

# AWARENESS UNDER GENERAL ANAESTHESIA IN PATIENTS UNDERGOING ELECTIVE CAESAREAN SECTION USING THIOPENTONE AND KETAMINE AS INDUCTION AGENTS- A RANDOMISED PROSPECTIVE STUDY

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## ABSTRACT

### BACKGROUND

Awareness during general anaesthesia for caesarean section is a big concern because of its serious adverse consequences. It has been reported that ketamine used as induction agent reduces awareness. This study was conducted to compare awareness under general anaesthesia when thiopentone and ketamine are used as induction agents for caesarean section.

### MATERIALS AND METHODS

Fifty healthy mothers scheduled for elective caesarean section were randomly divided into two groups to receive thiopentone (4 mg/kg<sup>-1</sup>) or ketamine (1.5 mg/kg<sup>-1</sup>) for induction of anaesthesia. Mothers were examined for intraoperative awareness using isolated forearm technique until the delivery of the baby. Postoperatively, they were spoken about recall and any hallucination by using a set of questionnaire.

### RESULTS

15% patients who received thiopentone were able to follow the commands compared to 8% patients who received ketamine. 65% patients who received thiopentone made reaching movements of the isolated forearm towards the stimulus compared to 20% patients of ketamine group. None of the patients in thiopentone group experienced any hallucinations compared to 1 patient (4%) in ketamine group who exhibited hallucinations. None of fifty patients could recall the intraoperative events like squeezing of hands or the pain of operation.

### CONCLUSION

Ketamine can be used as substitute for thiopentone as an induction agent in a dose equal to 1.5 mg/kg<sup>-1</sup>. Having profound analgesic effect, property to maintain foetoplacental exchange better than any other induction agents, ketamine can be used routinely as an induction agent for mothers undergoing caesarean section under general anaesthesia.

### KEYWORDS

Awareness, General Anaesthesia, Caesarean Section, Ketamine.

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### BACKGROUND

Under general anaesthesia, it is possible to produce a state in which the patient is analgesic and able to tolerate abnormal situations while retaining some knowledge about the surroundings, ability to communicate in a selected manner with the person in vicinity.<sup>1</sup> This awareness which is defined as "spontaneous recall of intraoperative events under general anaesthesia in the postoperative period"<sup>1</sup> occurs more during caesarean section. This may act as a deterrent to further pregnancy, preventing sexual intercourse and possibly breaking up a relationship.

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A lower incidence of awareness when ketamine was used as an induction agent for caesarean section has been reported.<sup>2,3</sup> In this study, it was proposed to compare the maternal awareness and neonatal outcome when thiopentone or ketamine were used as general anaesthetic induction agents for elective caesarean section.

### MATERIALS AND METHODS

This prospective randomised control study was conducted after approval from hospital ethics committee and after obtaining written informed consent from patients. Fifty mothers at term belonging to ASA-1 group scheduled for elective caesarean section under general anaesthesia were studied. Patients were randomly divided into two groups (thiopentone n=26 or ketamine n=24). Those with a history of hypertension, diabetes, preeclampsia, intrauterine growth retardation, morbid obesity, foetal distress, abnormal presentation or multiple pregnancy were excluded from the study. The mother was explained about the "isolated forearm technique"<sup>4</sup> to assess intraoperative awareness. A 14.5 cm wide pneumatic tourniquet was applied to the arm,

which was not used for blood pressure monitoring and intravenous fluid administration.

Patient was preoxygenated with 100% oxygen for three minutes. Anaesthesia was induced with thiopentone 4 mg/kg<sup>-1</sup> or ketamine 1.5 mg/kg<sup>-1</sup> after the surgeons have cleaned and draped the surgical field. Cricoid pressure was applied by a trained assistant after administering induction agent. The tourniquet was inflated 20 mmHg above the systolic blood pressure and succinylcholine 1.5 mg/kg<sup>-1</sup> was administered. The lungs were ventilated with 50% nitrous oxide in oxygen using Bain's modification of Mapleson D circuit. Neuromuscular blockade was maintained with pancuronium bromide 0.06 mg/kg<sup>-1</sup> intravenously given one minute after intubation and then 0.01 mg/kg<sup>-1</sup> as and when required. Vital signs were recorded at the time of intubation and surgical incision then every two minutes until delivery of the baby and every 5 minutes thereafter till the end of surgery. Maternal awareness was tested two minutes after induction and then every two minutes till the delivery of the baby.

After the delivery of the baby, morphine 0.15 mg/kg<sup>-1</sup> intravenously was administered, nitrous oxide was increased to 66% and oxytocin infusion was started after a bolus. Residual neuromuscular blockade was reversed with neostigmine 0.05 mg/kg<sup>-1</sup> and atropine 0.02 mg/kg<sup>-1</sup> and extubated when patient was fully awake. Neonate was assessed using Apgar score at 1<sup>st</sup> and 5<sup>th</sup> minute.

**Isolated Forearm Technique<sup>4</sup>**

After administering the anaesthetic induction agent, tourniquet was inflated 20 mmHg above systolic blood pressure before administering succinylcholine. A pre-recorded message asking mother to squeeze the hand if she is aware of the surroundings was played into her ears through a record player and headphones every two minutes till the delivery. If the patient is able to follow the commands, it was registered as positive response and the patient is considered to be awake. Postoperatively,

response to a set of questionnaire about awareness and hallucinations was collected from the patient.

**Statistical Analysis**

Student's t-test was used to compare demographic data and Blood Pressure (BP) values. Intragroup BP changes by a repeated measure analysis of variance. Awareness was compared using chi-square test. Neonatal Apgar score were compared using Mann-Whitney U test. A probability of 0.05 or less was considered statistically significant.

**RESULTS**

Both the groups were comparable with respect to age, weight, preoperative blood pressures, heart rate and induction delivery interval (Table 1).

	<b>Thiopentone (n=26)</b>	<b>Ketamine (n=24)</b>
Age (yrs.)	26.23±4.14	26.4±4.15
Weight (kg)	57.73±8.78	58.58±8.82
Blood Pressure (mmHg)		
Systolic	129.58±16.62	123.83±14.76
Diastolic	83.69±7.97	82.17±9.50
Heart Rate (beats/min.)	91.73±11.57	94.83±18.01
Induction Delivery Interval (min.)	10±3.35	9.96±3.66

**Table 1. Demographics of Study Groups**

Values are mean±S.D., p <0.05.

Systolic and diastolic blood pressure and heart rate increased significantly from the basal level in both the groups during endotracheal intubation. The rise in heart rate, systolic blood pressure and diastolic blood pressure was more in the thiopentone group as compared to the ketamine group. The difference amongst the groups was not statistically significant (Table 2).

	<b>Systolic Blood Pressure (mmHg)</b>		<b>Diastolic Blood Pressure (mmHg)</b>		<b>Heart Rate (Beats/min.)</b>	
	<b>Thiopentone</b>	<b>Ketamine</b>	<b>Thiopentone</b>	<b>Ketamine</b>	<b>Thiopentone</b>	<b>Ketamine</b>
Hospitalisation	129.58±16.62	123.83±14.76	83.69±7.97	82.17±9.50	91.73±11.57	94.83±18.00
Intubation	159.54±18.89*	160.21±15.07*	106.15±15.27*	105.29±11.24*	118.31±10.11*	117.92±14.65*
Incision	159.92±17.91	162.38±15.60	105.92±14.69	106.75±9.71	121.54±11.30	123.17±15.11*
End of 6 <sup>th</sup> min.	138.31±19.77*	141.58±16.72*	91.69±13.44*	94.58 ±12.58*	119.73±13.91	116.54±13.79

**Table 2. Cardiovascular Effects of Anaesthetic Induction Agents**

#values are mean±S.D.\* p <0.05 compared with parameters during hospitalisation (intragroup).

Responsiveness of the patient in intraoperative period was divided into two categories "made reaching moments", i.e. reached towards face or abdomen in response to endotracheal intubation or surgical stimulation "followed commands", i.e. squeezed the hand of investigator (anaesthesiologist) on commands for requested number of times.

<b>Type of Responses</b>	<b>Thiopentone (n=26)</b>	<b>Ketamine (n=24)</b>
Followed commands	4	2
Reaches movements	17*	5
Recall	0	0
Hallucination	0	1

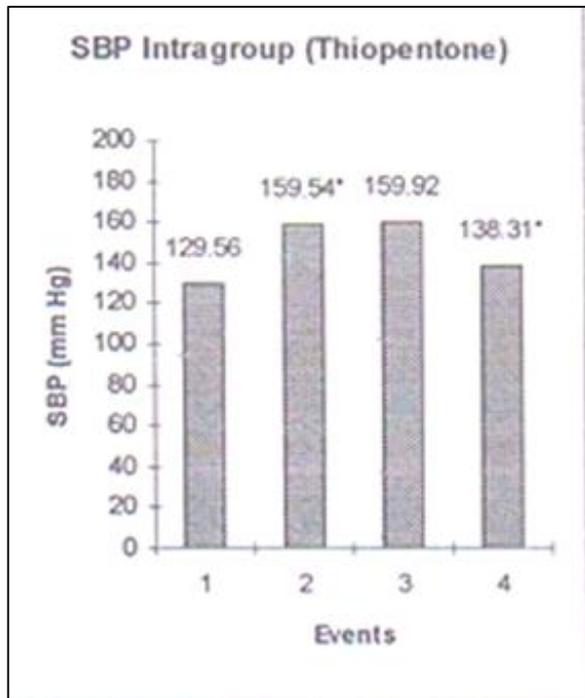
**Table 3. Incidence of Positive Responses**

\* p <0.05 compared with ketamine group.

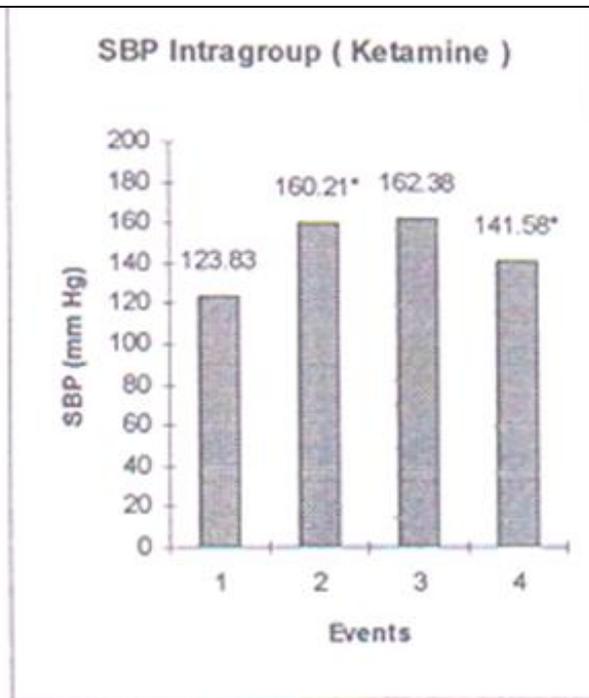
The incidence of Apgar scoring at 1<sup>st</sup> and 5<sup>th</sup> minute did not differ amongst the groups (Table 4).

Apgar Score ≥7	Thiopentone (n=26)	Ketamine (n=24)
1 <sup>st</sup> minute	16	13
5 <sup>th</sup> minute	26	24

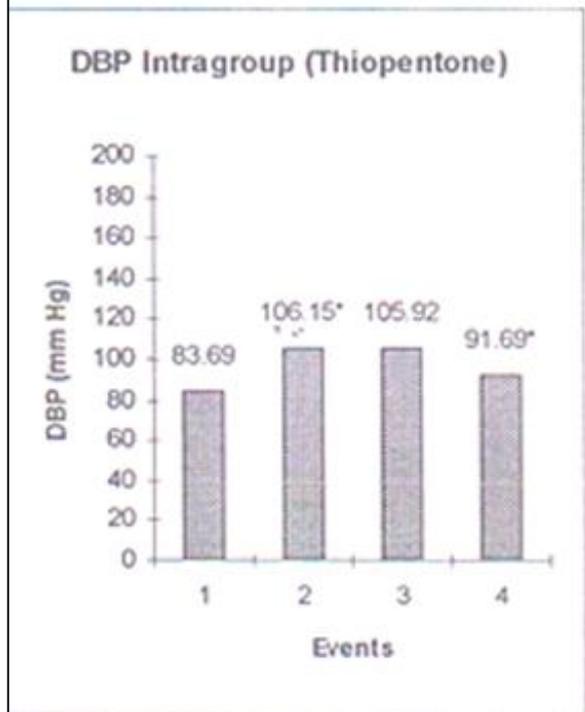
**Table 4. Neonatal Apgar Scoring**



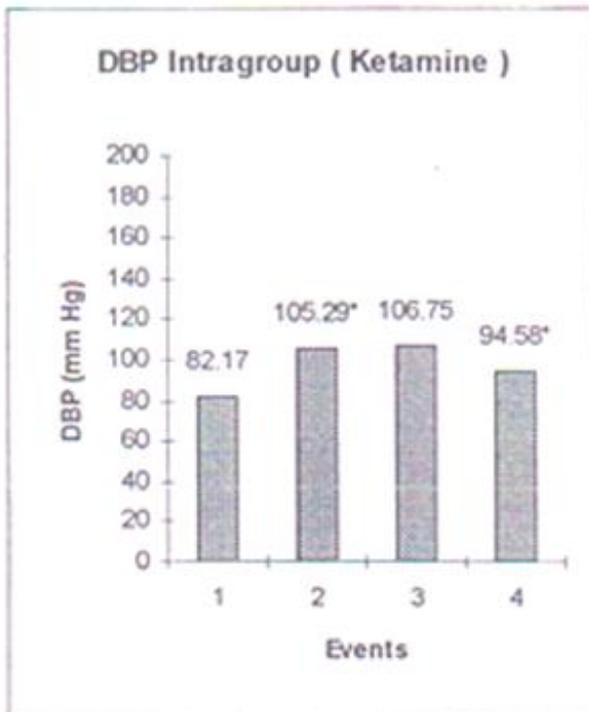
**Figure I**



**Figure II**



**Figure III**



**Figure IV**

\* p < 0.05, compared with parameters during hospitalization within the group

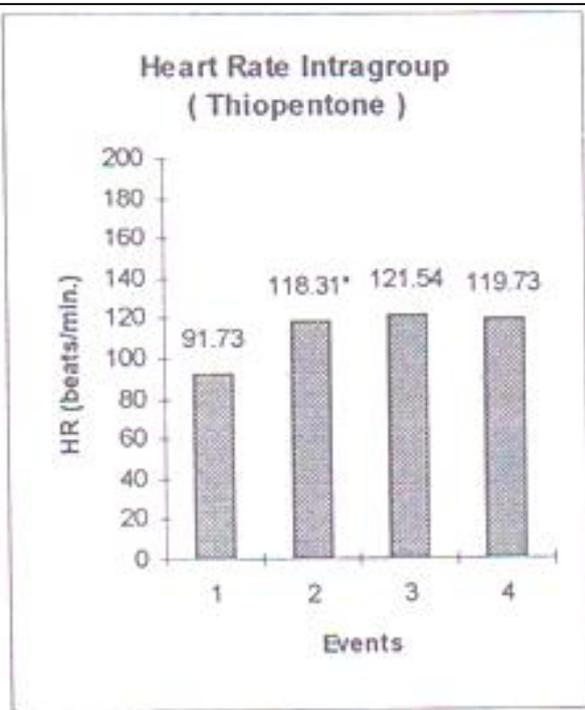


Figure V

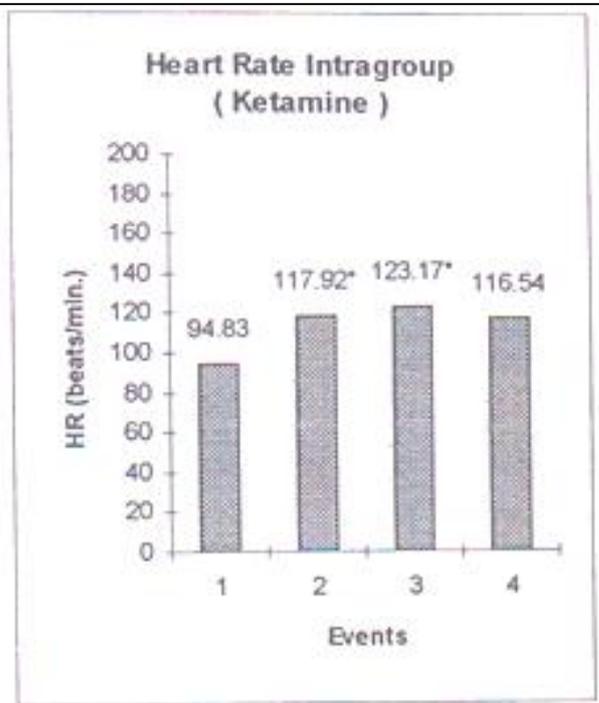


Figure VI

\*  $p < 0.05$ , compared with parameters during hospitalization within the group

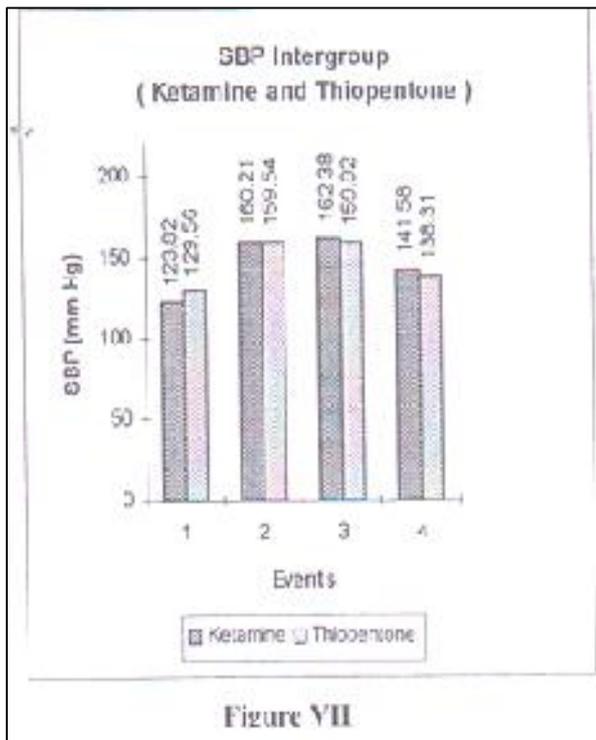


Figure VII

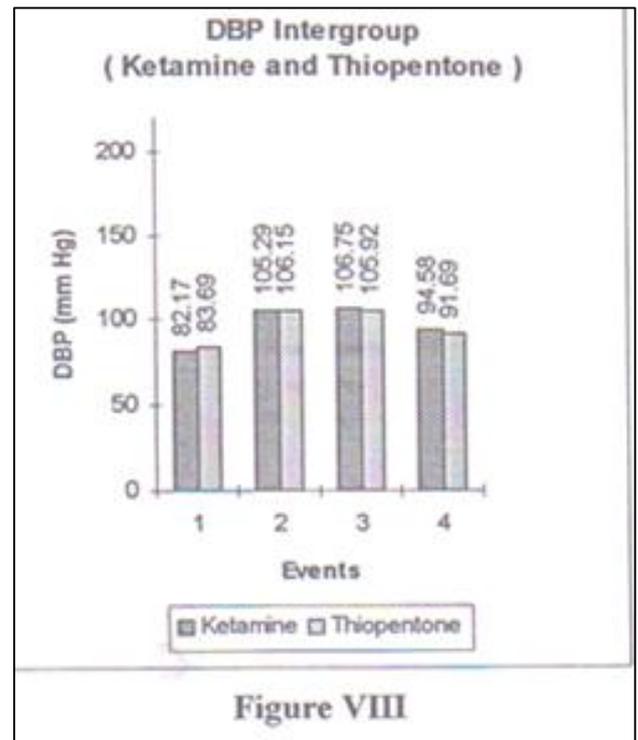
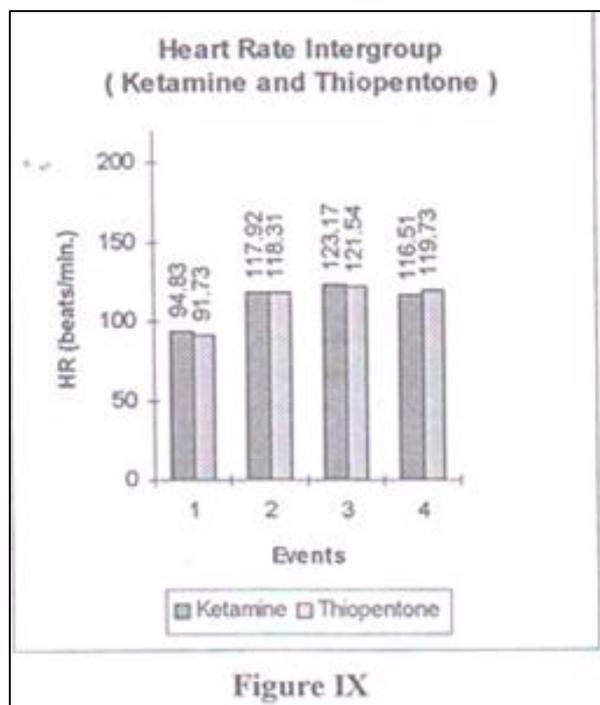


Figure VIII



## DISCUSSION

Most studies of intraoperative awareness have depended on patient's recall. The provision of anaesthesia for caesarean section by the use of unsupplemented 50 percent nitrous oxide until delivery of foetus was common in 1960s and this was associated with an unpleasant awareness ranging from 12-26 percent<sup>5</sup> and likelihood of 2 percent of awake patients.<sup>6</sup> Awareness and recall are only partly related because awareness may occur without remembrance.<sup>7</sup> Studies also reveal that patient can recall an experience, but may not be able to verbalise it.<sup>8</sup> In our study, 4 out of 26 patients (15%) in thiopentone group and 2 out of 24 patients (8%) in ketamine group followed commands. Schultetus<sup>9</sup> et al in their study using same method of detecting awareness found that the incidence of patients who followed the commands was 5 percent in ketamine group, which is almost similar to the incidence, which we have found in our study, but the incidence in thiopentone group was 53 percent in their study compared to 15 percent in this study. As patients were given fixed dose of thiopentone, difference in effect may be due to difference in the body mass index of the two patient populations. Cardiovascular responses to both the induction techniques during endotracheal intubation and skin incision were comparable (Table 2 and Figure 7, 8, 9). Twenty percent of the patients who received ketamine responded to the strong stimuli of intubation and skin incision by reaching the unparalysed hand towards the stimuli as compared to 65 percent of the patients who received thiopentone. These results are comparable with those of Schultetus<sup>9</sup> et al who had none of the patients in ketamine group responding to strong stimuli as compared to 70 percent patients in the thiopentone group. Greater occurrence of reaching movements in thiopentone groups suggests greater awareness in these patients. Ketamine may have blocked this response by producing a deeper and longer lasting unconsciousness or by producing enough

analgesia that patients though partially conscious did not respond.<sup>9</sup> Alternatively, ketamine could have produced a state where in the patients though awake and stimulated were unable to respond.<sup>9</sup>

None of our patients in both the groups recalled any events that had taken place during intraoperative period. This is not significantly different from the results of study done by Schultetus<sup>9</sup> where only one out of thirteen patients who received thiopentone exhibited recall. Downing et al<sup>10</sup> found that three out of fifty patients (6 percent) who received ketamine (2 mg/kg<sup>-1</sup>) as the induction agent for caesarean section exhibited recall. These results cannot be comparable to results of our study because the convincing evidence of factual recall was not obtained by those authors. Eight percent of the patients who received ketamine and 15 percent of the patients who received thiopentone were able to respond to the verbal commands intraoperatively in our study, but none of them recalled those events postoperatively. This shows awareness and recall maybe only partly related as awareness can occur without remembrance.<sup>7</sup>

Apgar score was more than 7 in all neonates in both the groups at the end of 5th minute. These findings are comparable to those of Schultetus.<sup>9</sup>

## CONCLUSION

Thiopentone and ketamine in a dosage 4 mg/kg<sup>-1</sup> and 1.5 mg/kg<sup>-1</sup> respectively effectively prevent recall of intraoperative events during postoperative period following caesarean section. Incidence of emergence phenomena in pregnant mothers is negligible (4 percent) with ketamine in 1.5 mg/kg<sup>-1</sup> dosage. There is no difference in cardiovascular responses to endotracheal intubation and skin incision between thiopentone 4 mg/kg<sup>-1</sup> and ketamine 1.5 mg/kg<sup>-1</sup>. Foetal outcome was comparable.

With these results, we conclude that ketamine can be used as substitute for thiopentone. Having profound analgesic effect, property to maintain foetoplacental exchange<sup>11</sup> better than any other induction agents, ketamine can be used routinely as an induction agent for mothers undergoing caesarean section under general anaesthesia.

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