



Haemodynamic Effects during Induction in Cervical Spine Injuries Patients: Comparison of Three Drug Dose Combinations of Ketamine and Propofol (Case Study)

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ABSTRACT

Background and Aims: Cervical spine injured patients have bradycardia & hypotension, which may be aggravated during induction of anaesthesia. Very few studies are available regarding this problem. Studies are available where propofol and ketamine or propofol and ephedrine are used to maintain cardiovascular stability but these too are limited to normal population.

We decided to compare the haemodynamic parameters during induction with three different drug dose combinations of propofol and ketamine to know the best drug dose combination of these two drugs for haemodynamic stability in cervical spine injury patients.

Methods: We studied 60 adult patients of either sex with established cervical spine injury with quadriplegia scheduled to undergo elective surgical procedures under general anesthesia and randomly divided into 3 groups. Data was collected by measuring Pulse rate, Systolic Blood Pressure, Diastolic Blood Pressure & Mean Blood Pressure.

The results: Haemodynamic changes in group PK (propofol 1.0 mg/kg + ketamine 1.0 mg/kg) were less than the group PPK (propofol 1.5 mg/kg + ketamine 0.5 mg/kg) but more as compared to PKK (propofol 0.5 mg/kg + ketamine 1.5 mg/kg).

Conclusion: To avoid haemodynamic changes during induction of anesthesia in cervical spine injury patients, drug dose combination of PKK (propofol 0.5 mg/kg + ketamine 1.5 mg/kg) should be preferred over PPK (propofol 1.5 mg/kg + ketamine 0.5 mg/kg).

Keywords: Cervical Spine Injury, Haemodynamic stability, Induction of Anaesthesia, Ketamine, Propofol.

INTRODUCTION

Spinal cord injury causes unique pathophysiological changes. The most important perioperative dangers are autonomic dysreflexia, bradycardia, hypotension, respiratory inadequacy. These problems are very peculiar to cervical spinal cord injury patients, especially in early stage (phase of spinal shock) of injury which may last from few days to 6-8 weeks¹.

Cervical spine injury patients in stage of spinal shock have bradycardia & hypotension, which may be aggravated during induction of anaesthesia. Very few studies are available regarding this problem. Studies are available where propofol and ketamine or propofol and ephedrine are used to maintain cardiovascular stability but these too are limited to normal population. Many a time we face bradycardia & hypotension or tachycardia & hypertension. So we decided to do a study to optimize the doses of propofol & ketamine for induction of anaesthesia in cervical spine injury patients.

MATERIALS AND METHODS

All patients underwent a thorough pre-anesthetic checkup comprising of history, general physical examination, systemic examination and routine investigations. Special investigations were conducted wherever required.

Patient with anticipated difficult intubation, history of hypertension, cardiac disease, gross obesity, history of autonomic hyperreflexia and patient in acute phase of spinal shock (0-48 hr) were excluded from the study.

METHODOLOGY

Adult patients with established cervical spine injury with quadriplegia scheduled to undergo elective surgical procedures under GA were randomly assigned to one of the three groups each of which comprised 20 patients. Approval was obtained from the Clinical Research Ethics Committee of the hospital and informed consent from the patients was obtained. Adequate numbers

of patients were included in each group to make the study statistically significant.

Group I (Group PKK): Induction of anaesthesia with IV propofol (0.5mg/kg) & IV ketamine (1.5 mg/kg)

Group II (Group PK): Induction of anaesthesia with IV propofol (1mg/kg) & IV ketamine (1mg/kg)

Group III (Group PPK): Induction of anaesthesia with IV propofol (1.5mg/kg) & IV ketamine (0.5 mg/kg)

CALCULATION OF IDEAL BODY WEIGHT²

- Male: $50 + 2.3 \times (\text{Height in inches} - 60)$
- Female: $45.5 + 2.3 \times (\text{Height in inches} - 60)$

PREMEDICATION

Uniform premedication was given to all patients with:

- Tab alprazolam 0.25 mg orally night before surgery.

Once patient was brought to OT iv line was secured with 16 G cannula.

After taking patient to operation table 5 min before induction, i.v. premedication were given as below:

- Injection glycopyrrolate 4 µg/kg
- Injection midazolam 30 µg/kg
- Injection fentanyl 2 µg/kg
- Injection xylocaine 1 mg/kg i.v. was given 2 min just before induction.

Injection ketamine was given first followed by the propofol.

Group PKK: propofol 0.5 mg/kg and ketamine 1.5 mg/kg

Group PK: propofol 1.0 mg/kg and ketamine 1.0 mg/kg

Group PPK: propofol 1.5 mg/kg and ketamine 0.5mg/kg

Injection rocuronium 0.8 mg/kg was used as muscle relaxant for intubation & was given immediately after the induction agents. All patients were preoxygenated with 100% O₂ for 90 sec after giving rocuronium. Patients were intubated (after 90 sec of rocuronium given) using

Macintosh laryngoscope with Manual In Line Stabilization (MIST) technique. Patients for whom intubation was not successful within 30 sec were excluded.

Anesthesia was maintained on N₂O (66%) and Isoflurane (0.2%) till the 15 min of observation period after the intubation.

Following parameters were observed for the study:

1. Pulse rate
2. Blood pressure – systolic, diastolic, mean

The readings were recorded at the following intervals:

- T0. Baseline just before premedication (5 min before 2nd reading)
- T1. Before induction of anesthesia
- T2. Just before intubation (90 sec after 2nd reading)
- T3. Just after intubation
- T4. 2 minutes after intubation
- T5. 5 minutes after intubation
- T6. 10 minutes after intubation
- T7. 15 minutes after intubation

Haemodynamic data were analyzed using Duncan's Mean Test and one-way analysis of variance (ANOVA).

All values were expressed as mean \pm SD, and difference were considered significant when $P < 0.05$, highly significant when $P < 0.01$, very high significant when $P < 0.001$.

DISCUSSIONS& RESULTS

Most of the literature on cervical spine injuries patients is focused on airway management. Though it is true in suspected cervical spine injuries patients in immediate period but in established cervical spinal cord injuries patients with quadriplegia it rarely poses a challenge. Usually these patients come to operation theatre with a mechanical traction in place or have already fixed cervical spine in previous surgeries. Instead of airway, the main problem which is faced by an anesthesiologist in routine practice is

cardiovascular depression during induction of anaesthesia as these patients are already on lower side of haemodynamics and unable to cope with fall in blood pressure due to functional sympathectomy¹.

The most vital element in providing safe anaesthesia is use of an anaesthetic technique that maintains stable haemodynamics. Sudden changes in blood pressure during anesthesia may be catastrophic especially in cervical spine injury patients³. So main objective in these patients is to maintain blood pressure within normal limits during induction of anesthesia.

The changes in the blood pressure during the induction of anaesthesia can be due to various factors such as drugs used for premedication⁴ and induction of anaesthesia^{4, 5} and airway manipulation during intubation. This can be prevented by using cardio stable drugs or appropriate combination of drugs having opposite action on haemodynamics^{6,7}.

Ketamine and propofol are very commonly used combination of drugs used for this propose in clinical practice. Some anesthesiologists also mix both drugs in same syringe, also popularly as 'Ketofol', though this practice is not recommended.

Ketamine is good induction agent for patients having haemodynamics on lower side⁷. It cause tachycardia and increase in BP. propofol on the other side cause bradycardia and decrease in BP^{8, 9, 10, 11}.

No major study regarding haemodynamic changes due to induction of anesthesia in established cervical spine injury patients is documented so far. Studies are available where propofol and ketamine or propofol and ephedrine are used to maintain cardiovascular stability but these too are limited to normal population.

Also only few human studies are available for combined use of ketamine and propofol even in normal individuals^{7,12} though these drugs are commonly used together in anesthesia practice.

We studied haemodynamics changes in sixty patients of age group 20-60 years divided in 3

groups receiving three drug dose combinations of ketamine&propofol.

Following conclusions were drawn after observation, statistical analysis and discussion:

- There was no correlation of age, sex & weight in all 3 groups.
- Injection xylocaine 1mg/kg i.v. 2 minute before intubation does not prevent hypertensive response to laryngoscopy and intubation effectively.
- Significant changes in Pulse, systolic BP, diastolic BP and Mean BP were observed during induction and intubation in all groups which remained elevated in post intubation period for 2 to 5 minutes due to stress response of mechanical stimulation of trachea.
- Drop in pulse and systolic BP, diastolic BP, mean BP was more and of much prolonged period in cervical spine injured patients compared to normal individuals in other studies.
- Haemodynamic changes were least in group PKK and on higher side of base line compared to other 2 groups especially just after induction.
- Haemodynamic changes in group PK were less than the group PPK but more as compared to PKK.
- Though significant haemodynamic changes were observed during induction and intubation in all groups, the Pulse, systolic BP, diastolic BP and Mean BP reached near to base line much earlier in group PKK.

Based on findings in our study, it can be postulated that to avoid haemodynamic changes during induction of anesthesia in cervical spine injury patients, drug dose combination of PKK should be preferred over PPK. Also a more extensive and elaborate study is required to further explore the other drugs and techniques to maintain the haemodynamic stability during induction and

intubation in established cervical spine injury patients.

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