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# COMPARISON OF KETAMINE AND LIGNOCAINE INFUSION FOR ATTENUATION OF TOURNIQUET INDUCED HYPERTENSION IN UPPER AND LOWER LIMB ORTHOPEDIC SURGERIES

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**Abstract:**

***Objective:*** *To compare frequency of tourniquet induced hypertension in patients undergoing limb surgery after administration of lignocaine infusion vs Ketamine.*

***Material and methods:*** *This randomized controlled trial was conducted at Department of Anesthesia, Pak red crescent medical and dental college, Dina Nath, Kasur from September 2017 to October 2018.*

*Total 300 patients undergoing orthopedic surgery of limbs involving tourniquet time >45 minutes, with ASA status I & II, both male and female having age 18-50 years were selected.*

*Patients were randomized (by lottery method) into two groups: group A (lignocaine) and group B (Ketamine). Tourniquet induced hypertension was assessed between the both groups.*

***Results:*** *A total of 300 patients (150 in each group) were included in the study. The mean age of the patients was found to be 38.14 ± 8.67 years in group A and 38.59 ± 8.93 years in group B. Gender distribution of the patients showed that in both groups most of the patients were male. Similarly most of the patients in this study had upper limb involved in group A while lower limb involved in group B. The main outcome of this study was to determine frequency of TIH in both groups. It was found in 46 patients in group A while in 24 patients in group B (p= 0.003). TIH was stratified according to age, gender, BMI and limb involved and results were found significant for higher age, female gender, high BMI and lower limb involved.*

***Conclusion:*** *We conclude that Ketamine is better than Lignocaine infusion as it had ess frequency of tourniquet induced hypertension in patients undergoing limb surgery. Therefore I recommend usage of Ketmaine to reduce the morbidity of the patients.*

***KEYWORDS:*** *Ketamine; Lignocaine; Tourniquet; Hypertension*

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## INTRODUCTION:

Pneumatic tourniquets are used routinely during orthopedic procedures on limbs to minimize surgical bleeding and to provide a bloodless surgical field. Tourniquet inflation is associated with pain and an increase in arterial pressure observed 30–60 min after inflation of the tourniquet.[1-2] The increase in blood pressure is more marked under general anaesthesia and during lower limb surgeries and occurs despite adequate analgesia and depth of anaesthesia.[3]

Many methods are used to reduce tourniquet induced hypertension (TIH) intra-operatively such as use of ketamine, lignocaine and ketorolac.[4] Intravenous lignocaine is known as having anti-inflammatory, analgesic, anti-hyperalgesic properties and is used for attenuating TIH.[5] Ketamine, an NMDA receptor antagonist, and a potent analgesic, has been found to be effective in this respect by many researchers.[6]

In a study by El-Syed et al, tourniquet induced hypertension was found in 10/38 patients (26%) receiving Lignocaine infusion.[7] In another study, TIH was found in 5/38 patients (13.2%) receiving Ketamine.[8]

The rationale of our study is that TIH is one of the frequently observed complications among patients undergoing surgery with tourniquet. So it is important to know the best method for management of TIH. Also whichever drug is proved to be having more control on TIH, we may use it regularly for this purpose. Minimal literature is available on the topic, so this study will help us delineate the effects of both drugs and will be an addition to literature itself.

## MATERIAL AND METHODS:

This randomized controlled trial was conducted at Department of Anesthesia, Pak red crescent medical and dental college, Dina Nath, Kasur from September 2017 to October 2018. Total 300 patients undergoing orthopedic surgery of limbs involving tourniquet time >45 minutes, with ASA status I & II, both male and female having age 18-50 years were selected. Patients with allergy to lignocaine or Ketamine (on past history), patients with sickle cell disease, peripheral vascular disease and DVT (medical records/past history) and hypertensive patients (medical records/past history) were excluded from the study. Study was approved by the ethical committee and written informed consent was taken from every patient.

Demographic details of patients including age, gender, limb involved (upper or lower) and BMI will be noted. Patients were randomized (by lottery method) into two groups: group A (lignocaine) and group B (Ketamine). All the patients in both groups were given general anesthesia according to standard protocol( induction agents : inj. propofol 2mg/kg and inj. atracurium 0.5mg/kg ). The baseline heart rate and blood pressure of patients was monitored. Patients in group A were given lignocaine 2% as 1 mg/kg IV bolus, followed by lignocaine infusion (2 mg/kg/h) diluted in 50 ml syringe. Patients in group B received Ketamine injection intravenously. Then tourniquet was applied over the limb in a standard way and surgery was started.. The tourniquet pressure for upper limb is 100-300 mmHg ,while for lower limb is 150 – 400 mmHg. Blood pressure was monitored after every 15 minutes till the end of surgery and if TIH develops (as defined in operational definition), it was noted. Also if TIH develops, labetalol boluses of 5 mg was given to control the hemodynamic changes. At the end of surgery, tourniquet was removed and patients were extubated(smooth, awake extubation by giving inj. Neopyrolate 0.03 -0.07mg/kg).

The collected data was entered and analyzed accordingly using SPSS version 20. The study variables were analyzed using simple descriptive statistics, calculating mean and standard deviation for quantitative values like age. Frequencies and percentages were calculated for qualitative variables like gender, limb involved, BMI and TIH. Stratification of TIH for age, gender, limb involved and BMI was done. Post-stratification, chi-square test was applied. Statistical significance was considered as p value $< 0.05$.

## RESULTS:

A total of 300 patients (150 in each group) were included in the study. The mean age of the patients was found to be 38.14 ± 8.67 years in group A and 38.59 ± 8.93 years in group B. Study group A, tourniquet induced hypertension was found in 46 (30.66%) patients while in study group B, tourniquet induced hypertension was noted in 24 (16%) patients. Frequency of tourniquet induced hypertension in study group A was significantly higher than study group B with p value 0.003. (Table 1)

Selected patients were divided into two age groups i.e. age group 18-40 years and age group 41-50 years. Total 88 (58.67%) patients of group A and 78 (52%) patients of group B belonged to age group 18-40 years. Tourniquet induced hypertension was noted in 27 (30.68%) patients of study group A while in 15 (19.23%) patients of study group B. But the difference of Tourniquet induced hypertension between the both group was statistically insignificant with p value 0.090. In age group 41-50 years, out of 62 (41.33%) patients of study group A, Tourniquet induced hypertension was noted in 19 (30.65%) patients. In study group B, Tourniquet induced hypertension was noted in 9 (12.5%) patients. Difference of Tourniquet induced

hypertension between the both groups was statistically significant with p value 0.010. (Table 2)

Out 99 (66%) male patients of study group A and 81 (54%) male patients of study group B, tourniquet induced hypertension was noted in 31 (31.31%) male patients of study group A while in 18 (22.22%) patients of study group B. difference of tourniquet induced hypertension between the both groups was not significant (P = 0.173) statistically.

In study group A, out of 51 (34%) female patients, tourniquet induced hypertension was noted in 15 (29.41%) patients. While in study group B, out of 69 (46%) female patients, tourniquet induced hypertension was noted in 6 (8.70%) patients. Difference of tourniquet induced hypertension between the both groups was statistically significant with p value 0.003. (Table 3)

Non-obese patients were 91 (60.67%) and 56 (37.33%) respectively in study group A and B. Tourniquet induced hypertension was found in 29 (31.87%) patients of study group A while in 10 (17.86%) patients of study group B. But the difference of tourniquet induced hypertension was not statistically significant with p value 0.062. Out of 59 (39.33%) obese patients of study group A, tourniquet induced hypertension was found in 17 (28.81%) patients. In study group B, there were 94 (62.67%) patients were obese, tourniquet induced hypertension was noted in 14 (14.89%) patients. Difference of Tourniquet induced hypertension between the both groups was statistically significant with p value 0.037. (Table 4)

In upper limb group, there were 46 (30.67%) patients and 81 (54%) patients respectively in study group A and B. Tourniquet induced hypertension was noted in 12 (26.09%) patients of study group A while in 16 (19.75%) patients of study group B but the difference was insignificant (P = 0.408) statistically. In lower limb group, there were 104 (69.33%) patients belonged to study group A and Tourniquet induced hypertension was found in 34 (32.69%) patients. In study group B, out of 69 (46%) patients, Tourniquet induced hypertension was noted in 8 (11.59%) patients. Difference was statistically significant with p value 0.002. (Table 5)

**Table No. 1**
**Comparison of Tourniquet induced hypertension in both groups**

| Group | Tourniquet induced hypertension | | Total | P value |
|---|---|---|---|---|
| | Yes (%) | No (%) | | |
| A | 46 (30.66%) | 104 (69.33%) | 150 | 0.003 |
| B | 24 (16%) | 126 (84%) | 150 | |

**Table 2: Comparison of TIH between the groups for age**

| Groups | Tourniquet induced hypertension | | Total (%) | P-Value |
|---|---|---|---|---|
| | Yes (%) | No (%) | | |
| **Age group 18-40 years** | | | | |
| Group A | **27 (30.68)** | 61 (69.32) | 88 (58.67) | **0.090** |
| Group B | **15 (19.23)** | 63 (80.77) | 78 (52) | |
| **Age group 41-50 years.** | | | | |
| Group A | **19 (30.65)** | 43 (69.35) | 62 (41.33) | **0.010** |
| **Group B** | **9 (12.5)** | **63 (87.5)** | **72 (48)** | |

**Table 3: Comparison of TIH between the groups for gender**

| Groups | Tourniquet induced hypertension | | Total | P-Value |
|---|---|---|---|---|
| | Yes (%) | No (%) | | |
| **Male** | | | | |
| Group A | **31 (31.31)** | 68 (68.69) | 99 (66) | **0.173** |
| Group B | **18 (22.22)** | 63 (77.78%) | 81 (54) | |
| **Female** | | | | |
| Group A | **15 (29.41%)** | 36 (70.59%) | 51 (34%) | **0.003** |
| **Group B** | **6 (8.70%)** | **63 (91.30%)** | **69 (46%)** | |

**Table 4: Comparison of TIH between the groups for obesity**

| Groups | Tourniquet induced hypertension | | Total | P-Value |
|---|---|---|---|---|
| | Yes (%) | No (%) | | |
| **Non-obese** | | | | |
| Group A | **29 (31.87%)** | 62 (68.13%) | 91 (60.67%) | **0.062** |
| Group B | **10 (17.86%)** | 46 (82.14%) | 56 (37.33%) | |
| **Obese** | | | | |
| Group A | **17 (28.81%)** | 42 (71.19%) | 59 (39.33%) | **0.037** |
| Group B | 14 (14.89%) | **80 (85.11%)** | **94 (62.67%)** | |

**Table 5: Comparison of TIH between the groups for upper and lower limb**

| Groups | Tourniquet induced hypertension | | Total | P-Value |
|---|---|---|---|---|
| | Yes (%) | No (%) | | |
| **Upper limb** | | | | |
| Group A | **12 (26.09%)** | 34 (73.91%) | 46 (30.67%) | **0.408** |
| Group B | **16 (19.75%)** | 65 (80.25%) | 81 (54%) | |
| **Lower limb** | | | | |
| Group A | **34 (32.69%)** | 70 (67.31%) | 104 (69.33%) | **0.002** |
| Group B | 8 (11.59%) | **61 (88.41%)** | **69 (46%)** | |

## DISCUSSION:

Tourniquet use is widespread in orthopaedic surgery to provide a bloodless operating field during surgical procedures involving the extremities and for intravenous regional anaesthesia. Pneumatic tourniquet (PT) is the most commonly used tourniquet since its introduction by Harvey Cushing in 1904. The Esmarch tourniquet is generally considered less safe than PTs, although some surgeons continue to use this device. Modern PTs are designed to minimize the incidence of complications, and recent prospective randomized clinical trials have shown no significant long-term deleterious effects of using PTs in extremity surgery.[9]

Although serious complications of the use of a PT are rare, there is a definite morbidity and even mortality. Nowadays, it is generally accepted that wide-cuff PT systems at low-pressure allow more predictable and precise pressure regulation at the site of application resulting in improved safety for extremity surgery. In order to eliminate these complications, the PTs should be kept in good condition by routinely checking all valves and gauges, daily calibration checks, intraoperative frequent monitoring of tourniquet function and monthly performance assurance tests. The tourniquet should be tested by in deflation and then completely deflated before application and experienced personnel should apply the appropriated padding and the tourniquet cu V around the limb.[10]

After the ischemic period, blood flow is necessary both for renewal of cells and clearance of the accumulated toxic metabolites. When the tourniquet is released, excessive formation of reactive oxygen species (ROS) causes peroxidation of membrane lipids. This process triggers oxidation of the polyunsaturated fatty acids, destroying membrane structures and producing toxic metabolites such as malondialdehyde (MDA). This process is defined as ischemia- reperfusion injury. Orthopedic surgery with a tourniquet is a good human model for ischemia-reperfusion injury. There are several defense mechanisms against ischemia- reperfusion injury in the body. Endogenous enzymes such as superoxide dismutase (SOD), catalase, and glutathione peroxidase (GSH) play a part in the defense mechanisms of the body in normal conditions by removing ROS effectively. They are overwhelmed during ischemia and subsequent reperfusion when a large amount of free radicals are rapidly produced. Some specific agents have been used to prevent the effects of ischemia-reperfusion injury.[11]

Our study had few limitations also. The collection of data was not blinded to the tourniquet used. Also I did not include age groups of >50 years and children in the study. Therefore I recommend more trials with proper blinding and randomizations to be conducted on the subject which must be multi-centric to unreveal more features of the study.

## CONCLUSION:

There is a difference in frequency of tourniquet induced hypertension in patients undergoing limb surgery after administration of lignocaine infusion vs Ketamine. Therefore I recommend usage of fiberoptic bronchoscopy to reduce the morbidity of the patients.

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