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To Compare The Efficacy Of Infusion Injection Propofol And Injection Dexmedetomidine In Maintaining Hemodynamic Stability During Intracranial Aneurysmal Clipping

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Abstract

Bakground - Intracranial aneurysm is an abnormal focal dilatation of intracranial artery due to weakening of inner muscular layer (intima) of the blood vessel. It is essential to maintain hemodynamic stability during clipping surgeries to avoid various neurological as well as non neurological complication that can result from unstable hemodynamics. In this study, we have used either Inj. Propofol or Inj. Dexmedetomidine infusions to maintain intraoperative hemodynamic stability. Their effects are compared in terms of blood pressure and heart rate.

Methods – This study was conducted with a sample size of 20 in a tertiary care center. Patients were divided in 2 groups by random allocation. 10 patients were started on Inj. Propofol infusion 2mg/kg loading dose over 5 mins followed by 150mcg/kg/min maintenance dose and other 10 on Inj Dexmedetomidine infusion 1mcg/kg loading dose over 15 minutes and 0.5mcg/kg/hour maintenance dose.

Result – Inj. Dexmedetomidine infusion showed a better control of heart rate and diastolic blood pressure as compared to Inj. Propofol. However, the total dose of muscle relaxant required in the propofol group was lesser.

Conclusion - The anaesthesia management of intracranial cerebral aneurysm clipping is better maintained by dexmedetomidine due to it giving a more stable and better hemodynamic response intraoperatively.

Keywords: Intracranial aneurysm, Dexmedetomidine infusion, Propofol infusion, anaesthesia

Introduction

A cerebral aneurysm is an abnormal focal dilatation of an artery in the brain that results from a weakening of inner muscular layer (intima) of the blood vessel[8]. The progression of aneurysms and remodeling of aneurysm tissue is a discontinuous but ongoing process and that cerebral aneurysm cannot be generally assumed to be stable lesions[7].The patient may come with either ruptured or unruptured aneurysm. Unruptured aneurysm is rare and usually an incidental finding on investigating unresolved headaches. The main challenge for an anaesthetist while managing a craniotomy with aneurysmal clipping surgery is to maintain the transmural gradient, that is the difference between the pressure within the aneurysm (mean arterial pressure) and the pressure outside the aneurysm (intracranial pressure). This is achieved by maintaining a dep plan of anaesthesia. Various pharmacological options are available for the same. In our study we compared the efficacy of dexmedetomidine and propofol infusion in maintaining the hemodynamic stability and thereafter minimizing the adverse effects that may be caused by sudden shifts in blood pressure during aneurysmal clipping.

Material And Methods

This is a randomized control study of intracranial aneurysmal clipping surgeries done under general anesthesia comparing the clinical efficacy of Inj.

Propofol or Inj. Dexmedetomidine infusion to maintain intraoperative hemodynamic stability.

Inclusion Criteria:

1. Patients giving consent to participate in the study
2. Patients with intracranial aneurysm confirmed by CT Brain Angiography or Digital Subtraction Angiography
3. Age > 18 years
4. Hemodynamically stable preoperative vitals (mean arterial pressure > 60mmHg and/or heart rate > 60/minute)

Exclusion Criteria:

1. Patient refusal
2. Age < 18 years and > 60 years
3. Preoperative mean arterial blood pressure < 60mmHh
4. Preoperative baseline heartrate < 60beats/minutes
5. Glassgow coma scale less than or equal to 8
6. Patient on mechanical ventilation preoperatively
7. Patients with severe coronary artery disease
8. Patients with cardiac dysrhythmias
9. Patients allergic to egg

20 patients that fulfilled the inclusion criteria were considered for this study and were randomly divided in 2 groups by chit system

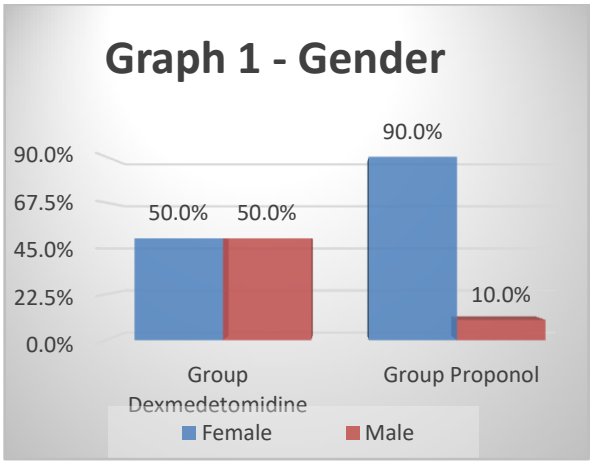
Group P – patient receiving Propofol infusion

Group D – patients receiving Dexmedetomidine infusion

Patients were premedicated with Inj. Glycopyrrolate 0.004mg/kg, Inj. Midazolam 0.05mg/kg and Inj. Fentanyl 2mcg/kg 10 minutes prior to induction. Group P was Induced with 2mg/kg Inj. Propofol 1%w/v followed with Inj. Propofol 1%w/v infusion at rate 150mcg/kg/min. In Group D Inj. Dexmeditomidine infusion was started at rate of 1mcg/kg as inducing dose over 15 minutes followed by 0.5mcg/kg/hr maintenance dose. Once the patients were sedated, muscle relaxant Inj. Vecuronium 0.1mg/kg was given and patient was intubated with appropriate size endotracheal tube after 3 minutes of mask ventilation. Patient's vitals heartrate, systolic and diastolic blood pressure were noted preoperatively, post intubation, thereafter at intervals of 5, 10, 15, 30, 60, 90, 120, 150 and 180 minutes. The infusions were titrated as per requirement to maintain hemodynamic stability. The infusion was stopped 15 minutes prior to extubation.

Result:

Our study shows that females have a greater probability of having intracranial aneurysms (Graph 1). Preoperative heart rate (table 1), systolic blood pressure (table 2) and diastolic pressure (table 3) comparison was not significant between both groups at 0.05 level of significance.



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Variables (TABLE 1)	Group	N	Mean	t-value	p- value
Pre-operative heart rate	Dexmedetomidine	10	91.2	-0.87646	<.196164
	propofol	10	93		

Variables (TABLE 2)	Group	N	Mean	t-value	p- value
Pre-operative systolic blood pressure	Propofol	10	164	-0.94304	<.179073
	Dexmedetomidine	10	169		

Variables (TABLE 3)	Group	N	Mean	t-value	p- value
Pre-operative diastolic blood pressure	Propofol	10	87	0.58799	<.128
	Dexmedetomidine	10	85		

Variables (TABLE 5)	Group	N	Mean	t-value	p- value
Post intubation Heart Rate	Dexmedetomidine	10	91.4	-2.57289	<.00958
	Propofol	10	98.6		

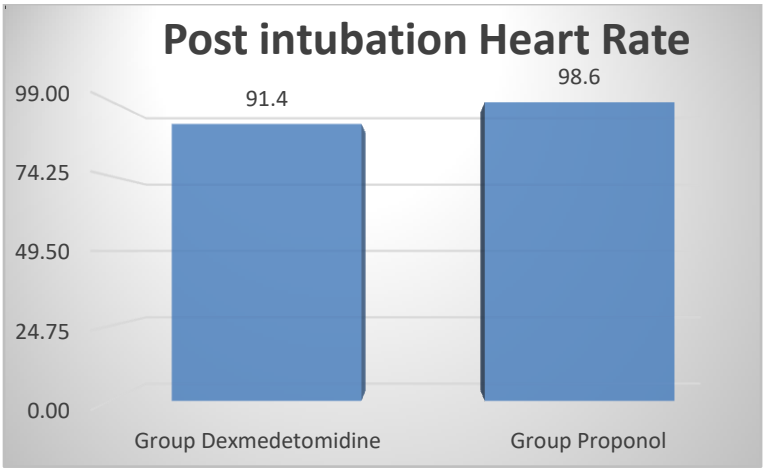

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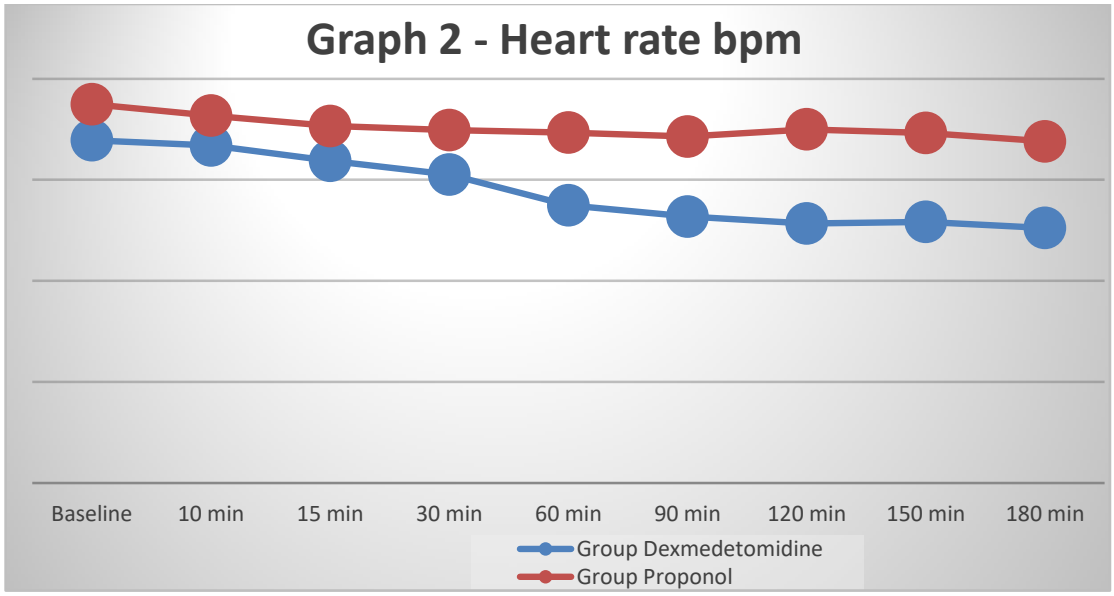
Table 5 shows post intubation heart rate comparison was significant between both the groups at 0.05 level of significance showing that Dexmedetomidine group had a lower post intubation heart rate than that of the Propofol group.

Variables (TABLE 6)	Group	N	Mean	t-value	p- value
Post intubation systolic blood pressure	**Propofol**	10	176.6	-0.08206	**<.467752**
	Dexmedetomidine	10	177		

Variables (TABLE 7)	Group	N	Mean	t-value	p- value
Post intubation diastolic blood pressure	**Propofol**	10	95.4	2.84161	**>.005413**
	Dexmedetomidine	10	90.6		

Post intubation systolic blood pressure comparison was not significant between both the groups. However, the Post intubation diastolic blood pressure comparison was significant between both the groups at .05 level of significance showing that Propofol group had a higher post-operative diastolic blood pressure than that of the Dexmedetomidine group. Table 5 and 7 show that Dexmedetomidine is better at lowering the intubation response.



Graph 2 shows a significant difference between study groups in terms of heart rate at baseline and its mean change during follow up till 180 mins ($p<0.05$).

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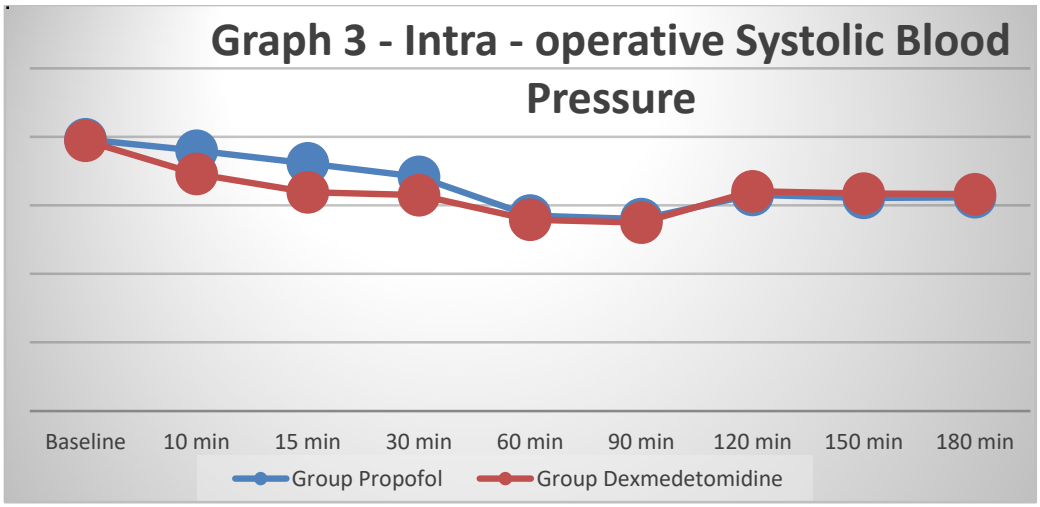

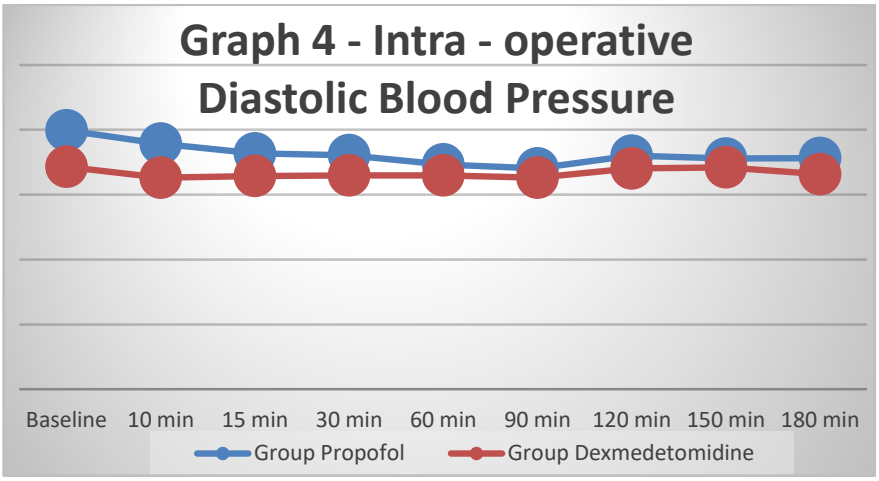

Graph 3 and 4 show there is no significant difference observed between study groups in terms of intra operative systolic blood pressure, but there is a significant difference in intraoperative diastolic group between both groups at baseline and its mean change during follow up till 180 mins ($p<0.05$).

Based on our statistical report, Dexmedetomidine infusion is better at controlling heat rate and diastolic blood pressure. The systolic blood pressure however shows similar trends in both groups.

Discussion

Cerebral arteries have three layers the intima, the tunica media and the tunica adventitia. Intracranial blood vessels are somewhat different, when compared to extracranial vessels, because of their thicker internal elastic lamina, decreased proportion of elastin fibers and smooth muscle cells in the media and the thinner adventitia[7]. This makes the cerebral vessels more prone to form an aneurysm. Vascular remodeling occurs due to apoptosis of vascular smooth muscle wall and elastin degradation. This remodeling can either cause aneurysm sac stabilization or progress to rupture[7]. Digital Subtraction Angiography is used to decide the perioperative management as it gives information regarding the exact number, site and extent of the aneurysm.

During rupture, there is a free communication between intra-arterial and subarachnoid space which leads to regional increase in intracranial pressure. The spread of this blood can lead to headache, meningism and subsequent development of hydrocephalus. The Triple – H therapy which includes Induced hypertension, hypervolemia and hemodilution is considered to reduce the incidence of cerebral vasospasm in patients with subarachnoid hemorrhage associated with intracranial aneurysms.

The anaesthetic management goals in these cases are to maintain hemodynamics and to sustain the cerebral

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perfusion pressure to avoid intraoperative rupture of aneurysm prior to clipping and cerebral vasospasm after clipping of aneurysm. Other non- neurological complications like cardiac dysfunction probably due to subendocardial necrosis, pulmonary dysfunction and electrolyte imbalance especially hyponatremia as a consequence of cerebral salt wasting or syndrome of inappropriate ADH secretion. The main key to avoiding these complications is to maintain the transmural gradient across the aneurysm. In our study, we have used infusions Dexmedetomidine and propofol to achieve the anaesthetic goals and intraoperative stability.

Dexmedetomidine is alpha 2 adrenergic agonist that acts on pontine locus ceruleus, which is an important nucleus mediating sympathetic nervous system function, vigilance, memory, analgesia and arousal. Propofol is 2,6-diisopropylphenol which is gamma – Aminobutyric acid agonist. It is one of the oldest drugs that is used for rapid induction and rapid emergence.

These drugs being sedative and hypnotics, apart from maintaining hemodynamic stability, they maintain a deep plane of anaesthesia and minimize the inhalational anaesthetic requirement as well as the requirement for muscle relaxants.

In our study, both the drugs were equally effective in maintaining the systolic blood pressure. However, the diastolic blood pressure and heartrate were better maintained by Dexmedetomidine. It was also noted that patients on Inj. Propofol infusion had a lesser overall requirement of muscle relaxant top up as compared to Dexmedetomidine group. Although the dexmedetomidine group maintained stable hemodynamics even on return of spontaneous respiration.

Conclusion:

The anaesthesia management of intracranial cerebral aneurysm clipping is better maintained by dexmedetomidine due to it giving a more stable and better hemodynamic response intraoperatively and post operatively. Dexmedetomidine also had the advantage of easy arousability as compared to propofol at the end of the surgery.

Limitations Of This Study – Either of these drugs cannot be used in patient has hypotension preoperatively. It is a pilot study, a larger sample size will be required to to confirm the extrapolated findings to a population. A BIS monitor can be used to monitor and compare the depth of anaesthesia provided by each drug, which is unavailable in our institute.

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