CARDIOVASCULAR RESPONSES TO SCALP INFILTRATION, USING ADRENALINE, WITH OR WITHOUT LIGNOCAINE, DURING CRANIOTOMY

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ABSTRACT

Objective: *To find out changes in the heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure after infiltrating scalp with adrenaline with or without Lignocaine in craniotomies.*

Material and Methods: *This comparative study was carried out at AIMS international hospital Hayatabad, Peshawar from January to June 2009. Cardiovascular response to scalp infiltration with adrenaline was noted in 100 unpremedicated patients undergoing craniotomy. They were divided into 2 groups of 50 patients each. Group A received lignocaine 2% with adrenaline 1:200,000 and Group B received normal saline with adrenaline 1:200,000.*

Results: *Episodes of tachycardia occurred more frequently in group B. Systolic blood pressure, diastolic blood pressure and mean arterial pressure were significantly increased in group B. Significant decrease in diastolic blood pressure and mean arterial pressure occurred in group A.*

Conclusion: *In neurosurgical patients undergoing craniotomy, infiltration of the scalp with solution containing adrenaline alone causes significant hypertension. The addition of lignocaine attenuates the hypertensive response but causes decrease in blood pressure.*

Keywords*: Adrenaline, Lignocaine, Craniotomy, Scalp infiltration.*

INTRODUCTION

Mean arterial pressure (MAP) is one of the main determinants of cerebral perfusion pressure[1]. Maintenance of stable MAP is therefore very essential during anaesthesia for neurosurgical procedure. To prevent blood loss during craniotomy, it is a common practice to infiltrate scalp with adrenaline. Adding lignocaine to the solution provides analgesia at the time of scalp incision. It also decreases the side effects of absorbed adrenaline. With this combination hypotensive[2, 3, 4] as well as hypertensive[5] responses have been reported. Others have reported no significant changes[6, 7]. Bupivacaine has also been used to attenuate the haemodynamic response to adrenaline infiltration[8]. It also reduces postoperative pain in supratentorial craniotomies[9, 10].

It has been reported that keeping a lighter general anesthesia caused less decrease in arterial blood pressure and was a relative effective method to prevent hypotension episode induced by adrenaline scalp infiltration[11].

The aim of the study was to find out changes in Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure(DBP) and Mean Arterial Pressure after infiltrating scalp with adrenaline, with or with out lignocaine.

MATERIAL AND METHODS

This comparative study was carried out at AIMS international hospital Hayatabad, Peshawar from 1st January to 30th June 2009. Hundred patients were selected for this study. Written informed consent was obtained from all the patients. All of them were ASA (American Society of Anesthesiologists) Grade I or Grade II undergoing craniotomy. Patients were randomly allocated in blocks of ten patients. First ten patients were allocated group A and second block of ten patients group B and vice versa. Patients with Diabetes Mellitus, Hypertension and Cardiopulmonary disease were excluded from the study. Patients with intracerebral aneurysm were also excluded from the study to avoid the possibility of premature rupture of the aneurysm. All the patients did not receive any premedication.

Induction of anaesthesia was done by Nalbuphine 0.1 mg/kg and Propofol 2mg/kg. Vecuronium 0.1 mg/kg was used for muscle relaxation. After intubating the patient anaesthesia was maintained with Halothane 0.5% in 40% Oxygen and 60% Nitrous Oxide. Surgical positioning was done, surgical area sterilized. When the patient was haemodynamically stable, baseline values for Heart rate, Systolic blood pressure, diastolic blood pressure and Mean arterial pressure were recorded just 1 minute before the infiltration of scalp.

The patients were then randomly allocated to one of the two groups of fifty patients each. The patients in group A received lignocaine 2% with adrenaline (1:200,000) while the patients in Group B received normal saline with adrenaline (1:200,000). The infiltration of the scalp was done by the surgeon. Depending on the site and size of the incision the volume of the solution was decided by the surgeon. HR, SBP, DBP and MAP were recorded every minute for 15 minutes. A 20% of change in HR and Blood Pressure was considered significant as suggested in earlier literature[12]. After the collection of data surgeon was allowed to make the incision.

RESULTS

There were no statistically significant differences among the groups regarding age, weight or sex (Table 1)

HYPERTENSION In group A, 3(6%) patients showed transient increase in SBP in the first 5 minutes which came back to normal after 15 minutes. In group B, 14(28%) patients had increase in SBP and 13 patients had increase in DBP. Only 6 (12%) patients had increase in MAP. The magnitude of increase in SBP, DBP and MAP is shown in Figure 1.

HYPOTENSION In group A, 5 (10%) patients had decrease in SBP, 20 (40%) patients had decrease in DBP and 13(26%) patients had decrease in MAP In group B, no patient had any decrease in SBP, DBP, or MAP. The magnitude of decrease in SBP, DBP and MAP is shown in Figure 2.

HEART RATE Heart rate increased in both the groups but remained within 20% of the baseline readings in both the groups. No significant change was seen from the initial readings as shown in Figure 3.

Table 1: General Characteristics of the study population

Variable	Group A (Lignocaine+adrenaline)	Group B (Saline +adrenaline)
Age (years)	45 ± 16	38 ± 17
Sex (M:F)	28 : 22	26 : 24
Weight (Kg)	55 ± 17	50 ± 15
Dose of adrenaline (µg/kg)	2 ± 0.4	2 ± 0.6
Volume of infiltrate (ml)	15 ± 3	15 ± 4

Figure 1: Percentage of patients who had hypertension at the end of 15 minutes Group A (Lignocaine +adrenaline), Group B (Saline +adrenaline)

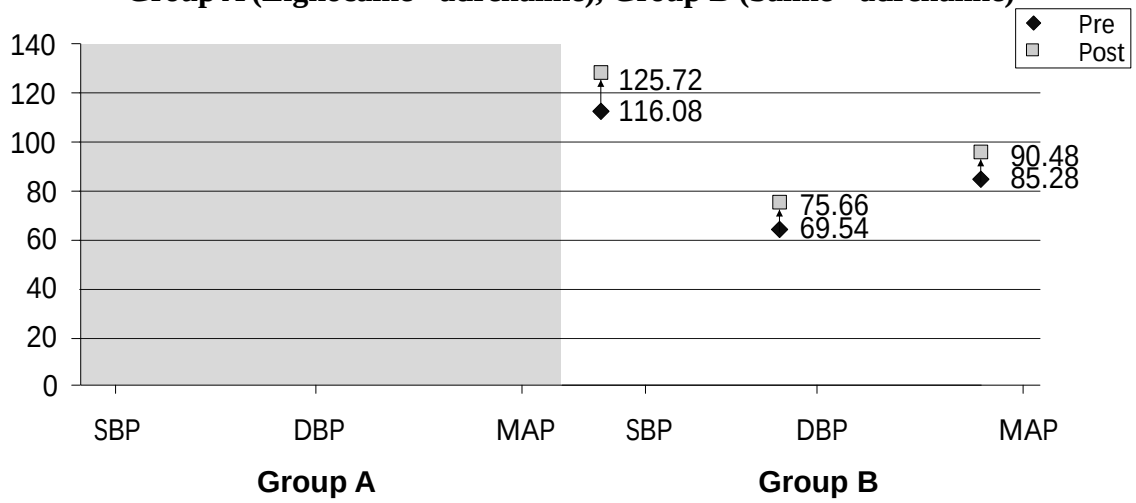


Figure 2: Percentage of patients who had hypotension at the end of 15 minutes Group A (Lignocaine +adrenaline), Group B (Saline +adrenaline)

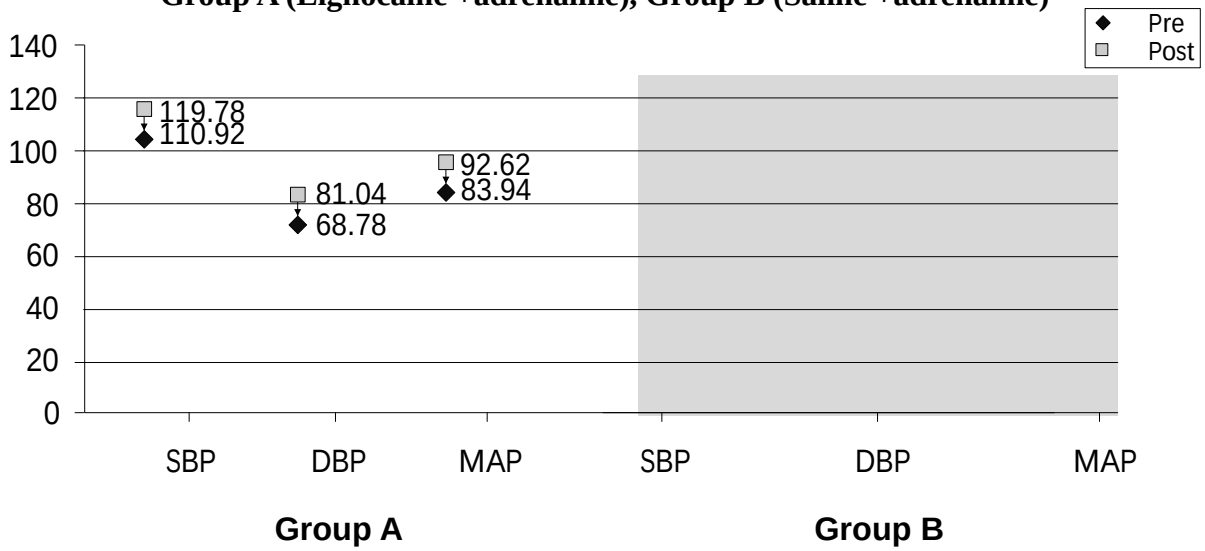
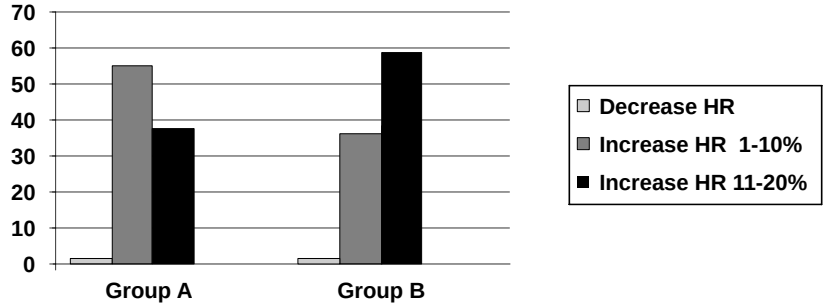


Figure 3: Change in Heart Rate: Group A (Lignocaine +adrenaline), Group B (Saline +adrenaline)



DISCUSSION

Scalp is a highly vascular structure; a significant proportion of the large volume of infiltrating solution used during a craniotomy may get absorbed and cause significant hemodynamic changes. In intracranial pathology wide fluctuations in blood pressure are highly undesirable. In patients undergoing aneurysmal subarachnoid haemorrhage surgery, increase in BP may cause rupture of aneurysm. In patients with intracranial tumours or head injury hypotension may aggravate or cause cerebral ischaemia. Adrenaline is injected to control bleeding from the scalp. It may lead to significant changes in blood pressure and heart rate. Earlier studies have shown that these changes depend on total dose of adrenaline, speed of absorption of adrenaline into the systemic circulation[13], vascularity at the site of injection[13-16] and the systemic effects of the absorbed local anaesthetic[17].

Lignocaine is generally added to the adrenaline solution to obviate these unfavorable cardiovascular side effects through its action on the myocardium and systemic vasculature. This effect was more prominent on the DBP, as indicated by the fact that in Groups A, a significant decrease was observed only in the DBP and MAP and not in the SBP (Fig. 2). In addition, lignocaine also suppresses the highly nociceptive stimulus caused by dissection of the subcutaneous tissue because of the large amounts of solution used for infiltration.

The increase in BP seen in Groups B (adrenaline without lignocaine) may be explained on the basis of vasoconstriction resulting from the effect of adrenaline on α-1, receptors.

Decrease in BP was observed in Groups A. This probably is a result of the potentiation of the ß-2 effects of adrenaline by lidocaine. At small plasma concentrations, adrenaline exerts a predominant ß-2 effect[18]. The myocardial depressant and vasodilatory effects of lignocaine seem to

potentiate this ß-2 effect of adrenaline and cause hypotension. The ß-2 effect of adrenaline seems to cause hypotension only in the presence of lignocaine, because a similar decrease in BP was not seen in Groups B, which received only adrenaline.

Other studies also reported hypotension when adrenaline is used in combination with lignocaine. Hanuman and Umamaheswara reported more than 20% decrease in mean arterial pressure in 40% of the patients compared to preinfiltration values[19]. Philips and his colleagues noted significant decrease in mean arterial pressure in 55% of the patients[2]. Yang and his colleagues found decrease of mean arterial pressure in 24% of the patients when lignocaine was combined with adrenaline[3]. However Biswas and colleagues noted no significant change in mean arterial pressure. They attributed this to lower concentraion (1:800,000) of adrenaline[6]. In a national study Masood and colleagues reported that the varying concentration of epinephrine present in local anesthesia did not affect the blood pressure and pulse rate significantly. Whatever fluctuation occurred was attributed to patients` stress due to sympathetic over activity[7].

CONCLUSION

In neurosurgical patients undergoing craniotomy, infiltration of the scalp with solution containing adrenaline alone causes significant hypertension. The combination of lidocaine with epinephrine, although attenuates the hypertensive response but leads to decrease in BP.

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