Original Article

Effect of a second dose of thiopentone on haemodynamic response to laryngoscopy and intubation

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Abstract

Objectives
This observational study was designed to assess the effect of a second dose of thiopentone on the haemodynamic response to laryngoscopy and intubation.

The study was conducted in Soba University and Khartoum Teaching Hospital, in the period from January to May 2006.

One hundred patients were selected and divided into two groups (group 1 and group 2) with 50 patients each. Group 1 was given 4mg/kg of thiopentone initially, to induce anaesthesia, and another 4mg/kg of the same drug, following the administration of 1mg/kg of suxamethonium to facilitate endotracheal intubation.

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intubation. Group 2 candidates, the control group, received the usual induction dose of thiopentone only. All patients were premedicated with 0.02 mg/kg atropine IV. Blood pressure (Systolic, diastolic and mean), using Non-Invasive Blood Pressure monitor (NIBP), and heart rate were measured before induction and after intubation.

**Results**

The use of a second dose of thiopentone significantly attenuated the haemodynamic response to laryngoscopy and intubation in comparison to those who didn't receive it. The increase in heart rate, systolic, diastolic and mean arterial pressure in the second dose thiopentone group was 23.14 beats/min, 12.44 mmHg, 17.04 mmHg and 18.7 mmHg respectively. Concerning the control group, there was a significant rise in heart rate (32.7 beats/minute), systolic (22.52 mmHg), diastolic (24.78 mmHg) and mean arterial pressure (23.7 mmHg) from the preinduction values.

**Conclusion**

The study showed that giving a second dose of thiopentone significantly attenuated the haemodynamic response to laryngoscopy and intubation without causing undue prolongation in recovery time.

**Keywords:** Thiopentone, second dose, laryngoscopy, intubation, pressor response.

**Introduction**

Laryngoscopy and tracheal intubation, after standard induction dose of thiopentone, often provokes a refer increase in both sympathetic and sympathoadrenal activity, which may result in increased blood pressure, tachycardia and arrhythmia(1).

The arrhythmogenicity was noticed by Raid in 1940(2), while the tachycardia and hypertension were described by King JD in 1950(3).

The pressor response to laryngoscopy and intubation is probably of little consequence in healthy subjects. It may, however, be harmful in patients with cardiac, cerebrovascular and intracranial lesions; hypertensive patients show an exaggerated response(4). Laryngoscopy and intubation have lead to pulmonary oedema in preclamptic patients and ruptured cerebral aneurysm in other patients(4). This effect can lead to marked hypertension before the start of anaesthesia(5) and sudden death following intubation(6).

Many methods have been devised to mitigate the haemodynamic response to laryngoscopy and intubation, including the use of fentanyl(7,8), fast and short-acting vasodilators(9), beta-adrenergic blockers(10), intravenous lignocaine(11), propofol induction of anaesthesia(12) and clonidine premedication(13).

Thiopentone is a peripheral vasodilator and cerebral vasoconstrictor. The cerebral vasoconstrictive properties of thiopentone have made it useful in clinical practice to control preoperative intracranial hypertension, including that elevation caused by laryngoscopy and intubation(12).

Thiopentone generally depresses the cardiovascular system. However, the induction dose alone is not sufficient to prevent the pressor response to laryngoscopy and intubation. This study is designed to assess the effect of a second dose of thiopentone, given after the induction dose and just before laryngoscopy and intubation, on the haemodynamic changes aggravated by laryngoscopy and intubation.

**Methodology**

This prospective observational study was designed to assess the effect of a second dose of thiopentone on haemodynamic response to laryngoscopy and intubation. The study was conducted in Soba University and Khartoum Teaching Hospital, in the period from January to May 2006.

One hundred patients, undergoing elective surgical procedures and needing endotracheal intubation were randomly selected and allocated into two groups. Patients in group 1 (50 patients) received a
second dose of thiopentone after induction of anaesthesia and before intubation, while patients in group 2, the control group (50 patients) did not receive a second dose of thiopentone.

Patients included were those who underwent elective surgical procedures under general anaesthesia with endotracheal intubation. All selected patients were adults (20-65 years of age), mixed gender, weighing between 40-80 kg patients (ASA) classification (the American Society of Anesthesiologists) physical status class I and II.

Patients with intercurrent disease, those taking drugs with cardiovascular effect and those for emergency or day-case surgery were excluded from the study.

All patients were seen in the ward at least one day before surgery for preoperative assessment. Each patient’s preoperative heart rate, systolic and diastolic arterial pressure (DAP) were measured, and the mean arterial pressure (MAP) was derived mathematically (MAP=Diastolic + 1/3 pulse pressure).

On arrival to the operating theatre, the patients were assigned sequentially to either the second dose thiopentone group or the control group.

In the operating room, an intravenous cannula was inserted for fluids and drugs administration and monitors were attached, including noninvasive automatic blood pressure monitor, ECG and pulse oximeter.

The pre-induction baseline heart rate, systolic, diastolic and mean arterial blood pressures were measured and values were recorded in the patient’s data form. Each patient was premedicated with 0.2 mg atropine and preoxygenated for 3 minutes. Patients in the second dose thiopentone group were given 4 mg/kg thiopentone sodium 2.5% by slow intravenous injection for induction of anaesthesia, followed by 1mg/kg IV suxamethonium chloride to facilitate tracheal intubation. A second dose of thiopentone, equal to the induction dose, was given intravenously just before laryngoscopy and intubation. Patients in the control group (group 2) were only given 4 mg/kg thiopentone sodium by slow intravenous injection for induction of anaesthesia and then I.V suxamethonium chloride 1mg/kg. After adequate relaxation, as judged by loss of lower jaw tone, laryngoscopy was undertaken with Magill long blade laryngoscope and the trachea was intubated with the appropriate size of endotracheal tube.

One minute after intubation the heart rate, systolic, diastolic and mean arterial pressure were recorded and were registered in the patient’s data form. Cases with difficult and/or repeated laryngoscopy and/or intubation (Attempts taking more than 60 seconds) were excluded from the study. Intubation time in this study was taken as the time from oral introduction of the laryngoscope to successful placement of endotracheal tube.

The difference between the pre-induction and post intubation haemodynamic values, in each group, were considered as the surrogate for haemodynamic response to laryngoscopy and intubation.

Patient’s data was collected by data form and electronic monitoring.

The collected data was analyzed using master sheet and excel computer program and SPSS. The data were then presented in figures and tables. Hypothesis was tested using Chi square and paired t-test and whenever a variable has a P-value <0.05, it was considered significant.

Results

The study recruited one hundred patients fulfilling the inclusion criteria. Selected patients were divided into two equal groups. Group 1 received a second dose of thiopentone while group 2 patients, the control group, did not receive a second dose of this drug.

Patients in both groups were comparable in number, age, sex, and weight (Table 1 and 2).
Table 1: Age distribution among study groups.

<table>
<thead>
<tr>
<th>Age range</th>
<th>Group (1)</th>
<th>Group (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Percent</td>
<td>Frequency</td>
</tr>
<tr>
<td>20-29</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>30-39</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>40-49</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>50-59</td>
<td>21</td>
<td>2</td>
</tr>
<tr>
<td>60-69</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 2: Sex and weight distribution among study groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Patients</th>
<th>Sex (M/F)</th>
<th>Mean weight (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second dose thiopentone</td>
<td>50</td>
<td>16/34</td>
<td>71.1 ± 8.67</td>
</tr>
<tr>
<td>Control Group</td>
<td>50</td>
<td>20/30</td>
<td>71.35 ± 8.43</td>
</tr>
</tbody>
</table>

Table 3: Mean haemodynamic values.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Second dose group</th>
<th>Control group</th>
<th>P.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (Beats/min)</td>
<td>Pre induction</td>
<td>Post intubation</td>
<td>Difference</td>
</tr>
<tr>
<td>SAP (mmHg)</td>
<td>Pre induction</td>
<td>Post intubation</td>
<td>Difference</td>
</tr>
<tr>
<td>DAP (mmHg)</td>
<td>Pre induction</td>
<td>Post intubation</td>
<td>Difference</td>
</tr>
<tr>
<td>MAP (mmHg)</td>
<td>Pre induction</td>
<td>Post intubation</td>
<td>Difference</td>
</tr>
</tbody>
</table>

Discussion
Thiopentone is affordable and readily available in theatres of developing countries, including Sudan. Thiopentone remains the most commonly used intravenous anaesthetic induction agent in many places. Its effectiveness in mitigating the cardiovascular response to laryngoscopy and intubation will have salutary clinic-economic effects. Thiopentone causes reduced systemic vascular resistance, arterial blood pressure and coronary perfusion pressure. Myocardial contractility is depressed and there is a compensatory tachycardia. Its haemodynamic effects include peripheral blood pooling, reduced venous return and cardiac output.

Giving a second dose following induction will obviate reflex tachycardia as sympathetic output from the central nervous system is decreased. The rapid onset thiopentone anaesthesia is due to fast cerebral uptake of the drug, while recovery is caused by redistribution of the drug to other sites. Thus giving a second
Thiopentone dose just before laryngoscopy ensures sufficiently high concentration of the drug in the brain to depress cerebral reflexes. Although relatively high dose was selected in this study (8 mg/kg), prolonged recovery time was not observed. It is well known from literature that the incidence of significantly prolonged recovery time is observed when using doses more than 10 mg/kg\(^{15}\). Moreover, it is known that the higher the initial doses of thiopentone, the higher the concentration of the brain plasma level at which the patient will wake on. This phenomenon has been termed acute tolerance\(^{16}\). Thus the divided dose technique, as used in this study, may be appropriate to mitigate acute tolerance than a single high induction dose technique.

In this study, the second dose thiopentone technique significantly attenuated the post intubation rise in heart rate, compared with the control group. Conventional induction dose of thiopentone usually causes a rise in heart rate to compensate for the drug induced fall in blood pressure. The less proportionate increase in heart rate in the second dose thiopentone group after intubation may be due to depression of sympatho-adrenal response cause by increased depth of anaesthesia. In this study atropine was administered to both study groups as a premedicant drug. Atropine increases heart rate, an effect noted in both groups. This is expected to alter the measurement of the heart rate and to some extent other haemodynamic variables. On the other hand, the use of atropine is necessary in this study to overcome the effect of both suxamethonium and thiopentone on the heart.

Despite this fact, the use of atropine in this study had no remarkable influence on post induction heart rate.

In this study, the increase in systolic and diastolic arterial pressures in second dose group was consistent with the findings of Takkune and Cowarker\(^{17}\) who used thiopentone 1mg/kg and 2.5 mg/kg just before laryngoscopy and intubation. They found that both doses of thiopentone reduced the haemodynamic values close to their initial levels. The mean arterial pressure in the second dose thiopentone group increased, following laryngoscopy and intubation, by only 18.7 mmHg from the preinduction value, compared with 23.7 mmHg increase in the control group. This is compatible with the findings of Unni\(^{18}\) and Cowarker who used the second dose thiopentone at a dose of 2.5 mg/kg over 30 seconds before laryngoscopy.

In conclusion, the second dose thiopentone technique, used in this study, is appropriate for mitigation of acute tolerance to thiopentone than the single induction dose technique. The second dose thiopentone, as used in this study, significantly attenuated the post intubation rise in haemodynamic variables seen after laryngoscopy and intubation. attenuation of the systolic arterial pressure was more remarkable than that seen with diastolic, mean or heart rate.

The use of a second dose of thiopentone is recommended to mitigate the haemodynamic response to laryngoscopy and intubation in hypertensive, cardiac, those with aneurysm and atherosclerotic patients.

References
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