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Comparison of High Thoracic Epidural Anaesthesia versus Intravenous Opioids in Adult Patients Undergoing Open Heart Surgery for Atrial Septal Defect

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Abstract **Original Research Article**

Background: Effective post-operative pain therapy is the most vital aspect which determines a successful surgical outcome in cardiac patients. ***Aim & Objectives:*** To compare perioperative outcome of HTEA with conventional Intravenous opioid in adult patients undergoing corrective surgery for ASD. ***Material & Methods***: After approvals from institutional Ethical Committee, a total of 40 patients were included in the study & were randomised into two groups of 20 each namely group A (epidural Anaesthesia) & group B (Intra venous opioid). The two groups were compared for haemodynamic parameters namely heart rate (HR), systolic & Diastolic blood pressure (SBP & DBP). Echo for assessment of LVEF (after 12 hrs of surgery), time to extubation & re-intubation if any, duration of post-operative ventilation, length of stay in ICU, post-operative bleeding (drainage), perioperative urine output & blood glucose levels & pain scores were also compared between the two group. ***Results:*** In our study perioperative haemodynamic were found better controlled in HTEA group, there was lower rise in heart rate & systolic blood pressure detected post sternotomy & in the post-operative period. Duration of post op ventilation & time to extubation were also found to be significantly lower in the HTEA group. HTEA group also proved to control post-operative pain better, with significantly lower post-operative bleeding there by overall stay in ICU was also lower in HTEA group. ***Conclusion:*** HTEA is recommended for patients undergoing ASD closure under CPB for a better inter operative control of haemodynamic parameter & overall improvements in the outcome of surgery.

Keywords: Atrial Septal Defect, High thoracic epidural Anaesthesia, Intra Venous Opioid, Invasive Blood Pressure.

INTRODUCTION

Atrial septal defect (ASD) is a congenital condition. The condition is essentially a cardiac developmental anaomaly which usually manifests after birth. There exist, in this condition, numerous intraatrial communications along with defects in the terminations of systemic and pulmonary veins, along with the incomplete development of the interatrial septum [1]. Left untreated, the condition may progress with alteration in the systemic and pulmonary circulation, manifesting as shortness of breath, pedal oedema, and early fatigability leading to restriction of physical activity [2]. There will however be a sizeable number of patients who will not present with the above symptoms and the condition being diagnosed incidently on an echo study as patent foramen ovale [3].

Treatment options for this malady are varied with percutaneous (non-surgical) approach [4, 5] requiring at the most procedural sedation to surgical closure with a mini thoracotomy or open heart procedure [6]. The current study describes the patients managed with an open heart procedure under general anaesthesia with option of post operative analgesia in the form of high thoracic epidural analgesia [7] [8] or intravenous opioid infusion delivered by a patient controlled infusion pump[9].

MATERIALS AND METHODS

After institutional ethics committee approval and after written informed consent were taken 40 patients with ASD undergoing corrective open heart surgery under cardiopulmonary bypass were randomly divided into two groups (n=20 each)namely group A (epidural anaesthesia) and group B (intravenous opioids). Randomization was done by computer generated randomization method. The study was carried out between mar 2017 to July 2018. Patients with ASD coming for corrective surgery were included. Patients with deranged coagulation (INR>1.5) spinal deformity and other contraindications to central neuraxial blocks were excluded.

In group A patients epidural catheter inserted at T4-T5 epidural space in sitting posture using loss of resistance technique and the catheter was fixed to skin with 3 cms length remaining inside the epidural space. Sub cutaneous tunnelling of catheter and sterile dressing was done for stability and prevention of infection tracking the epidural catheter. Injection 0.25% bupivacaine 0.5 ml/kg just before skin incision followed by continuous infusion of injection 0.125% bupivacaine at 0.2ml/kg/hr intraoperatively followed by 0.1 ml/kg/hr postoperatively continued. And systemic heparinisation was assured to be given 1hr after the placement of epidural cathter.

In group B intravenous fentanyl 2-3 mcg/kg iv bolus given just before skin incision followed by 1-2 mcg/kg/hr iv fentanyl started after weaning from CPB.

In both the groups peripheral venous access was secured and the patients were induced with injection etomidate (0.2mg/kg) midazolam (0.1mg/kg) injection fentanyl (1 mcg/kg) and rocuronium (1mg/kg) and maintained on oxygen/air/isoflurane. Vecuronium (0.002mg/kg) was administered intermittently for neuromuscular blockade. Methyl prednisolone 30 mg/kg iv was given to all patients. In both the group after induction injection dexmetidomidine 0.25mcg/kg/hr was started and was continued through out the perioperative period. All the patients were continuously monitored for heart rate, invasive blood pressure, pulse oximetry, urine output, capnography, nasopharengeal temperature arterial blood gases with serum lactate levels. Once the surgery was commenced and sternotomy performed heparinisation was done with 300 units/kg prior to placing the patient on cpb.another 100 units/kg heparin was administered if activating clotting time was less than 480 secs therafter repeated on pump as per the requirements.

As per the institutional protocol inotropes dopamine 5mcg/kg/min and vasopressin 0.003 units/kg/min stated to maintain MAP>60 mm of hg.At the time of release of aortic cross clamp milrinone infusion was started at a loading dose of 100 mcg/kg and maintained at the dose of 0.75mcg/kg/min. After surgery patients were shifted to cardiac surgical intensive care unit and mechanically ventilate with inotropes support till the extubation criteria were met. Parameters such as heart rate, invasive blood pressure NIRS, LVEF(ECHO) blood sugar, urine output, pain scores, time to extubation, length of stay in ICU and post-operative bleeding(drainage) were monitored. All these values were measured once at the preoperative period, at the time of induction, every 10 min intraoperatively and post operatively at 1 hr interval for initial 6hrs followed by 4 hourly reading till the stay in ICU.

Statistical analysis

Data analysis was done by using SPSS (statistical package for social sciences).Qualitative data expressed by using frequency and percentage. Quantitative data were expressed by using mean ,SD, median , and range.2 independent sample T tests/Mann Whitney U test were used to find the significant difference between group A and B. P value of< 0.05 was considered statistically significant.

RESULTS

The mean age group and weight in the two group were comparable with no statistical difference ($p<0.005$) (table 1).Mean HR,SBP and DBP in the preoperative period and during induction were comparable in both groups. But following skin incision, during sternotomy and in the post op period the mean HR and SBP was higher in group B which is statistically significant ($p<0.05$) (table 2). DBP, CVP and UOP in both the groups were comparable in the intra and post op period with no statistical difference Blood sugar levels were significantly lower in group A during 60^{th} and 90^{th} min intraoperative which is statistically significant ($p<0.05$). However in the post op period both the groups were comparable with no statistical differences. LVEF at 12 hrs and post op bleeding at 24 and 48 hrs were comparable in both the groups. However the time to extubation, duration of stay in ICU (table 3) and post op pain scores were significantly lower in group a ($P<0.05$) (Table 4).

DISCUSSION

Open heart surgical management of ASD essentially requires a sternotomy. Intra-operative implications of anaesthetic management involve avoiding any bubble of air entering the circulation for the fear of causing a paradoxical embolus subsequent to transfer of this bubble to systemic circulation and further to brain. The other implications include flow dynamics related to the intra cardiac shunt. The discussion of these implications is beyond the scope of this study.

The post operative management of pain and thus reducing the inflammatory response is an important concern of anaesthesia management. There are various modalities available which include neuraxial techniques and systemic. The suggested extent of analgesia extends from thoracic segments T2-T12, although the incision extends in the region extending T3-T7.

Table-1: Demographic characteristic

Parameter	Group A	Group B	P
Age (yrs)	35.1±8.05	36.7±7.05	0.507
Weight (kg)	55.85±2.42	56.88±2.46	0.189

Table-2: Hemodynamic parameters

Time	Group	Mean HR	SBP	DBP
Pre op	Group A	68.65±8.25	124.50±6.90	72.60±5.65
	Group BP	69.65±12.65	127.05±7.98	71.80±5.38
		0.768	0.287	0.649
At induction	Group A	69.75±7.53	124.45±6.30	73.00±5.87
	Group BP	71.30±12.73	128.80±8.77	71.30±5.56
		0.642	0.080	0.353
At skin incision	Group A	69.75±7.33	124.20±6.10	73.85±4.37
	Group BP	77.00±12.83	130.15±7.73	73.15±4.30
		0.036*	0.010*	0.612
At sternotomy	Group A	69.45±7.55	123.55±6.66	74.90±4.79
	Group BP	76.82±12.80	129.50±7.47	75.20±3.72
		0.047*	0.011*	0.826
Post op at 1 hr	Group A	71.30±7.06	125.00±5.53	72.15±3.30
	Group BP	71.65±12.73	128.90±6.43	72.80±2.75
		0.031*	0.047*	0.502
2hr	Group A	70.90±6.62	124.30±6.11	73.25±3.54
	Group BP	78.55±12.59	130.15±6.06	73.05±3.85
		0.023*	0.004*	0.865
10hr	Group A	70.90±7.27	125.55±4.93	75.15±6.31
	Group Bp	79.35±13.98	133.00±8.35	76.70±4.67
		0.019*	0.014*	0.207
24 hr	Group A	70.15±7.10	125.90±5.32	75.40±4.55
	Group BP	78.90±11.13	132.10±7.08	76.85±5.27
		0.009*	0.033*	0.357

Table-3: Intra operative and post-operative data

Parameters	Group A	Group B	p
Blood sugar level (intraop)			
60^{th} min	101.95±10.25	111.80±7.73	0.002*
90^{th} min	106.70±11.79	115.55±7.07	0.007*
Post op	113.85±10.53	113.30±8.64	0.857
Time to extubation (hrs)	3.7±7.09	23.55±13.02	<0.001*
LVEF(at 12hrs)	54.50±2.76	54.00±3.08	0.592
Duration of ICU stay (hrs)	48.45±10.29	56.80±10.02	0.013*
Post op bleeding			
24 hrs	58.95±14.01	64.40±13.34	0.215
48hrs	20.90±5.33	21.50±5.30	0.723

Table-4: Post-operative pain score

Time	Group A			Group B			p
	min	max	med	min	max	med	
1 hr	1	4	2	2	5	3	0.007*
4hr	2	4	3	3	4	4	0.017*
12 hr	2	5	3.5	4	5	4	<0.001*
24 hr	2	4	3	3	6	5	<0.001*
48hr	3	4	3	3	5	3.5	0.108

Bupivacaine is an amide, used as a local anaesthetic agent. The mechanism of action is by blockage of voltage dependent Na + channels. Current literature is suggestive of its action beyond the blockade of sodium channels and other receptors, notably, NMDA receptors have been studied in this context.

Fentanyl is a synthetic opioid and is highly lipophillic. It can be administered both by epidural route and systemically through intravenous infusion. There are conflicting reports regarding the use of fentanyl through the epidural route with numerous studies suggesting that the systemic uptake of fentanyl from the epidural route was in fact the mechanism of pain relief. In our current study the patients were not administered any opioid through the epidural route.

CONCLUSION

We found that use of HTEA in patients prior to sternotomy for cardiac surgeries resulted in much

better control of haemodynamic parameters. The result of the study also revealed lower amount of post-operative bleeding in the HTEA group. There was significant reduction in requirement of post-operative ventilation & time to extubation after and overall outcome, thereby reducing the total length of ICU stay.

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