

The effects of general anaesthesia on memory recall following day-case knee arthroscopy

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Abstract

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Retention of new information may be impaired during recovery from general anaesthesia. Patients are likely to be anxious if they cannot recall information conveyed at the surgeons' postoperative visit. Previous studies have shown evidence of short-term memory impairment after GA.

Patients undergoing day case knee arthroscopy under general anaesthesia were told five random words and three diagnostic findings from their operation, by the surgeon prior to discharge. The patients were telephoned the following day to test their recall of words and diagnostic findings, with a maximum possible score of eight. 96 patients

were available for the telephone follow-up. The patients were grouped according to the interval between the end of anaesthesia and the time the information was given to them.

For knee arthroscopy day cases it appears that, allowing as much time as possible after anaesthesia, at least two hours if possible, before reviewing a patient in the recovery area will likely enhance his/her later recall of the clinical information, potentially setting patient expectations at the appropriate level and improving compliance with postoperative rehabilitation.

For the surgeons' post-operative visit to be valuable to the patient, it should take place at least two hours following cessation of anaesthesia. It is advisable to endorse verbal communication with written information..

Keywords: Anaesthesia, Arthroscopy, Recovery, Memory, Day case.

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Introduction

Good communication is an essential element of the doctor-patient relationship. In the surgical setting, during post-operative recovery, patients may be anxious about the operative findings. The patient should be informed fully about the diagnostic findings and management decisions. Guidelines from the British Association for Day Case Surgery (BADs), state that the practice of giving diagnostic information to patients who may be under the effects of a general anaesthetic should be avoided, whenever possible [1, 2]. Some patients may appear alert and conversational following surgery, but may still be affected by the amnesic effects of general anaesthetic agents [3–5]. The duration of these effects is unknown. Patients may be concerned and worried if they cannot recall important diagnostic and management information which was given to them during the recovery phase risking psychological harm and possible medico-legal action, particularly if any decisions on further treatment are taken at this time [3, 6].

Healthcare providers aim to maximise the proportion of surgical cases carried out on a day stay basis. The quality of patient care and the patients' experience of their care are of paramount importance. There is much interest in the management of the day stay process, including recovery from anaesthesia. Several studies have assessed the time required for adequate recovery and safe discharge from hospital, using a variety scoring methods and criteria [7, 8]. We found three published papers in which memory for new information was tested after general. Using visual memory tests, Ogg et al. demonstrated that patients undergoing day case gynaecological procedures under general anaesthesia suffer considerable memory impairment for at

least the first post-operative hour. Full memory function returned at three hours post-operatively [3]. Blandford et al. showed that post-operative patients who had an interval of up to an hour to recover before being given verbal information, achieved a higher recall score 30 minutes later, compared with a group given the information at a mean of 18 minutes after recovery. On the basis of such findings, it has been recommended that the post-operative surgeons' review be conducted as late as possible after recovery to maximize retention of information by patients [4]. In a comparative study between propofol and thiopentone for day-case use Heath et al. proved that at 1 hour after recovery memory is impaired [9].

Our prospective study enrolled a group of patients undergoing knee arthroscopy as a day case procedure under general anaesthesia. The aim of the study was to investigate the relationship of the recall of information given at the post-operative visit with the time elapsed after general anaesthesia. To this end, we formulated two research questions: (a) how much verbal information conveyed to patients during the surgeon's post-operative review is retained 24 hours later? (b) is there a difference in the amount of retained information when this is given at different times after recovery from anaesthesia?

Methods

All patients included in this study underwent arthroscopic knee surgery on a morning operating list between June 2011 and May 2012 as a day case procedure by, or under the direct supervision of, the senior author. The patients were consented to enrolment on the day of surgery and were given an outline of the study. All patients

undergoing knee arthroscopy by the senior author were included in the study. Patients with preexisting mental disorders or known long term memory disorders were excluded from the study. All surgery was carried out under general anaesthesia. A record was made of the anaesthetic agents administered to each patient. The following time points were recorded: start times of anaesthetic induction and of the operation; the time of completion of surgery, the time at which the administration of anaesthetic agents was discontinued, and the time of the surgeon's post-operative review. For each patient, a record was made of the duration of the operation, duration of administration of anaesthetic agents and the time interval between the end of administration of anaesthetic agents and the post-operative review by the surgeon.

At the post-operative visit in the recovery area, each patient was told three phrases which described the arthroscopic findings and five random words. The random words were produced by an internet-based random word that randomly generates words of a given type and complexity; those were set as nouns with least complexity. The three phrases and five words gave a combined maximum possible memory score of eight. All patients were asked to repeat each word once and to commit them to memory before being tested the following day. Patients were instructed not to make a written record of the words. Patients were discharged by the nursing staff according to the criteria used in the Day Case Unit. At noon on the day after surgery, patients were contacted by telephone and asked to recall both the three arthroscopic findings and the five random words. A record was made of the memory score. Local Research Ethical Committee approval was obtained prior to starting the study.

For the purposes of data analysis patients were divided into three groups according to the time interval between the end of anaesthesia and the post-operative review (Group 1: less than 60 minutes, Group 2: 60–120 minutes, 3: more than 120 minutes). Trend analysis using analysis of variance (ANOVA) with Dunnett's post-hoc test (Group 1, serving as the control group and sequentially compared with Groups 2 and 3) was used to compare the memory scores amongst the three groups. Results are reported as mean values with ranges or standard deviations, as appropriate. Statistical significance was set at the ≤ 0.05

level. All statistical analyses were performed using IBM SPSS®.

Results

A total of 114 patients met the inclusion criteria to be enrolled in the study. Eighteen patients were lost to follow-up, as attempts to make contact the following day failed, leaving 96 patients (84.3%) available for analysis. The mean patient age was 53 years (range 16 – 90 years), there were 53 male patients and 61 female patients. The mean duration of anaesthesia was 41 minutes (range 20 – 78 minutes). The arthroscopic procedures done were diagnostic, lateral meniscectomy, medial meniscectomy, excision of loose body and synovectomy. Three patients received an anaesthetic for more than 1 hour each. The mean operative time was 29 minutes (range 10 – 60 minutes). Patients who had surgery at the beginning of the theatre session experienced a longer time period until their post-operative review, which took place at the end of the operating session. The mean time from the end of the anaesthetic to the post-operative review was 107 minutes (range 10 – 280 minutes)

Propofol was administered to all 96 patients in combination with the following: fentanyl in 62, isoflurane in 28 or sevoflurane in 39 and nitrous oxide in 36 patients. Across the three groups, there was no significant variation in the types of anaesthetic agents used, the duration of administration of the anaesthetic agents or the operative time (Table 1).

There was a statistically significant linear trend in the memory scores within the three patient groups ($p = 0.03$). Post-hoc analysis demonstrated a significant difference ($P = 0.02$) in the memory scores between group 1 (4.0, SD= 2.5) and group 3 (5.2, SD= 1.7). There was no significant difference ($p = 0.6$) identified between groups 1 and 2 (Table 2).

Memory scores (minimum 0, maximum 8; reported as mean values with standard deviations in parentheses and corresponding 95% confidence intervals in a separate column) amongst patients, stratified in three groups, according to the time interval they were spoken to in the recovery area by the operating surgeon.

Table 1

	Patient Group	Mean anaesthetic time in minutes (SD*)	Mean operative time in minutes (SD)	Anaesthetic agent used (percentage of use within group)				
				P	F	I	S	N
1	<60 minutes (n=25)	42.0 (16.2)	31.63 (16.7)	25 (100%)	15 (60%)	6 (24%)	10 (40%)	6 (24%)
2	60-120 minutes (n=36)	41.4 (10.9)	26.71 (8.6)	36 (100%)	23 (64%)	24 (33%)	15 (42%)	16 (44%)
3	>120 minutes (n=35)	42.1 (9.5)	30.58 (9.7)	35 (100%)	24 (69%)	10 (29%)	14 (40%)	14 (40%)
	Total (n=96)	41.8 (11.9)	29.38 (11.6)	96	62	28	39	36

Mean anaesthetic and operative time, anaesthetic agents used. *Standard deviation. P=Propofol, F=Fentanyl, I=Isoflurane, S=Sevoflurane, N=Nitrous Oxide.

Table 2

	Patient Group	Memory Score	95% Confidence Interval
1	<60 minutes (n=25)	4.0 (2.5)	2.6 – 5.0
2	60-120 minutes (n=36)	4.1 (1.9)	3.5 - 4.7
3	>120 minutes (n=35)	5.2 (1.7)	4.6 - 5.6
	Total n=96	4.5 (2.0)	4.0 - 4.9

Memory scores (minimum 0, maximum 8; reported as mean values with standard deviations in parentheses and corresponding 95% confidence intervals in a separate column) amongst patients, stratified in three groups, according to the time interval they were spoken to in the recovery area by the operating surgeon.

Discussion

Several studies have shown the effect of a range of analgesics and anaesthetic agents on impairment of memory after general anaesthesia [9–11]. Impairment of memory may be of particular relevance if patients are unable to recall surgical findings or post-operative instructions conveyed during the surgeons' postoperative review. In some reports, patients have been unable to recall any part of a consultation, despite appearing alert and conversational at the time [3–5]. Although it is recognised that post-operative memory impairment occurs following a general anaesthetic, the precise duration of this impairment is unknown [9–11].

Despite the presence of previous reports on the immediate post-operative recall of patients [3–5] the present investigation is the first to assess this in the field of day case orthopaedic surgery. The evaluation of patients at approximately 24 hours after surgery, rather than prior to discharge, constitutes a further strength of our prospective study. On the other hand, the influence of patient-related factors such as co-morbidities, level of education, fluency of English language) on their memory was not examined and the use of randomly selected words to test memory is not a validated test of memory function. These are the two weaknesses of this study and could both well be the subjects of future research.

Blandford et al. conducted a prospective study to assess patient recall following general anaesthesia using propofol. The study was based on evidence that neurobiological changes required to commit new information to memory are likely to occur within 30 minutes. Using a verbal method of testing recall, groups of patients were given five words to remember during recovery from general anaesthesia for day surgery [4]. An "early" group of patients were told the words at a mean of 17.6 minutes post-anaesthetic and a "late" group at a mean of 58.1 minutes post-anaesthetic. The patients were asked to recall the words after a 30-minute interval. The "late" group scored a mean recall of 3.4 words, compared with 4.4 words for a control group of patients who did not have anaesthesia or surgery. In contrast, the "early" group had a mean recall score of 1.85 words ($p < 0.001$).

Ogg et al allowed one minute for 40 otherwise healthy women to memorise pictures on cards and tested their recall after 10 minutes. The tests were performed either one or three hours after general anaesthesia for minor gynaecological surgery. The conclusion was that memory impairment was maximal at one hour and was regained only at three hours [3]. Visual memory recall following general anaesthesia has also been shown to be a valuable test for post-operative antegrade amnesia [5].

In the current study, we selected patients having day case arthroscopic knee surgery because the anaesthetic technique and the duration of surgery are fairly consistent. Our surgical practice in the day unit is to review each patient before discharge. We chose to use a verbal recall test, similar to that used by Blandford et al, which matches the verbal communication used during the post-operative surgical review. However, we felt it more logical to test the recall of information after an interval of 24 hours, offering patients more time, compared with similar studies published previously [3, 4]. A random selection of common words for recall was used in addition to diagnostic and procedural information, as the latter alone could be prone to bias from pre-operative consultations and the patients' own knowledge and research of their condition. Contacting the patients by telephone the following day proved a successful method, as 84% were available for the assessment.

Our results suggest a linear association between the time interval from the end of anaesthesia and the memory score ($p = 0.03$). This has particular relevance for retention of new information given to

patients immediately post-operatively. For orthopaedic day cases it appears that, allowing as much time as possible after anaesthesia, at least two hours if possible, before reviewing a patient in the recovery area will likely enhance his/her later recall of the clinical information, potentially setting patient expectations at the appropriate level and improving compliance with post-operative rehabilitation.

The post-operative patient review is an essential element of current surgical practice. Maximising the interval between the end of anaesthesia and the surgeons' post-operative visit is associated with increased retention of new information. It may be prudent to reinforce verbal information about diagnostic findings and post-operative management with additional measures such as written instructions, especially if patients are seen soon (less than two hours) after they recover from anaesthesia.

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