AWARENESS DURING ENDOTRACHEAL INTUBATION
A comparison of ketamine and thiopentone

I. A. R. DUNNETT

SUMMARY
As a result of a report suggesting an unacceptably high incidence (2%) of awareness during endotracheal intubation, two groups of patients were anaesthetized in a standard manner using a rapid induction technique. In one group of 38 patients anaesthesia was induced with thiopentone 3 mg/kg and in the other group of 39 patients anaesthesia was induced with ketamine 2 mg/kg. Suxamethonium 1 mg/kg was given immediately following the induction agent, to facilitate endotracheal intubation. The patients were interviewed after operation. A rapid induction technique did not result in unacceptable awareness with either induction agent.

Perhaps an examination of the relationships of anaesthetics to levels of consciousness is long overdue

(ECKENHOFF, 1961)

Awareness during apparent anaesthesia has long been recognized as a problem. Awareness during endotracheal intubation is less well documented. Reports have suggested that it is more common than is realized, and is unpleasant and frightening for the patient. In a retrospective study without standardization of the anaesthetic management the incidence was estimated at 2% in premedicated patients (McKenna and Wilton, 1973).

A study was made of the problem using a rapid induction technique with pre-determined doses of drugs given rapidly and suxamethonium given immediately after the induction agent. It was felt that this technique, in unpremedicated patients, might be the clinical situation most likely to reveal a significant incidence of awareness of endotracheal intubation. Two induction agents were compared.

METHOD
Adult patients with good general health were admitted to the study, but patients with psychiatric problems or those taking anti-psychotic drugs were not admitted lest they proved to be unreliable witnesses.

The patients were not premedicated apart from some who had received atropine only. Patients were allocated at random to induction of anaesthesia with either a barbiturate or ketamine. Tubocurarine 3 mg was given i.v. before the induction agent (Stept and Safar, 1970) and was followed by pre-oxygenation for at least 3 min (Nolan, 1967).

Thiopentone 3 mg/kg or ketamine 2 mg/kg was given by rapid i.v. injection, followed immediately by suxamethonium 1 mg/kg.

Tracheal intubation was performed as soon as it was possible technically and the time between starting the injection of the induction agent and completing intubation was recorded and is referred to as "induction time". A standard anaesthetic technique was then instituted using nitrous oxide in oxygen and halothane; IPPV was used and pancuronium given to produce muscle relaxation. The tracheal tube was removed with the patient deeply anaesthetized in order to avoid any possible awareness and thus confusion with intubation. The patients were visited between 24 and 48 h after operation by an independent non-medical observer. The same interviewer was used throughout the series and was not aware which induction agent had been used in a given patient. Patients were asked a series of seven questions relating to their experiences before and after operation. The significant question "Do you remember a tube or instrument being put into your throat?" was placed in the middle of the series.

RESULTS
All patients remembered arriving in the operating suite. About half the patients in both groups remembered falling asleep. Intubation was equally easy in both groups, with no significant difference in the time required to intubate. The induction times are shown in table I.

One patient in the thiopentone group remembered an unpleasant sensation of a tube being put into his throat and associated this with gagging. From a
shown consistently in man that the brain takes up plasma concentration is still decreasing. It has been early phase of redistribution of the drug while the equilibration with brain tissue occurs during the. suggest that this is not so. during induction might have occurred. The results an unacceptable increase in unpleasant awareness may be considered preferable to those of thiopentone, risk patients in whom its haemodynamic effects use of ketamine in emergencies, particularly in poor suxamethonium fasciculations. With the increasing 4 mg/kg, found only a 1% incidence of awareness of suxamethonium fasciculations following therefor reduce the likelihood of aspiration of gastric contents.

Davies (1963) investigated a comparable problem, awareness of suxamethonium fasciculations following the use of a thiopentone and suxamethonium mixture in an attempt to reduce the time during which the patient is at risk from aspiration, and was unable to recommend the technique. More recently however, Khawaja (1971), using larger doses of thiopentone 4 mg/kg, found only a 1% incidence of awareness of suxamethonium fasciculations. With the increasing use of ketamine in emergencies, particularly in poor risk patients in whom its haemodynamic effects may be considered preferable to those of thiopentone, an unacceptable increase in unpleasant awareness during induction might have occurred. The results suggest that this is not so.

In the case of short-acting barbiturates, rapid equilibration with brain tissue occurs during the early phase of redistribution of the drug while the plasma concentration is still decreasing. It has been shown consistently in man that the brain takes up thiopentone rapidly to attain a peak content less than 1 min after the end of the injection (Price et al., 1959). With ketamine also, peak brain concentrations have been shown to be achieved within 1 min of i.v. injection. Brain tissue concentrations then decline to parallel the decrease in the plasma concentration with c.n.s. tissue appearing to retain ketamine preferentially (Cohen et al., 1973). The brain has not been shown to concentrate barbiturates preferentially.

The possibility of retrograde amnesia is unlikely and it has been shown that it does not occur with clinical or even large doses of i.v. barbiturates (Dundee and Pandit, 1972). It has been suggested that some patients may have an unconscious “memory” of discomfort or may suppress from consciousness unpleasant memories (Cobb, 1961). Thus a negative answer to questions regarding awareness may not reveal the full extent of any trauma to the psyche. Such possibilities are beyond the scope of this communication.

It would seem that awareness during endotracheal intubation is more likely to occur when there is delay between injection of the induction agent and injection of the muscle relaxant, or in the event of a difficult or prolonged intubation. On the basis of this study it does not seem necessary to wait until the patient appears to be asleep before giving suxamethonium when using a dose of thiopentone 3 mg/kg or ketamine 2 mg/kg.

ACKNOWLEDGEMENTS
I am grateful for the help and advice given by Peter J. Cohen, Professor and Chairman, Department of Anesthesiology, University of Colorado Medical Center, Denver, and Charles J. Kopriva, Chief of Anesthesiology, Veterans Administration Hospital, Denver, and for the co-operation of the Anesthesiology residents.

REFERENCES

<table>
<thead>
<tr>
<th>TABLE I. Induction times (mean ± SD) and awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction agent</td>
</tr>
<tr>
<td>Ketamine</td>
</tr>
<tr>
<td>Thiopentone</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
AWARENESS DURING ENDOTRACHEAL INTUBATION


PRISE DE CONSCIENCE PENDANT UNE INTUBATION ENDOTRACHEALE

*Comparaison de la kétamine et du thiopentone*

**RESUME**

A la suite d'un rapport prétendant qu'il existait une incidence importante et inacceptable (2%) de prise de conscience pendant l'intubation endotrachéale, on a anesthésié deux groupes de malades d'une manière standard à l'aide d'une technique d'induction rapide. Sur un groupe de 38 malades, l'anesthésie a été provoquée à l'aide de thiopentone (3 mg/kg) et sur un autre groupe de 39 malades l'anesthésie a été provoquée à l'aide de kétamine (2 mg/kg). On a administré immédiatement après l'agent d'induction 1 mg/kg de suxaméthonium pour faciliter l'intubation endotrachéale. Les malades ont été interrogés après l'opération et on en a déduit qu'une technique d'induction rapide ne provoque pas de prise de conscience inacceptable avec l'un ou l'autre de ces agents d'induction.

BEWUSSTSEIN WAHREND ENDOTRACHEALER INTUBATION

*Ein Vergleich von Ketamin und Thiopenton*

**ZUSAMMENFASSUNG**


CONSCIENCIA DURANTE INTUBACION ENDOTRAQUEAL

*Una comparación de ketamina y tiopental*

**SUMARIO**

Como resultado de un informe sugiriendo una frecuencia inaceptablemente elevada (2%) de consciencia durante la intubación endotraqueal, dos grupos de pacientes fueron anestesiados según manera normal usando una técnica de inducción rápida. En un grupo de 38 pacientes se indujo la anestesia con tiopental 3 mg/kg y en el otro grupo, de 39 pacientes, la anestesia fue inducida con ketamina 2 mg/kg. Succinilcolina fue administrada (1 mg/kg) inmediatamente tras el agente de inducción, para facilitar la intubación endotraqueal. Los pacientes fueron entrevistados tras la intervención quirúrgica. Una técnica de inducción rápida no resultó en un nivel inaceptable de consciencia empleando cualquiera de los agentes de inducción.