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Recovery after single-breath halothane induction of anaesthesia in daycase patients

A comparison with thiopentone

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Summary

A single-breath technique of inhalational induction of anaesthesia allows intravenous induction agents to be avoided. We have investigated recovery from anaesthesia in 40 daycase patients, using tests of psychomotor function. Patients anaesthetised with inhalational induction awaken earlier than those who receive thiopentone, but not significantly earlier. There were no significant differences in postoperative psychomotor function between patients who received thiopentone and those who had inhalational inductions. Single-breath halothane, nitrous–oxide, oxygen induction is an alternative to intravenous induction in cooperative adults, but does not confer significant benefits in terms of recovery.

Key words

Anaesthetics, volatile; halothane.
Anaesthetics, intravenous; thiopentone.

Inhalational induction of anaesthesia in adults, which employs a single-breath technique[1] with halothane and oxygen, is faster than conventional techniques of inhalational induction, because it produces a more rapid rise in alveolar halothane concentration.[2] The addition of nitrous oxide to the mixture further reduces induction time, by decreasing the alveolar concentration of halothane required to induce anaesthesia,[3] and by means of the second gas effect.[4,5] This technique is a safe and practicable alternative to intravenous induction in cooperative adults.[6]

Thiopentone is almost completely metabolised by the liver; it has a long terminal half-life[7] and is associated with a prolonged hangover effect. The avoidance of thiopentone may increase the speed of recovery from anaesthesia, which would be of particular benefit to daycase patients.[8] We have used tests of psychomotor function to assess recovery from anaesthesia in unpremedicated daycase patients, and to compare single-breath halothane induction with thiopentone.

Methods

Forty patients who underwent check cystoscopy as day cases gave informed consent, and were admitted to the study, which was approved by the hospital ethics committee. All were aged between 18 65 years, and ASA grade 1 3. No patients were included who had taken any psychotropic medication within 72 hours, or had had a halothane anaesthetic within the previous 3 months, or in whom an anaesthetic longer than 20 minutes was anticipated. All patients were unpremedicated, and were allocated randomly to receive either single-breath halothane induction or thiopentone. Anaesthetics were conducted by two of us (J.G.L.S. and E.P.McK.), and psychomotor tests by one of us (J.J.N.), who was unaware of the anaesthetic technique employed.

Each patient undertook four tests on admission to the ward. The critical flicker frequency (CFF) is an index of the effect of centrally acting depressants.[9] Choice reaction time (CRT)[10] was recorded as the mean of 20 times, using a serial five-choice test. Digit span and letter deletion tests were also performed. Practice runs were performed with all tests to minimise learning effects. These tests were undertaken before and repeated 1, 2 and 4 hours after, operation.

Monitoring was started in the anaesthetic room with a continuously displayed electrocardiograph, and automatic oscillometric measurement of blood pressure (Dinamap) recorded every 60 seconds. A 23-gauge cannula was inserted into a vein. Anaesthesia was induced either by single-breath

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halothane or with thiopentone 4 mg/kg and maintained with nitrous oxide, oxygen and halothane in all cases. The time from when the vital capacity breath was taken or the start of the thiopentone injection to loss of the lash reflex was noted. The anaesthetic technique was standardised by decreasing the inspired halothane concentration from the level used for induction to the maintenance level of 1% in set increments at standard time intervals after induction. The halothane was turned off as the cystoscope was withdrawn and the nitrous oxide as the patient was taken out of the lithotomy position. Indices of early recovery were timed from the point at which nitrous oxide was discontinued.

Three simple tests of awakening were conducted in the recovery room. The times after anaesthesia were recorded when the patient opened his eyes to command, could give his own name correctly, and perform a simple task correctly, in this case 'show me your left thumb'. All patients took home a questionnaire which enquired about the acceptability of the method of induction, anaesthetic morbidity and the time at which they felt completely recovered from anaesthesia. The Mann–Whitney *U* test was applied to all data.

Results

Forty patients were studied; 20 received single-breath halothane induction and 20 thiopentone. The demographic data are similar in both groups (Table 1). The mean time of induction was 102 seconds with halothane and 63 seconds with thiopentone. Changes in pulse rate and blood pressure were similar, with a mean decrease in systolic blood pressure of 15 mmHg in either group. The mean duration of anaesthesia was 12.9 minutes in the halothane group and 12.3 minutes in the thiopentone group. The times to awakening and the performance of simple tasks are shown in Table 2. These times are shorter for patients in the halothane group, but the difference does not reach significance. Critical flicker fusion threshold is the mean of the critical flicker frequencies measured with increasing and decreasing rates of flicker. The data are shown in Table 3. There are no significant differences between groups. Choice reaction time (Table 4), letter deletion performance (Table 5) and digit span (Table 6) also show no significant differences between groups. Replies to the questionnaire (Table 7) show that the average time after anaesthesia when patients felt completely recovered was longer for those who had received inhalational induction than thiopentone, but this difference also failed to reach statistical significance. Sixteen out of 19 who returned questionnaires (84%) found inhalational induction acceptable.

Table 1. Demographic data. Age and weight expressed as mean (SD).

	Halothane	Thiopentone
Age, years	55.4 (14.7)	53.5 (13.7)
Weight, kg	70.9 (10.6)	70.5 (12.6)
Male:female ratio	15:5	15:5

Table 2. Recovery from anaesthesia. Values expressed as mean (SD).

	Halothane	Thiopentone
Time to open eyes, seconds	321 (147)	486 (270)
Time to give own name, seconds	360 (151)	525 (265)
Time to obey command, seconds	366 (149)	532 (269)

Table 3. Critical flicker fusion thresholds. Values expressed as mean (SD).

CFFT, Hz	Halothane	Thiopentone
Before operation	29.12 (2.85)	30.33 (2.50)
1 hour after operation	28.92 (2.97)	29.37 (3.32)
2 hours after operation	28.31 (2.82)	29.34 (3.59)
4 hours after operation	28.63 (2.87)	29.55 (2.49)

Table 4. Choice reaction times. Values expressed as mean (SD).

CRT, ms	Halothane	Thiopentone
Before operation	664 (133)	691 (81)
1 hour after operation	705 (142)	725 (134)
2 hours after operation	646 (106)	645 (70)
4 hours after operation	635 (995)	610 (72)

Table 5. Letter deletion performances. Values expressed as mean (SD).

Letter deletion score	Halothane	Thiopentone
Before operation	17.1 (4.99)	18.2 (4.01)
1 hour after operation	21.6 (6.39)	21.8 (3.24)
2 hours after operation	13.9 (5.13)	12.7 (4.35)
4 hours after operation	13.4 (5.49)	12.9 (4.23)

Table 6. Digit span. Values expressed as mean (SD).

Digit span	Halothane	Thiopentone
Before operation	6.05 (1.13)	6.66 (1.24)
1 hour after operation	6.27 (1.07)	6.29 (0.99)
2 hours after operation	5.78 (1.90)	6.72 (1.23)
4 hours after operation	6.32 (1.25)	6.50 (1.15)

Table 7. Data from questionnaire.

	Halothane	Thiopentone
Number of questionnaires returned	19	19
Number (%) of patients who considered induction technique acceptable	16 (84)	19 (100)
Mean time to feeling completely recovered, hours (SD)	7.7 (8.6)	3.6 (5.6)

Discussion

This study confirms that inhalational induction of anaesthesia using a single-breath technique is a safe and practical alternative to intravenous induction in cooperative adult patients. It is rapid, and most patients find it acceptable. Patients anaesthetised by this means are awake sooner after anaesthesia than those given thiopentone; they become wide awake and ready to return to the ward almost immediately after they have opened their eyes, and this was remarked upon by the staff of the recovery ward. However, the difference in recovery times is not statistically significant.

The prolonged hangover associated with thiopentone is particularly undesirable in daycase surgery, and much effort has been devoted to the development of induction agents with shorter elimination half-lives. Inhalational

induction provides an alternative method to avoid barbiturate induction agents. Critical flicker fusion threshold is sensitive to the effects of barbiturates,[11] but the decreases in CFFT were very small in both groups and were not statistically significant. This contrasts markedly with a study of CFFT in daycase patients premedicated with benzodiazepines, in whom decreases in CFFT of between 4 and 5 Hz were observed.[12]

Choice-reaction time, digit span and letter-deletion tests also failed to show any significant difference in recovery between patients who received thiopentone and those who did not. Information from the questionnaire also showed no significant difference between groups, which suggests that thiopentone is not primarily responsible for delayed recovery in patients who have also received nitrous oxide and halothane.

We conclude that, while single-breath inhalational techniques offer an alternative to intravenous induction, no positive benefit to recovery can be shown. The routine use of halothane in patients who undergo repeat cystoscopies may be unwise, because of the possibility of hepatotoxicity[13] after repeated exposure. Isoflurane and enflurane are less suited to this technique, since they have pungent aromas, and are more irritant and less potent than halothane. This technique may therefore not be suitable for repeated use.

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