AWARENESS DURING TOTAL I.V. ANAESTHESIA

R. SANDIN AND O. NORDSTRÖM

SUMMARY
Five cases of awareness have been identified during total i.v. anaesthesia with mechanically controlled ventilation and neuromuscular block. Two of the cases resulted from inability to deliver the target dose of anaesthetics, while the patient's need for anaesthetics was greater than anticipated in three. It is concluded that all cases were caused primarily by lack of experience, and could have been prevented. These five cases occurred in experience from approximately 2500 patients anaesthetized with this technique. Pre-, per- and postoperative data on the most recent 1727 patients have been entered into a database and may serve to provide data on the group of patients in whom the five cases of awareness occurred. (Br. J. Anaesth. 1993; 71: 782-787)

KEY WORDS

Awareness and subconscious learning during anaesthesia have been addressed in several recent papers. Previous studies of awareness have indicated an incidence of 1-4% in most types of surgery, but considerably greater incidences have been described in cardiac, trauma and obstetric surgery [1]. In a recent study on the incidence of awareness associated with currently used anaesthesia techniques, Liu and colleagues found two cases in 1000 patients [2]. As it is generally agreed that awareness occurs mainly with anaesthetic techniques using neuromuscular block [1], it may be appropriate to interpret these results as two cases of awareness in 684 patients who had been given neuromuscular blockers [2]. In that study the type of anaesthesia was not reported.

The incidence of awareness during total i.v. anaesthesia (TIVA) has not been investigated, but there are surprisingly few case reports of this complication associated with TIVA [3–5]. TIVA based on alfentanil (fentanyl in a few cases) and propofol was introduced at our hospital in 1989. Since then, there have been approximately 2500 cases of TIVA (without nitrous oxide) using mechanically controlled ventilation and neuromuscular block. Initially all patients were asked if they had “slept well” immediately after anaesthesia. However, the most recent 1727 patients have also been questioned on a second occasion about recall of intraoperative events. Five cases of awareness during TIVA have been identified.

PATIENTS AND METHODS

Patient No. 1
A 50-yr-old woman with epileptic seizures, breast cancer with cutaneous and intrapleural metastases and broncho-pleural fistulae was jaundiced because of obstruction and it was planned to insert a catheter percutaneously in order to drain bile. Her daily medication included more than 180 mg of morphine, diazepam, carbamazepine and dixyrazine. Her weight was 60 kg. She requested general anaesthesia for the procedure and it was decided to avoid nitrous oxide as she was considered to be at risk for pneumothorax. She refused any i.m. premedication and it was decided to give diazepam 20 mg rectally as premedication. Anaesthesia was induced 30 min later with fentanyl 0.2 mg and propofol 100 mg. Tracheal intubation was facilitated with vecuronium 5 mg. A continuous infusion of propofol at a scheduled rate of 600 mg h⁻¹ (60 ml h⁻¹) was started. However, in the poor lighting in the x-ray department it was not noticed that, although the digits on the display of the Terumo infusion pump are illuminated, this is not the case for the decimal point indicating tenths of millilitres. Thus instead of 60 ml h⁻¹, the patient received 6.0 ml h⁻¹. Heart rate (HR) increased from 80 to 115 beat min⁻¹ and the erroneous infusion rate was discovered; a simultaneous increase in systolic arterial pressure (SAP) was less pronounced. Immediately after tracheal extubation, the patient declared that she had been awake for a short period, but had not felt any pain. The mistake was explained to the patient approximately 1 h after tracheal extubation and she stated that she was satisfied and felt confident in the event of future anaesthetics. On the following day, the patient’s attitude to the events had not changed.

Patient No. 2
A 35-yr-old woman was anaesthetized for laparoscopic tubal ligation. Her weight was 63 kg, height 1.76 m and haemoglobin 14.2 g dl⁻¹. Premedication was given 80 min before induction of anaesthesia and comprised ketobemidone 5 mg (Ketogran, Lundbeck A/S, Copenhagen, Denmark) not available in the U.K.; ketobemidone 5 mg is equipotent to morphine 5-8 mg [6]) and dixyrazine 10 mg (Essuco, UCB, Bruxelles, Belgium) given i.m. An i.v. dose of glycopyronium 0.2 mg was followed

R. SANDIN, M.D.; O. NORDSTRÖM, M.D.; Department of Anaesthesia, Länsjukhuset, S-391 85 Kalmar, Sweden. Accepted for Publication: June 1, 1993.
AWARENESS AND TIVA

<table>
<thead>
<tr>
<th>TABLE 1. Routine method for TIVA</th>
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<tr>
<td><strong>Without concomitant regional block</strong></td>
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<tr>
<td>Premedication</td>
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<tr>
<td>Anticholinergic</td>
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<tr>
<td>Induction</td>
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<tr>
<td>Alfentanil 1 mg min(^{-1}) until the patient responds slowly or not to commands (usually 25–90 μg kg(^{-1}))</td>
</tr>
<tr>
<td>Propofol 1 (1.5) mg kg(^{-1})</td>
</tr>
<tr>
<td>Additional vecuronium to 0.07–0.1 mg kg(^{-1})</td>
</tr>
<tr>
<td>An infusion consisting of alfentanil 5 mg (10 ml) mixed in propofol 500 mg (50 ml); total volume 60 ml is started at a rate of: 1.0 mg kg(^{-1}) h(^{-1}) for 10 min; 0.8 mg kg(^{-1}) h(^{-1}) for 10 min; 0.6 mg kg(^{-1}) h(^{-1}) for 10 min, thereafter adjusted to clinical signs and anticipated demand. Smallest doses: &lt; 60 yr 0.5 mg kg(^{-1}) h(^{-1}); ≥ 60 yr 0.4 ml kg(^{-1}) h(^{-1}).</td>
</tr>
<tr>
<td>In case of increases in SAP or HR indicative of light anaesthesia at any time in the above scheme, 5 ml of the mixture and 0.5 mg of alfentanil are injected and infusion rate is increased by 20 %.</td>
</tr>
<tr>
<td>With concomitant regional block</td>
</tr>
<tr>
<td>Only 2.5 mg of alfentanil is added to propofol 500 mg. Infusion rates as above.</td>
</tr>
<tr>
<td>Smallest infusion rates: &lt; 60 yr 0.4 ml kg(^{-1}) h(^{-1}); ≥ 60 yr 0.3 ml kg(^{-1}) h(^{-1}).</td>
</tr>
</tbody>
</table>

The duration of awareness could not be determined. However, it clearly took place during surgery. The situation was discussed with the patient 2 h after surgery and also the following day. She was encouraged to request another consultation if late symptoms ensued, but no further contact was made.

**Patient No. 3**

A 37-yr-old female suffering from vesico–ureteral reflux underwent reimplantation of the right ureter. No renal impairment or other medical illness was evident. Cosmetic breast surgery had been performed 2 months earlier. Her weight was 60 kg and her height 1.73 m. Premedication consisted of dixyrazine 10 mg i.p. given 290 min before induction and an i.m. injection of ketobemidone 3.75 mg 100 min before induction. An i.v. dose of glycopyrronium 0.2 mg was followed by alfentanil 2.5 mg and propofol 100 mg. Infusion of a mixture of propofol and alfentanil (100 mg:1 mg) was started at a rate corresponding to propofol 8 mg kg\(^{-1}\) h\(^{-1}\) and alfentanil 80 μg kg\(^{-1}\) h\(^{-1}\) (table I). Intubation of the trachea was facilitated with vecuronium 6 mg. The venous cannula was accidently pulled out when the patient was placed in the left lateral position and was not easy to re-insert. This took approximately 5 min. Immediately before a rapid infusion of anaesthetics was given, the surgeon’s assistant entered the theatre and made an appreciative remark about the results of the previous plastic surgery. After tracheal extubation, the patient immediately announced that she had heard the assistant’s comment. No other input was recalled, but she had understood her situation perfectly well. She had found the situation amusing and not at all unpleasant. This opinion persisted on the following day. No alterations in HR and SAP were found in the anaesthesia record which corresponded to the period when awareness occurred.

**Patient No. 4**

A 29-yr-old woman underwent laparoscopy because of infertility. She had suffered from decreased arterial pressure and occasional orthostatic reactions. No other disease was indicated in the medical history. Her weight was 50 kg, her height 1.67 m, and her haemoglobin concentration 13.3 g dl\(^{-1}\). Premedication was given 65 min before induction and consisted of i.m. injections of ketobemidone 5 mg and dixyrazine 10 mg. An i.v. dose of glycopyrronium 0.2 mg was followed by alfentanil 2.5 mg and propofol 80 mg. Infusion of a mixture of propofol and alfentanil (100 mg:1 mg) was started at a rate corresponding to propofol 8 mg kg\(^{-1}\) h\(^{-1}\) and alfentanil 80 μg kg\(^{-1}\) h\(^{-1}\) (table I). Intubation of the trachea was facilitated with vecuronium 4 mg. The surgeon was called for an emergency case, and the operation was not started until 55 min after induction. In the meantime, SAP and HR remained unchanged, and the infusion of propofol and alfentanil had been reduced gradually to 4 mg kg\(^{-1}\) h\(^{-1}\) and 40 μg kg\(^{-1}\) h\(^{-1}\), respectively. This infusion rate was continued for 15 min. Immediately before the start of surgery the infusion rate was increased by 20 %, and an additional dose of...
vecuronium 2 mg given. Catheterization of the bladder, introduction of the instrument for intrauterine injection of methylene blue and introduction of the needle for i.p. insufflation of carbon dioxide were not followed by any response in SAP or HR. After i.p. insufflation of carbon dioxide and a head-down tilt, SAP increased by 10 mm Hg, to that recorded before anaesthesia; and HR remained unchanged, at 55 beat min\(^{-1}\). Introduction of the trochar, however, was followed by a sudden increase in HR to 90 beat min\(^{-1}\), and an additional increase in SAP to 110 mm Hg. At this time, approximately 10 min after the start of the operation, the infusion rate of the anaesthetic mixture was increased to propofol 6.4 mg kg\(^{-1}\) h\(^{-1}\) and alfentanil 64 µg kg\(^{-1}\) h\(^{-1}\), and an additional dose of vecuronium 2 mg was given. The patient was then given terbutaline 0.25 mg i.v. for relaxation of the uterus and HR increased further to 130 beat min\(^{-1}\) and SAP to 120 mm Hg. Surgery was completed 10 min later. Neuromuscular block was antagonized with neostigmine 2.5 mg and glycopyrronium 0.5 mg. The patient regained consciousness 5 min after the anaesthetic mixture was discontinued and communicated, immediately after extubation of the trachea, that she had been awake. An initial interview was repeated 2 h later, and revealed that the patient remembered something pressing against her belly. She could also relate what the anaesthesia nurse had done in that situation. Thus it could be established that the patient had been conscious for a short period during the introduction of the trochar, corresponding to the increase in HR from 55 to 90 beat min\(^{-1}\). No memories were recalled after that. The patient expressed that she was satisfied with the explanation of what had happened. The situation was explained once again on the following day.

**Patient No. 5**

A 52-yr-old woman underwent anterior resection because of malignant tumour of the sigmoid colon. She was sensitive to aspirin. No other disease was indicated in the medical history. Her weight was 75 kg, her height 1.63 m, and her haemoglobin concentration 13.0 g dl\(^{-1}\). The patient had not been scheduled for surgery until the evening before, and therefore no preoperative visit had taken place and there was no order for premedication. In the anaesthesia room the patient was given fentanyl 1.25 mg. A decrease in SAP to 100 mm Hg was treated by i.v. injection of ephedrine 5 mg. Because of a delay in the theatre, scheduled general anaesthesia was not induced until 80 and 60 min after the i.v. doses of fentanyl and midazolam, respectively. Anaesthesia was induced with alfentanil 2.5 mg and propofol 40 mg, followed by infusion of a mixture of propofol and alfentanil (200 mg:1 mg) started at a rate corresponding to propofol 23 mg min\(^{-1}\) and alfentanil 110 µg min\(^{-1}\). When the patient no longer responded to verbal command and no eyelid reflexes were evident, vecuronium 7 mg was given (the total dose of propofol at this time is not known). Tracheal intubation was attempted after an additional dose of alfentanil 0.5 mg, but was difficult and several attempts were required. Approximately 10 min elapsed before the tracheal tube was in place. (There were some difficulties in the adjustment of the anaesthetic infusion because the technical assistant was not sufficiently familiar with the infusion pump. The significance of this is not known.) The recordings of HR and SAP during this period were few and the timing may not be correct. HR 120 beat min\(^{-1}\) was observed on the monitor by the anaesthetist who was called to aid with the intubation (HR 70 beat min\(^{-1}\) before induction). After tracheal intubation, the anaesthetic infusion was reduced to propofol 7.8 mg kg\(^{-1}\) h\(^{-1}\) and alfentanil 39 µg kg\(^{-1}\) h\(^{-1}\). Immediately after tracheal extubation the patient declared that she remembered a painful sensation in her throat, but nothing after that. From her description it could be established that she had experienced the tracheal intubation. This patient wanted to talk about what had happened on four occasions, the last time being 7 days after surgery. She had no nightmares, but wanted to “get it out of her system”. She was offered additional contact, but said that she felt relieved after the last consultation. It was confirmed 3 weeks later that this patient had recovered well mentally.

**Patient data**

Our routine at the time when TIVA was introduced was to ask all patients after extubation if they had “slept well” (approximately 800 TIVA in that period). It has become our practice since April 15, 1991, to enter into a database pre-, per- and postoperative data on all patients anaesthetized in our department. This report is based on all patients for whom details were entered in the database at March 1, 1993 (anaesthetized up to February 24, 1993).

The occurrence of awareness has been a major concern in the collection of data. Thus the most recent 1727 patients were also questioned on a second occasion, when they left the postoperative care unit (PCU), about their opinion of the anaesthesia and whether “any unpleasant experiences during anaesthesia” have been evident. Reliable answers were obtained from 83% of these patients. Data from the 1727 patients anaesthetized after the questioning about awareness had been extended are summarized in table II.

In this report “TIVA” refers only to those procedures involving muscle relaxation and mechanically controlled ventilation.

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**Table II. Data on 1727 patients anaesthetized with TIVA (number, median [range] or mean (SD) [range])**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Men:women</th>
<th>644:1083</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambulatory surgery (%)</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Age (yr)</td>
<td></td>
<td>41 [2-96]</td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td></td>
<td>68 [2-708]</td>
</tr>
<tr>
<td>End of surgery–extubation (min)</td>
<td></td>
<td>11.5 (8.4) [0-70]</td>
</tr>
<tr>
<td>Stay in PCU (h)</td>
<td></td>
<td>2.3 [0-9.9]</td>
</tr>
<tr>
<td>Use of naloxone (%)</td>
<td></td>
<td>0.9</td>
</tr>
<tr>
<td>Concomitant extradural block (%)</td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

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**Table Notes:**

- **Men:women:** The number of men and women anaesthetized with TIVA.
- **Ambulatory surgery (%)** indicates the percentage of patients who experienced awareness during surgery.
- **Age (yr):** The median age of patients.
- **Duration of surgery (min):** The median duration of surgery.
- **End of surgery–extubation (min):** The median time from end of surgery to extubation.
- **Stay in PCU (h):** The median time spent in the postoperative care unit.
- **Use of naloxone (%):** The percentage of patients who received naloxone.
- **Concomitant extradural block (%):** The percentage of patients who received an extradural block.

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**Data on 1727 patients anaesthetized after the introduction of TIVA (number, median [range] or mean (SD) [range]):**

- **Men:women:** The number of men and women anaesthetized after the introduction of TIVA.
- **Ambulatory surgery (%)** indicates the percentage of patients who experienced awareness during surgery.
- **Age (yr):** The median age of patients.
- **Duration of surgery (min):** The median duration of surgery.
- **End of surgery–extubation (min):** The median time from end of surgery to extubation.
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**BRITISH JOURNAL OF ANAESTHESIA**

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AWARENESS AND TIVA

In patient No. 1, arterial pressure was recorded manually by means of a calibrated mercury column. In patients Nos 2–5 automatic non-invasive arterial pressure (every 5 min) and heart rate were displayed by means of a Hewlett–Packard 1092A monitor and written manually into the anaesthesia record.

**DISCUSSION**

Factors thought to be of relevance to the occurrence of awareness in the five patients described are summarized in table III.

**Organization**

The organization of anaesthesia service may require some comment, as it seems probable that an experienced and vigilant anaesthetist would have been able to prevent all five cases of awareness (table III).

In Sweden and the Scandinavian countries, anaesthesia is administered frequently by anaesthesia nurses [7]; in our department they are allowed to induce (including tracheal intubation), maintain and terminate general anaesthesia in ASA I–II patients. Each senior anaesthetist is responsible for supervision of approximately four simultaneous cases (The Swedish Anaesthetists Association recommends a maximum of two simultaneous anaesthetics). The anaesthetist must always be immediately available for consultation, help and performance of certain procedures.

**Awareness in relation to the introduction of a new anaesthesia technique**

As TIVA is based on administration of anaesthetics via an infusion pump instead of a vaporizer, this requires special considerations. Understanding of pharmacokinetics is essential, as the effects of propofol and alfentanil are terminated rapidly by redistribution and elimination, and interindividual variability is great. Despite the fact that methods for detection of awareness have not been described, it seems that awareness can be avoided when TIVA is administered by highly qualified anaesthetists [8]. However, introduction of this technique into widespread clinical practice may be more complicated.

When TIVA was introduced in our hospital, an anaesthetist experienced in this technique attended or supervised all patients closely. This was no longer possible after approximately the first 500 cases, as the method was considered to be advantageous in some cases and the number of TIVA increased. This increased use of TIVA was associated with four cases of awareness (patients Nos 1–4) within 8 months (739 TIVA were performed in that period). It may be argued that all five cases of awareness could have been prevented if there had been better knowledge about technical equipment (patient No. 1, possibly patient No. 5), pharmacokinetics (patients Nos 2–5) and the importance of observing and responding to vital signs (patients Nos 2, 5). The number of TIVA conducted by the anaesthesia nurse before a case of awareness occurred (patient No. 1: n = 2; patient No. 2: n = 16; patient No. 3: n = 47; patient No. 4: n = 17; patient No. 5: n = 52) may support the assumption that lack of experience was a major factor in at least some instances. An alternative view is to regard these events as indicative of an insufficient number of anaesthetists in the organization, insufficient supervision by the responsible anaesthetist, or both. However, this does not constitute evidence that all cases could have been prevented simply by replacing the anaesthesia nurse with an anaesthetist—an anaesthetist who was rather unfamiliar with TIVA attended patient No. 1. During the past year, only one case (patient No. 5) of awareness has occurred (925 TIVA procedures with neuromuscular block) despite the fact that anaesthesia nurses have administered the majority of TIVA. In addition to the increasing experience that comes with conducting a greater number of cases, an important reason for the seemingly decreasing incidence of awareness in our department may be that every case of awareness has been publicized to all anaesthesia nurses and anaesthetists and appropriate routines introduced.

**Vital signs in TIVA**

It is interesting to note that awareness was associated with marked increases in HR and SAP in patients Nos 1, 2, 4 and 5. The increases in HR were generally more distinct than those for SAP when compared with preanaesthetic values. The reason that no changes in vital signs were observed in patient No. 3 may have been that noxious stimulation was minimal and this patient found the period of awareness amusing rather than unpleasant. It has been suggested that, if no pain is evident, mental distress during awareness is necessary to evoke a response in vital signs [9].

There are three previous case reports on awareness or wakefulness during propofol anaesthesia [3–5]. A continuous infusion of alfentanil was not used in any of these patients. An increase in HR from 82 beat min\(^{-1}\) before anaesthesia to 122 beat min\(^{-1}\) with hypertension was found in the patient described by Kelly and Raymond (no opioid) [3]. The patient described by Schäfer and Marsch (alfentanil 25\(\mu\)g kg\(^{-1}\) as bolus at induction) felt that he was suffocating and an increase in SAP was evident during insertion of the Kleinsasser laryngoscope. This was followed by SAP and HR slightly greater than the values before anaesthesia [5]. In a case of wakefulness without recall described by Ruprecht.

<table>
<thead>
<tr>
<th>Table III. Probable reasons for, and factors contributing to, awareness</th>
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<tr>
<td><strong>Patient No. 1</strong></td>
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<tr>
<td><strong>Patient No. 2</strong></td>
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<tr>
<td><strong>Patient No. 3</strong></td>
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<tr>
<td><strong>Patient No. 4</strong></td>
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<tr>
<td><strong>Patient No. 5</strong></td>
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</table>
(fentanyl 0.2 mg > 45 min before the wakefulness), “none of the monitored variables changed” (the type of monitoring is not described) [4]. Thus in five of the seven cases of awareness during propofol anaesthesia without nitrous oxide described to date, a marked increase in HR was observed. If the cases of awareness which occurred during noxious stimulation or which were associated with possible mental distress are considered, two of three patients (our patient No. 1 and one from each of references [3] and [5]) have responded with an increase in HR when an infusion of alfentanil was not used, whereas awareness during painful stimulation was associated with an increase in HR in all three patients given a continuous infusion of alfentanil (our patients Nos 2, 4, 5).

Despite the fact that it is generally agreed that vital signs may be fallible as indicators of impending awareness [1], this has not been investigated for TIVA. The value of HR as an indicator of impending awareness may differ for different drug combinations [10]. Propofol, alfentanil and vecuronium have minimal or no vagotonic action when administered singly [11, 12], but in combination, these drugs have a pronounced vagotonic action and a stable, moderately slow HR is common during most types of non-cardiac surgery.

It may have been expected that vital signs would be less obvious in the elderly because of an increased prevalence of cardiac disease and medication interfering with the sympathetic nervous system, thus making dose requirements more difficult to estimate. However, no case of awareness in a subject older than 52 yr has been identified, despite the fact 33% of patients were older than this, cardiovascular disease was evident in 36%, and an abnormal ECG was found in 26% of the patients in this subgroup.

Method for detection of awareness

Many patients are reluctant to discuss awareness spontaneously [1]. In order to detect awareness, patients should therefore be interviewed to elicit this complication. The interview should probably be performed within 2–3 days after surgery [1]. An example of correct questioning has been described by Brice, Hetherington and Utting [13]. Our routine at the time when TIVA was introduced was to ask all patients after extubation if they had “slept well”. Despite the fact that many patients seem clear-headed immediately after TIVA, this interview may not be sufficient. After approximately 800 TIVA had been performed, we changed our routine, and since then all patients are also questioned when they leave the PCU about their opinion of the anaesthesia and whether “any unpleasant experiences during anaesthesia” had been evident. The results of this questioning are documented in the medical record. According to Adam, even this time of questioning may be too soon after anaesthesia [14]. For inhalation agents, memory of verbal material may be better after 1 week than after 2 h [14]. This has not been investigated for propofol and alfentanil. However, we have found it difficult to question the patient after he has left the PCU. Thus we cannot guarantee that we have identified all cases of awareness, especially not before the additional questioning was introduced. However, despite the fact that all five cases of awareness were identified after the questioning had been extended, all these patients communicated their awareness immediately after extubation and no case of awareness during TIVA has remained undiscovered until the second questioning. The two previously described patients with recall of intraoperative events after propofol anaesthesia were also capable of communicating their experiences immediately after anaesthesia [3, 5]. This may indicate that, provided no dramatic and unreported improvement in recall took place several hours after propofol anaesthesia, the number of undiscovered cases of awareness among the first 800 patients (approximately) was small. Nevertheless, a prospective study is necessary in order to establish the incidence of awareness with TIVA. It should be noted also that, as discussed previously, these cases occurred during a period when the TIVA technique was introduced into routine practice and may therefore reflect a temporary lack of experience.

Dose regimen and mixture vs separate infusions of alfentanil and propofol

A mixture of alfentanil and propofol was used in patients Nos 2–5. Our initial dose regimen used in patients Nos 2–4 is given in table I. At the time when the fifth case of awareness occurred, a modified scheme had been introduced in order to avoid underdosing light, young patients, to avoid overdosing elderly patients, to obtain an idea of the individual dose requirements and to reduce the effect of propofol on SAP because of the hysteresis effect [15] (doses are calculated according to lean body mass: 1% reduction of doses for every year > 45 yr; induction with a bolus dose of propofol 0.5 mg kg⁻¹ followed by an initial rapid infusion). Fewer than 10% of TIVA procedures in our department have been performed with separate infusions. In addition to the initial study of a mixture of alfentanil and propofol published by Kay in 1986 [16], there are now two studies [17, 18] and one report of four patients [19] indicating that the pharmacodynamics of alfentanil and propofol are not altered if they are administered as a mixture instead of separate infusions. Despite the fact that, in some situations, it may be desirable to be able to alter the relative amounts of alfentanil and propofol [8], the cases presented provide no evidence that infusion of a mixture of alfentanil and propofol increased the risk of awareness compared with separate infusions. Furthermore, awareness and wakefulness have also occurred with large infusion rates of the hypnotic component, propofol [3–5].

CONCLUSION

All five cases of awareness during TIVA must be considered as having been avoidable with experience and vigilance. Despite the fact that the five patients do not provide any answers on incidence of awareness in TIVA, reliability of vital signs, optimal time for postanaesthesia interview, or the risk for persisting neurotic symptoms, they may provide useful
AWARENESS AND TIVA

hints for future studies of these factors. Because of the low incidence (for scientific purposes) of awareness, reliance is often placed on case reports. Therefore, all cases of awareness in TIVA should, in our opinion, be published in detail and a judgement should be made as to whether or not information in the anaesthesia record (timing of events and haemodynamic responses) is reliable.

REFERENCES
