


Sir,—In any clinical situation the benefits of a particular drug or technique must be balanced against the drawbacks. Our communication described the use of atracurium to facilitate tracheal intubation in circumstances where there is no ideal agent. Day-stay patients often require tracheal intubation, in order that the surgery may be performed safely, although surgery is often brief. This lies at the heart of the problem. A larger dose of relaxant improves intubating conditions, a benefit, but increases the duration of block, a drawback if surgery is brief (as difficulty in reversal may occur). A compromise has to be made and although I would agree that this compromise is not "ideal", it is, at least, fairly good. Dr Sosis argues that the use of suxamethonium in these circumstances, provides a better benefit:drawback profile. Although, unlike our report, he has not subjected this point of view to scientific analysis, he does cite work in support of his contention. I would not disagree that better intubating conditions may be achieved more rapidly by administering suxamethonium—a benefit. The drawback is a high incidence of muscle pains—a side effect not to be lightly dismissed (as anyone who has suffered from suxamethonium pains will attest to). Day-stay patients also tend to be just those in whom this unwanted effect is most pronounced—young, fit adults who are ambulant soon after its administration. Dr Sosis states "We have found that a small dose of non-depolarizing muscle relaxant minimizes the postoperative myalgias seen in young ambulatory patients who were intubated using suxamethonium". This anecdote is not, of course, an original observation. I have gone through my file of papers by researchers who have attempted to test this observation in a methodical and scientific manner. It is a very big file. Rather more than half the communications suggest that this method is, at best, unreliable.

Finally, your correspondent worries about the risks of gastric aspiration in outpatients. I believe it is quite insupportable to suggest that properly prepared outpatients, with no other risk factor such as hiatus hernia etc., be subjected to a "crash induction" technique—the natural conclusion to be drawn from Dr Sosis' comments.

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RESPONSE TO INTRAOPERATIVE CONVERSATION

Sir,—We read with much interest the recent article by Bennett, Davis and Giannini (1985), in which non-verbal responses to intraoperative suggestions were reported. The authors' findings concur with the results of an accumulating amount of research in this area. However, in regard to Bennett and colleagues findings, we would like to point to one of the problems that may arise in this kind of research, which makes the interpretation of data difficult if not unreliable.

In the reported study ear-pull suggestions were played to the patients:..."approximately 5 min before beginning the reversal of anaesthesia..." The message lasted 3 min, so it seems reasonable to assume that the suggestion-patients were no longer in the deepest levels of anaesthesia, immediately before the reversal of anaesthesia. Anaesthetists generally attempt to allow the patient to lighten gradually as the surgical procedure comes to an end. Consequently, the depth of anaesthesia during this period is not comparable to the average depth of anaesthesia during the procedure. In addition, the possibility of tolerance to the anaesthetics used, with subsequent awareness, is ever present (Stevens, 1984).

For these reasons we hesitate to ascribe the authors' findings to intraoperative hearing, but instead would attribute their results to suggestion with subsequent amnesia, similar to the effect of post-hypnotic suggestions. Studies in which the effects of sounds during general anaesthesia are studied, must be conducted in such a way that sounds are only administered after anaesthesia has reached a sufficiently deep level (e.g. after the first incision as Bennett and colleague did, and not from intubation onwards) and must be stopped before any awakening from anaesthesia may be expected (e.g. at the beginning of the closing of the wound; that is at least some 20 min before the end of anaesthesia). Then, if postoperative signs of intra-operative hearing are found, there will be much less chance for normal auditory perception (and suggestion) with amnesia to have occurred.

The importance of a careful scrutiny of the depth of anaesthesia during the administration of sounds is further illustrated by our recent findings in volunteers, that prolonged inhalation of nitrous oxide may result in tolerance to the anaesthetic effects of the gas. In each of eight healthy, male volunteers, the minimal effective concentration of nitrous oxide was established, based upon continued absence of motor responses to repeated verbal commands. One week later this concentration of nitrous oxide was administered for a 3 h period; return of motor responses after at least 30 min of absence of such responses was considered a sign of tolerance to the anaesthetic effect of the gas. Four volunteers showed return of motor response within the 3 h of exposure, but two of these had been rather restless throughout the session. They may not have been deeply anaesthetized after all. The other two appeared calm, had continuously received 70 and 80% of nitrous oxide in oxygen, were clinically unconscious and nevertheless showed the demanded responses at some 140–150 min from the start of the experiment.

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REFERENCES


Sir,—Drs Bonke and Ruprecht (1985) raise two salient points with their letter concerning our recent paper (Bennett, Davis and Giannini, 1985). First, they correctly state that anaesthesia may have been lighter than is necessary for adequate surgical anaesthesia (e.g. incisional stimulation) during presentations of the instructions to patients of the importance of touching their
ears after the operation. Second, they state their own findings regarding a similar phenomenon with volunteers who apparently became tolerant during nitrous oxide inhalation and were responsive to verbal commands for motor response. Thus, they state our findings should be viewed with caution regarding generalization to deep anaesthesia and propose the ear-touching results may be more analogous to suggestion with subsequent amnesia than to intraoperative hearing. In response, we would like to clarify the following points.

The design of our research was aimed at maximizing the possibility of discovering if hearing is maintained during the intraoperative period with subsequent verbal amnesia. We did not in this study test whether deeper anaesthesia would ablate the response to verbal suggestion. Rather, reviewing the literature as a whole we were impressed by (1) the fact that all studies assessing “awareness during anaesthesia” used only verbal retrieval to test intraoperative hearing; (2) it is well-known in cognitive psychology that lack of verbal retrieval (verbal amnesia) does not necessarily indicate lack of learning (Squire, 1982); and (3) assessment of learning during anaesthesia has been found to be more successful later rather than sooner after exposure to inhalation agents. Taken together, these and other data together with the clinical reports of episodes of awareness suggested that the patient during anaesthesia is assimilating more auditory information than is usually thought to be the case. That, then, was our hypothesis and, simple as it may be, we believe future data will build upon it: that experimental assessments of intraoperative hearing, learning, perception or memory must seek more sensitive indicators than retrospective verbal report, for in every patient we have queried, verbal recall is completely blank.

Future work, which we have begun, should address the comments of Bonke and Rupprecht, for they are salient ones. Personalized suggestions, for example, of the importance of touching one or the other ear can be delivered just after skin incision, midway through surgery, or at skin closure. Preliminary analysis of 40 patients who received this suggestion indicates that deeper anaesthesia is not a guarantee of lack of hearing; in fact we are currently puzzled at some findings in our new data set suggesting patients’ continued ability to respond to the intraoperative suggestions during seemingly deep inhalation anaesthesia. In part we are simply confronting our own belief systems, for Weinberger, Gold and Sternberg (1984) have shown that “hearing” is maintained during deep isoflurane anaesthesia in rats. We believe a similar study could be done in humans exposed to electrococaudery. We are then confronted with a paradox. The visible evidence of an unresponsive patient who later recalls the anaesthetic experience as simply a blank or empty period in ongoing experience must be tempered by the data resulting from controlled studies indicating learning during the period of adequate anaesthesia for (a) words (Millar and Watkinson, 1983), (b) instructions, and (c) vegetative behaviour. Explanatory mechanisms for the phenomenon of hearing during anaesthesia will probably include the following:

(1) Clarification of the terms “awareness”, “consciousness”, “hearing”, “perception”, “learning”, “amnesia” and “memory”. These terms have more precise meanings in psychology than in anaesthesia; they are central to the topic. For example, we do not believe patients who are responding to personalized suggestions to later touch one or the other ear are “conscious” during surgery or even “aware” in the generic sense. They are clearly “perceiving” and exhibiting “learning” while also showing verbal “amnesia”.

(2) The relationship of the stress response to formation of memory is receiving increased attention (McGaughr, 1983). Anaesthesia and surgery are among the most potent stressors people undergo. Massive neuropeptide and catecholamine release often precedes and accompanies this period. Significant learning probably takes place during periods of high neurohumoral stress, although assessing it may be more difficult. The relation of stress hormones to learning of intraoperative events is one area of research which is likely to be partially explanatory.

(3) Assessment of learning during anaesthesia must be fairly evaluated. Interviewing and observing patients several days after anaesthesia is more valid than during the immediate postanaesthetic period (Adam, 1979). Using nonverbal assessments will increase the likelihood of detection of learning.

(4) Assessment of depth of anaesthesia is clearly an important theoretical question for continued studies. Use of mass spectrometry and processed EEG recordings will aid this question. However, the presence or absence of a stress response is a covariable with depth of anaesthesia and should also be addressed simultaneously with depth measures.

We thank Drs Bonke and Rupprecht for continuing to understand the questions surrounding what is known as “awareness during anaesthesia”. Their findings of responsiveness after several hours of nitrous oxide inhalation make more pressing the need for more work on learning during general anaesthesia.

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REFERENCES


