Absence of memory for intraoperative information during surgery under adequate general anaesthesia

I. F. RUSSELL AND M. WANG

Summary
Using the isolated forearm technique (IFT), we wished to determine if patients known to be unresponsive to commands during general anaesthesia with nitrous oxide, halothane and neuromuscular blocking agents had any evidence of explicit or implicit recall. Two groups of women, studied in a single-blind sequential block design, heard different tapes, either a command and information tape (n=34) or radio static (n=34), throughout surgery. Four women (two radio static, two command) had unequivocal evidence of explicit recall for a period near the beginning or end of the procedure, at a time when the IFT was not being used. With or without hypnosis, category generation, serial position of category exemplars and word association tests did not reveal evidence of priming. We conclude that during light general anaesthesia with nitrous oxide, halothane and atracurium, patients had neither explicit nor implicit memory for information presented during a period when they are known to be unresponsive to commands. (Br. J. Anaesth. 1997; 78: 3–9)

Key words
Anaesthesia, depth. Anaesthesia, general. Memory.

Over the past few years a belief has developed that postoperative tests of implicit memory (i.e. no explicit recall of a learning episode but test performance is altered) reveal that patients can process and recall auditory information presented to them during general anaesthesia. This subject has been discussed in depth at three international symposia entitled “Memory and Awareness under Anaesthesia”.1–3 Although results are mixed, virtually all of the evidence suggesting patients can process information during general anaesthesia has been obtained in patients undergoing surgery where neuromuscular blocking agents were used as an integral part of the anaesthetic technique.4 5

The use of the isolated forearm technique (IFT) has revealed that with some general anaesthetic techniques more than 70% of patients may be capable of responding to commands during surgery with no postoperative conscious (explicit) memory for these intraoperative events.6 8 Clinical monitoring of arterial pressure, heart rate, sweating and tear production was of little benefit in predicting the conscious state of patients during surgery and no clinically useful relationship could be found between changes in these clinical variables and a patient’s responses.9 Further evidence that clinical signs cannot be used to determine reliably the occurrence of intraoperative awareness comes from another study where anaesthetic records were examined in detail after surgery: three experienced anaesthetists were unable to identify the anaesthetic records of patients known to have been aware during surgery from the records of matched controls who had not been aware.10

A major flaw in the methodology of studies investigating implicit memory in relation to general anaesthesia lies in the assessment of “adequate” anaesthesia. These studies used no direct means of establishing the conscious level of patients during anaesthesia, relying instead on clinical monitoring, an indirect, unreliable and imprecise method of assessing conscious levels in the presence of neuromuscular blocking agents.11 Thus it is possible that in these previous studies clinical monitoring suggested adequate anaesthesia but all patients may not have been unconscious. If patients are awake during surgery, even with no explicit recall, then it is perhaps not surprising that sophisticated psychological tests reveal evidence of implicit memory.

While using the IFT we wished to investigate the occurrence of postoperative implicit recall when information was presented to patients during surgery at a time when they were non-responsive to commands.

Patients and methods
Approval for the study was obtained form the Hull and East Yorkshire Ethics and Clinical Trials Committee. Informed consent was obtained from women (ASA I or II) with no hearing difficulty presenting for major gynaecological surgery. The possible use of hypnosis on day 3 was mentioned, but patients were advised that the use of hypnosis was...
optional and that separate consent would be obtained at that time.

After premedication with temazepam 20 mg orally, 1–2 h before operation, and after baseline readings had been obtained from the monitoring system, anaesthesia was induced with thiopentone 5 mg kg\(^{-1}\). As soon as consciousness was lost (absence of response to command) 66% nitrous oxide in oxygen with halothane (0.5% set on the vaporizer) was commenced by mask ventilation. After tracheal intubation, facilitated by suxamethonium 1.5 mg kg\(^{-1}\), mechanical ventilation of the lungs was continued with this same gas mixture via an Oxford Penlon mark II ventilator in its non-rebreathing configuration. End-tidal carbon dioxide concentration was maintained at 4–5%. When the action of suxamethonium began to wear off, atracurium 0.2–0.4 mg kg\(^{-1}\) was used for more prolonged neuromuscular block.

The study included extensive automatic monitoring (with recording to computer hard disk) of haemodynamic, EEG and other psychophysiological variables, details of which are available from the authors. These data are not reported here as intraoperative cognitive status was determined directly using the IFT, as described in table 1. “Rescue” anaesthesia was built into the study design such that if the isolated forearm revealed persistent reflex movements or semi-purposive movements or a response to commands, the patient would receive thiopentone 1.5 mg kg\(^{-1}\).

The IFT commands were incorporated into a pre-recorded stimulus tape and the patients formed two groups, studied in a single-blind, sequential block design. Within 2 min of skin incision one of two continuous loop cassette tapes was played to the patient through open headphones. One group heard radio static throughout surgery (group RSG), while in the other group (group CG) a 1-min continuous loop cassette tape containing two commands was played. This latter tape contained two discrete 15-s messages (separated by 15 s). Each message was preceded by the patient’s preferred name (twice) and the words “this is Dr Russell speaking”; the first message was “if you can hear me I would like you to

**Table 1** Summary of the isolated forearm technique

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A padded arterial pressure cuff is placed around the right forearm.</td>
</tr>
<tr>
<td>2.</td>
<td>ECG electrodes, connected to a Relaxograph, are placed over the ulnar nerve just above the elbow joint and over the median nerve in the cubital fossa. Recording electrodes placed over the wrist and hypothenar eminence.</td>
</tr>
<tr>
<td>3.</td>
<td>Anaesthesia is induced and a supramaximal stimulus obtained.</td>
</tr>
<tr>
<td>4.</td>
<td>An appropriate dose of suxamethonium is administered for tracheal intubation and the patient is connected to the ventilator.</td>
</tr>
<tr>
<td>5.</td>
<td>The response from the Relaxograph is checked.</td>
</tr>
<tr>
<td>6.</td>
<td>As suxamethonium wears off the tourniquet is inflated and an appropriate dose of atracurium is administered.</td>
</tr>
<tr>
<td>7.</td>
<td>Start the tape recorder.</td>
</tr>
<tr>
<td>8.</td>
<td>Assess neuromuscular integrity at regular intervals.</td>
</tr>
<tr>
<td>9.</td>
<td>Deflate the tourniquet at 20 min.</td>
</tr>
<tr>
<td>10.</td>
<td>If further neuromuscular block is required re-inflate the tourniquet and administer a small dose of atracurium.</td>
</tr>
<tr>
<td>11.</td>
<td>Repeat steps 8, 9, 10 as necessary.</td>
</tr>
</tbody>
</table>

open and close the fingers of your right hand, open and close the fingers of your right hand”; the second message was “here are some special words I would like you to remember—“sour gooseberry, sharp lemon, green pear”.

The tape was switched off before halothane was discontinued during skin closure. Residual neuromuscular block was antagonized, if required, with 0.5–1 ml of a glycopyrronium and neostigmine mixture (ratio 0.5 mg/2.5 mg in 1 ml). After extubation, papaveretum 0.5 ml i.m. and 0.5 ml i.v. was administered and the patient taken to the recovery room.

One to two hours later patients had a structured interview to elicit any conscious memories of the surgical period, of the tape played to them or evidence of dreaming. Cue questions which did not presuppose a particular answer were used to elicit evidence of factual recall (table 2). Patients were then asked to name five vegetables and after their answers were asked to name five fruits. A word association test was then performed with the following words, “father”, “hill”, “sour”, “sharp”, “green”. Thus the study included three different types of probe for the same intraoperatively primed words: free (explicit) recall, word category and word association (implicit recall).

On the third day, patients were seen again and asked if they would consent to a second interview under hypnosis. If consent was not obtained for hypnosis then the original interview was repeated. If consent for hypnosis was obtained, patients walked to a side room and sat in a padded armchair with their forearms and hands resting on the arm rests. After a standard hypnotic induction the trance was deepened using a visualization technique and arm levitation. When hypnosis was thought to be adequate (i.e. arm levitation occurred) the patient was regressed to the preoperative period to the time when she was lying in bed awaiting transfer to the operating theatre. She was then asked to describe her feelings and the various events she experienced from that time to the present.

Because of the vivid “real life” experiences possible under hypnosis (Bennett, personal communication) it was felt essential to ensure that contact was maintained with the patient at all times to reduce the chance of some untoward occurrence. Thus just
before the patient’s experience of anaesthesia was investigated under hypnosis the following reassurance was given: “very soon you will be going off to sleep with your anaesthetic and I would like you to tell me what it feels like as you go off to sleep and what you are aware of as you go off to sleep. This time you will be able to speak to me and to hear me and you will be able to breathe normally; things you may not have been able to do during your anaesthetic”. The original recovery interview was then repeated under hypnosis. Before wakening from hypnosis the women were advised that they would remember only as much of the hypnotic interview as they wished. General reassurance about recovery from surgery, mobility and ego strengthening were the final aspects of the hypnotic session.

If arm levitation was not obtained the interview continued (as described above), but the results were analysed as belonging to the appropriate non-hypnosis group.

Results were analysed using t tests, chi-square tests and signal detection tests, as appropriate.

Results

We included 68 woman who were studied sequentially in the following single-blind manner: 17 command tape, 17 radio static, 17 radio static, 17 command tape. Intraoperative awareness during general anaesthesia was investigated under hypnosis the following reassurance was given: “very soon you will be going off to sleep with your anaesthetic and I would like you to tell me what it feels like as you go off to sleep and what you are aware of as you go off to sleep. This time you will be able to speak to me and to hear me and you will be able to breathe normally; things you may not have been able to do during your anaesthetic”. The original recovery interview was then repeated under hypnosis. Before wakening from hypnosis the women were advised that they would remember only as much of the hypnotic interview as they wished. General reassurance about recovery from surgery, mobility and ego strengthening were the final aspects of the hypnotic session.

If arm levitation was not obtained the interview continued (as described above), but the results were analysed as belonging to the appropriate non-hypnosis group.

Results were analysed using t tests, chi-square tests and signal detection tests, as appropriate.

Table 3 Type of surgery, patient age, weight, time from induction to skin incision and duration of exposure to tape (mean (SD or range)). AH = Abdominal hysterectomy, VH = vaginal hysterectomy, other = other major gynaecological surgery. *Chi-squared test; †t test.

<table>
<thead>
<tr>
<th>Type of surgery</th>
<th>Group RSG</th>
<th>Group CG</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>AH (n)</td>
<td>23</td>
<td>21</td>
<td>ns*</td>
</tr>
<tr>
<td>VH (n)</td>
<td>5</td>
<td>11</td>
<td>ns*</td>
</tr>
<tr>
<td>Other (n)</td>
<td>6</td>
<td>2</td>
<td>ns*</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>43.7 (17–57)</td>
<td>42.9 (30–67)</td>
<td>ns†</td>
</tr>
<tr>
<td>Weight</td>
<td>65 (12.2)</td>
<td>64.7 (10.1)</td>
<td>ns†</td>
</tr>
<tr>
<td>Time to skin incision (min)</td>
<td>10.6 (2.6)</td>
<td>9.5 (3.1)</td>
<td>ns†</td>
</tr>
<tr>
<td>Tape Exposure (min)</td>
<td>44.3 (14.05)</td>
<td>44.4 (14.25)</td>
<td>ns†</td>
</tr>
</tbody>
</table>

Table 4 Number of patients with possible recall or dreams on day 3. aAware of voices and a buzzing noise suddenly blocking them out. bAware of someone opening her eyelid, using her name, voices and a buzzing noise blocking things out. cAware of talking; someone cutting her lower abdomen. dAware of people “doing things down there”. eAware of talking; also wanted to move fingers but could not. fClaimed to hear voice during anaesthesia: no reference to the radio static. gClaimed to hear voice during anaesthesia: no reference to the radio static. hClaimed to be aware of surgery, but described a laparoscopy. PO = After operation (See appendix for a more detailed description of events pertaining to the above patients).

<table>
<thead>
<tr>
<th>Group RSG (n=28)</th>
<th>Group CG (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypnosis</td>
<td>No hypnosis</td>
</tr>
<tr>
<td>(n=15)</td>
<td>(n=13)</td>
</tr>
<tr>
<td>Evidence of recall</td>
<td>1*</td>
</tr>
<tr>
<td>Other memory</td>
<td>3*</td>
</tr>
<tr>
<td>Bad dreams</td>
<td>3 (2-PO)</td>
</tr>
<tr>
<td>Good dreams</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5 Number of patients who included the “target” fruit in their list of five fruits in recovery. Patients responding with both “pear” and “lemon” are also included in individual counts of “pear” and “lemon”.

<table>
<thead>
<tr>
<th>Group RSG (n=30)</th>
<th>Group CG (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pear</td>
<td>16</td>
</tr>
<tr>
<td>Lemon</td>
<td>4</td>
</tr>
<tr>
<td>Pear and lemon</td>
<td>3</td>
</tr>
<tr>
<td>Gooseberry</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 6 Number of patients who included the “target” fruit in their list of five fruits on day 3. Patients responding with both “pear” and “lemon” are also included in individual counts of “pear” and “lemon”. There were no significant differences in word category frequencies between the groups CG and RSG whether or not they are subdivided according to hypnosis. There was no significant difference between the numbers consenting to, or achieving, hypnosis between groups RSG and CG.
mind”. The responses of groups RSG and CG, both in recovery and on day 3, were not different from each other or from this previously obtained norm (table 7).

No patient at any time, with or without hypnosis, replied with an appropriate response in the word pair test.

Overall these tests for implicit memory of intraoperative information indicated no differences between groups RSG and CG and thus no evidence of a priming effect as a result of the command tape. There was no evidence that hypnosis, as performed in this study, enhanced recall of the primed words.

Discussion

It is generally accepted that explicit recall for intraoperative events or information is evidence of inadequate anaesthesia. Thus, by this criterion, five women were inadequately anaesthetized at some stage of the procedure. None of the five patients was aware of pain and only one was aware of surgery. All episodes of recall occurred during a period when the IFT was not in use (see appendix for individual patient details).

As the tape recorder was not switched on until shortly after skin incision, there is little doubt that the two women in group RSG (table 4, superscripts “a” and “b”) who described voices suddenly being blocked out by a buzzing noise were awake during the early part of surgery. Neither of these women was aware of surgery and it is not known for how long they remained awake after skin incision. Interestingly, after the day 3 interview, patient “a” volunteered that she had been awake during a previous Caesarean section: this had not been mentioned during the preoperative discussions.

Three patients in group CG (table 4, superscripts “c”, “d”, “e”) also produced evidence of being awake momentarily during surgery. Patient “c” recalled hearing voices, but not what was being said, and was aware of skin incision: this was not painful and she drifted off to sleep. On discontinuing halothane, patient “d” awoke more quickly than expected, just as the surgeon was inserting a vaginal pack at the end of vaginal hysterectomy: she recalls someone “doing something down there”. Patient “e” exhibited six reflex responses over a 15-min period with no other clinical signs of light anaesthesia, but unfortunately a few minutes after receiving her single incremental dose of atracurium the IFT cuff burst and deflated, with paralysis of the arm until the end of surgery. On the third day as she emerged from her hypnotic state she was observed to be opening and closing the fingers of her right hand. When asked why she was doing this she said she had wanted to “straighten and relax her fingers like this” while under hypnosis but had been unable to do so.

There seems little doubt that “c” was awake during the early part of the procedure and “d” at the very end, but before accepting the experience of patient “e” at face value, the responses of the three women in group RSG should be noted (table 4, f, g, h) who, under hypnosis, claimed to have had recall. The first of these was sure that the first author (I. F. R.) had asked her to do something with her hand; the second believed the first author (I. F. R.) spoke to her reassuringly during surgery. If these are real memories then they occurred either very early or very late in the procedure, before or after the radio static tape, at a time when anaesthesia may have been incomplete. The third patient in group RSG claimed to have been aware of surgery and when asked to describe her experience she clearly described a laparoscopy: whether this was related to her own previous diagnostic laparoscopy or to a recent television programme on laparoscopic surgery which she had watched is unknown. Nevertheless, despite the possibility of fabrication, the experience described by patient “e” as she emerged from hypnosis corresponds so precisely to actual intraintraoperative events that it seems extremely likely that she did indeed have recall for a period when anaesthesia was less than adequate.

It is of interest that none of the five women with evidence of recall voiced this during the interview in recovery. On the contrary, of the four patients capable of answering the questions, recall was specifically denied in recovery. This finding adds further to the confusion surrounding the issue of the most appropriate time to interview patients in the postoperative period. If subjects are interviewed in the immediate postoperative period then the residual effects of general anaesthetic drugs undoubtedly has some effect on cortical function. On the other hand, delaying a test too long may lead to degradation of the specific memory trace and thus reduce the likelihood of linking intraoperative information with postoperative recall. On balance, Bennett,13 believes that the evidence does not favour testing memory “as soon after surgery as possible”. To add further to the difficulties, the optimum time for testing recall may vary depending on which memory function is being tested, “from a few minutes to a few days”.4

Despite previous results to the contrary14,15 there was no evidence that hypnosis, as used in this study,
improved recall of primed words. Possible reasons for lack of enhanced hypnotic recall in this study could be: (1) information was presented during adequate anaesthesia; (2) the hypnotic trance was not sufficiently deep; (3) the hypnotic interview technique was not appropriate (previous studies used iodeo-motor and non-verbal signalling as evidence of intraoperative memory \textsuperscript{13-15}; (4) the reassurances given to the patients just before their hypnotic experience of anaesthesia may have implanted a suggestion that they would not be aware under anaesthesia and this implanted suggestion suppressed recall.

If adequate anaesthesia prevents encoding of auditorally presented material into long-term memory stores, then no amount of sophisticated psychological testing may extract the non-existent information.

In this study arm levitation was used as part of the technique for deepening the hypnotic state. There may be wide variations in susceptibility to hypnosis between subjects but, in general, those who attain arm levitation show substantially more hypnotic responsiveness than those who do not attain such levitation.\textsuperscript{16} While lack of arm levitation does not necessarily imply that an individual subject is resistant to hypnosis, on average, such subjects obtain scores in the lower third of the Stanford hypnotic susceptibility scale (i.e. may be less responsive to hypnosis).\textsuperscript{16} It seems unlikely that lack of an adequate depth of hypnotic trance was a cause for the absence of recall.

There is a suggestion that intraoperative instructions to perform a non-verbal response (e.g. touch your ear when you hear my voice again) may be a better indicator of recall for intraoperative information than verbal responses. Although the finger flexing response of the patient in whom the IFT cuff burst could be taken as evidence to support this view she was the only patient in the study to produce such a response and this followed exposure to a period when anaesthesia was known to be very light. Specifically designed studies of non-verbal responses have produced mixed results. Several of the investigations purporting to provide evidence for recall of suggestions for a non-verbal response had significant methodological or statistical inadequacies, or both, which makes interpretation of the results impossible.\textsuperscript{4} There appears to be little conclusive evidence that suggestions for non-verbal behaviour during a postoperative interview are any more reliable than verbal responses as an indicator of recall for intraoperative information presented during general anaesthesia.

The reassurance given to the patients before their hypnotic experience of anaesthesia was felt to be important. Bennett suggests that intraoperative reminiscences can be powerful stimuli and should be approached with caution.\textsuperscript{13} There would be little point in proceeding through the patient’s anaesthetic experience under hypnosis only to find either that she “could not speak” (because of paralysis and intubation), “could not hear you” (because she was unconscious) and worst of all, stopped breathing (because of paralysis). While possible, it is unlikely that recall was impaired by the reassurances given during hypnosis before exploring intra-anaesthetic memory. Four of the five women with recall expressed their recall under hypnosis. Another woman, under hypnosis, was “gagging” on the tracheal tube and “pushing” against the ventilator as she emerged from “anaesthesia” and as the “tracheal tube was removed” she said, “God I feel crap”. This was exactly the sequence of events and words used at the end of her real anaesthetic.

As in other studies,\textsuperscript{13} this investigation provided clear evidence of confusion and fabrication when using hypnosis, thus emphasizing the importance of being able to verify the material claimed as recall. There were also other unforeseen problems which arose during hypnosis and it is as well that other investigators should be aware of these. The hypnotic sessions of nine women deviated from normal. These women all “broke down” and began crying at some stage during hypnosis. With the patient’s permission the cause of the crying was investigated before continuing with the normal hypnotic interview. The most common reasons for crying were of a psychosexual nature: the woman’s “wholeness” and “attractiveness” for future sexual relationships (five women); sexual abuse as a teenager by her father (one); and psychological/physical/sexual abuse by her husband (one). The other two causes of crying were an overwhelming fear of cancer (one) and fear of experiencing severe postoperative pain, as experienced after previous abdominal surgery (one).

The importance of direct assessment of a patient’s conscious level during anaesthesia is emphasized by the lack of spontaneous movement from the three women with unequivocal evidence of recall for the time around the start of surgery: despite having a non-paralysed forearm none responded to skin incision. The unreliability of clinical monitoring is illustrated by the fact that only one of these three patients was suspected of being inadequately anaesthetized and this was confirmed by clear responses to command (see appendix).

Both premedication and neuromuscular blocking agents reduce the MAC value of inhalation anaesthetics and, taking these effects into account, it was estimated that the MAC value of the anaesthetic given was approximately 1.5 MAC. To assure surgical anaesthesia, a MAC value of 1.25–1.3 is recommended\textsuperscript{17} but Cormack\textsuperscript{18} stated that “With neuromuscular block, surgery can be carried out at less than 1 MAC, and this has proved satisfactory in millions of patients”. In the absence of an end-tidal halothane concentration monitor in this study, it is impossible to estimate alveolar halothane concentration at the beginning of surgery but the anaesthetic was sufficient to prevent the perception of pain in all patients and only one woman (patient c) was aware of surgery (a painless skin incision). The times from induction to skin incision in the three women with recall for the start of surgery were 14 min (patient a), 12 min (patient b) and 5 min (patient c). These three epidoses emphasize the need for a higher concentration of volatile agent for the first few minutes of anaesthesia, particularly if no direct assessment of conscious levels is being made. Normal clinical signs do not ensure unconsciousness.
As with all negative results, the power of a study is important. Previous studies with a positive result using a similar methodology reported target words more often in the test group than in the control group: 2.4 vs 1.84, 2.7 vs 0.9, 1.5 vs 0.5. A composite average response from analysis of these results suggests that our study had a power of 95% of detecting similar differences at the 0.05% level. While it is always possible that a type II error may have occurred, the responses of the two groups in this study were so similar that this seems unlikely.

In summary, there is no evidence from this investigation that women anaesthetized with nitrous oxide and halothane and who were unresponsive to commands at the time specific information was presented to them had either explicit or implicit memory for this information. Our results suggest that if intraoperative implicit learning occurred then it probably did so during episodes of inadequate anaesthesia. Further research in this area, if purporting to reflect an adequately anaesthetized state as opposed to some type of quasi-amnesia with paralysis, must include systematic, accurate and direct intraoperative monitoring of levels of consciousness with the IFT during the period when information is presented.

Appendix

DESCRIPTION OF EVENTS FOR PATIENTS WITH POSTOPERATIVE RECALL

**Table 4, patient “a”: group RSG—no hypnosis**

This 95-kg patient was aware of someone opening her eyelid and I. F. R.’s voice asking her to do something. She found I. F. R.’s voice soothing and comforting. There was no pain, she was unaware of any other sensations and was not aware of skin incision. She then described the sudden onset of a buzzing noise which blocked everything out before she drifted off to sleep.

During the 10 min after intubation, while she was being prepared for abdominal hysterectomy, her pupils remained moderately dilated, she continued to produce tears, and heart rate and arterial pressure remained high. Despite her being assigned to the white sound group, the first author (I. F. R.) asked her directly to “squeeze my fingers”. When she responded, which she did twice (at 6 min and 10 min) she was reassured everything was going well and she would soon be asleep. Thiopentone 100 mg was given on each occasion. At skin incision (14 min) she moved her hand reflexly but there was no response to direct command. No other commands were given. The white sound tape was switched off at 16 min. It is of some relevance that she had “a bad experience” during her second Caesarean section and after this she woke up crying and was “upset” for several days. The Caesarean section anaesthetic record was obtained subsequently from another hospital: this revealed the use of minimal doses of drugs, quite inadequate for a 100-kg patient (thiopentone 250 mg and 50% nitrous oxide only before delivery; 63% nitrous oxide, fentanyl 100 µg and 0.2% trilene after delivery). It seems likely that she had been awake during that Caesarean section but had no conscious recall of the events. Unfortunately, she did not give consent for hypnosis so further investigation of her Caesarean section experience was not possible. Details of this “bad experience” did not emerge during the preoperative interview.

During her postoperative interviews she responded with “pear” in recovery and on day 3, in third and fourth positions, respectively.

**Table 4, patient “b”: group RSG—hypnosis**

This patient was aware of female voices asking someone to “pass something” when the sudden onset of a buzzing noise prevented her from hearing anything else before she went to sleep. There was no pain. It is more than likely that this patient heard the surgical team during preparations for vaginal hysterectomy and then the white noise masked everything. She was unaware of surgery. There were no responses of any type from the isolated arm.

During the postoperative interviews she did not reply with any target fruits, either in recovery or on day 3.

**Table 4, patient “c”: group CG—hypnosis**

This patient, undergoing abdominal hysterectomy, claims to have heard talking, to have been aware of people “at the bottom” and was aware of skin incision. There was no pain and she drifted off to sleep before she could become anxious. There were no responses of any type from the isolated arm.

During postoperative interviews she gave no target fruits or recovery but in the word association test responded to “sour” with “lemon”. On day 3 she gave “pear” in fifth position and responded to “sour” with “grapefruit”.

**Table 4, patient “d”: group CG—hypnosis**

This patient undergoing vaginal hysterectomy was aware of someone “doing things to her down there, things she did not like”. Because of this she felt she was a “dirty person”.

This patient had a very poor body image and regarded anything to do with genitalia as “dirty”. After the tape was switched off and halothane was discontinued she woke up very quickly as the surgeon was placing a vaginal pack.

In recovery she gave “lemon” in first position. On day 3 she gave lemon in third position.

**Table 4, patient “e”: group CG—hypnosis**

During hypnosis this patient claimed to have been aware of talking. She does not know when, or what was said. She felt the colour “green” had particular significance. On emerging from hypnosis she was opening and closing the fingers of her right hand. When asked why she was doing this she said that she wanted to “straighten and relax her fingers” while hypnotized but had been unable to do so. She was sure she had been asked to do something with her fingers.

Under anaesthesia for abdominal hysterectomy there were six reflex responses of the isolated forearm over the first 15 min of surgery. There was no other clinical evidence of light anaesthesia and no response to command. At 16 min the cuff was inflated and atracurium 20 mg administered. The arm remained unparalysed and there were no further movements. However, 10 min after this second dose of atracurium the IFT cuff burst and the right arm became paralysed, remaining so until the end of surgery. The command tape continued playing during this time. At the end of surgery while her trachea was being extubated the surgeon made several loud comments regarding the “green swabs” used by anaesthetists in this hospital.

In recovery she was too sedated to respond adequately and only a single response was obtained. This was in the word pair test: she promptly gave “swab” to the cue word “green”. On day 3 under hypnosis she responded with “lemon” in first position and pear in fourth position. In the word association test she emphasized the importance of green but did not know why this colour should have such a special significance. In the word association test she responded to “green” with both “emerald” and “tree”.

References


