cyclase, result in decrease of cAMP intracellularly. I.V administration of Dexmedetomidine follows rapid allocation phase with division half life of six minutes and terminal half life of just 2 hours. It demonstrates linear order kinetics when given as I.V in dose ranging from 0.2-0.7micrograms/kg/hr upto 24 hours. After sub-lingual & intra-nasal administration, bioavailability is higher can be used in children for sedative and premedication agent. It is excreted via urine 95% and faeces4%. Biotransformation involves glucuro-nidisation and cytochrome P450[26,27]. It decreases the secretion and doesnot cause respiratory depression and side effects are Hypotension, transient hypertension a and dry mouth. It can be used as withdrawl drug and management of tetanus[26].

Esmolol is rapid-onset and short acting selective beta1 adrenergic receptor agonist that is administered only in I.V and initial dose is 0.5mg/kg IV over 60 seconds[25]. It is useful drug for treating adverse systolic blood pressure and heart rate that occurs intraoperatively in response to noxious stimuli by blocking beta-adrenergic receptors of sympathetic nervous system. It has short duration of action of 15 minutes. It has side effect include nausea ,vomiting, diarrhoea, hypotension, bradycardia.It is metabolized by esterase in cytosol of red blood cells and excreated in urine. It is used in atrial fibrillation or flutter and arrhythmia during surgery.

CONCLUSION

Dexmedetomidine and esmolol has sustained reduced mean arterial pressure compare to esmolol and Dexmedetomidine showed lesser blood loss where as esmolol showed faster recovery state.

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