Psychological impact of unexpected explicit recall of events occurring during surgery performed under sedation, regional anaesthesia, and general anaesthesia: data from the Anesthesia Awareness Registry

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Background. Anaesthetic awareness is a recognized complication of general anaesthesia (GA) and is associated with post-traumatic stress disorder (PTSD). Although complete amnesia for intraoperative events during sedation and regional anaesthesia (RA) may occur, explicit recall is expected by anaesthesia providers. Consequently, the possibility that there could be psychological consequences associated with unexpected explicit recall of events during sedation and RA has not been investigated. This study investigated the psychological sequelae of unexpected explicit recall of events during sedation/RA that was reported to the Anesthesia Awareness Registry.

Methods. The Registry recruited subjects who self-identified as having had anaesthetic awareness. Inclusion criteria were a patient-reported awareness experience in 1990 or later and availability of medical records. The sensations experienced by the subjects during their procedure and the acute and persistent psychological sequelae attributed to this explicit recall were assessed for patients receiving sedation/RA and those receiving GA.

Results. Among the patients fulfilling the inclusion criteria, medical record review identified 27 sedation/RA and 50 GA cases. Most patients experienced distress (78% of sedation/RA vs 94% of GA). Approximately 40% of patients with sedation/RA had persistent psychological sequelae, similar to GA patients. Some sedation/RA patients reported an adverse impact on their job performance (15%), family relationships (11%), and friendships (11%), and 15% reported being diagnosed with PTSD.

Conclusions. Patients who self-reported to the Registry unexpected explicit recall of events during sedation/RA experienced distress and persistent psychological sequelae comparable with those who had reported anaesthetic awareness during GA. Further study is warranted to determine if patients reporting distress with explicit recall after sedation/RA require psychiatric follow-up.

Keywords: consciousness; conscious sedation; intraoperative awareness, anaesthesia awareness; patient satisfaction; stress disorders, post-traumatic

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‘Anaesthetic awareness’ is a serious patient safety issue that can be defined as the unintended experience of, and subsequent explicit recall of, intraoperative events. The generally accepted incidence for awareness in unselected surgical patients undergoing general anaesthesia (GA) is ~1–2 cases per 1000.1,2 Awareness is a major concern for both patients and clinicians alike and is associated with a high incidence of post-traumatic stress disorder (PTSD).3 Studies of awareness and its sequelae are necessarily focused on patients undergoing GA, that is, a population intended to be unconscious from the anaesthesia provider’s perspective. It has become clear that the boundaries of GA are far less clear from the patient’s perspective, as evidenced by complaints of unexpected explicit recall from individuals who underwent sedation or regional anaesthesia (sedation/RA).4 The latter represents a failure of informed consent and of...
the formation of appropriate expectations of the experience of the procedure, whereas anaesthetic awareness represents a failure of anaesthesia. However, the failure of accurate informed consent and patient understanding in relation to sedation/RA has not been investigated. Using the American Society of Anesthesiologists (ASA) Anesthesia Awareness Registry, we investigated the psychological sequelae, short- and long-term, of patients reporting unexpected explicit recall of events occurring during sedation/RA.

Methods

This study was approved by the University of Washington institutional review board. Written consent was obtained from subjects who mailed in Registry materials. The requirement for written consent was waived for subjects who submitted their information online.

The ASA Anesthesia Awareness Registry was established in October 2007 to gather a large set of patient reports of anaesthetic awareness (unintended awareness during GA, with subsequent explicit recall of intraoperative events) in order to provide a patient perspective on anaesthesia expectations and experiences of anaesthetic awareness. The long-term goal is to improve education and intervention strategies for patients who experience anaesthetic awareness. English-speaking patients 13 yr of age or older who self-reported explicit recall of events during GA were recruited for the study. A website (www.awaredb.org) was the initial point of contact for recruitment. Patients had the option of requesting that survey materials be mailed to them if they were unable to access the online version.

Enrolled patients completed a written survey about their unexpected awareness experience (Supplementary Appendix). The survey opened with a structured interview, modified from that used by Sandin and colleagues, followed by a series of questions about sensations during the awareness experience, immediate and persistent emotional responses, and immediate and persistent psychological sequelae. After submitting the survey, patients had the opportunity to discuss their experiences in more detail with a member of the study team via telephone. Medical records pertinent to anaesthetic care (e.g. admitting history and physical exam, pre-anaesthesia assessment, anaesthetic record, recovery room record, surgical procedure dictation, postoperative records, discharge summary, and postoperative follow-up) were requested and submitted to the Registry.

Although participating subjects self-identified to the Registry with the understanding that they had experienced awareness during GA, confirmation that the patient had in fact received GA could only be determined after registration when the medical record was examined. One-third of the patients who provided medical records were subsequently noted by examination of the records to have received sedation by an anaesthesia provider, sedation without an anaesthesia provider, or RA. This population (sedation/RA group) was the primary focus of the current study.

Inclusion criteria for the present study were a patient-reported episode of unexpected explicit recall in 1990 or later and availability of medical records from the procedure associated with explicit recall. Exclusion criteria were explicit recall of events before induction, during emergence, or post-procedure in the GA group, and if the explicit recall was not of intraoperative events in the sedation/RA group.

Patient characteristics, recalled experiences, initial emotional responses, and persistent psychological sequelae were based on patient survey data. Psychological sequelae included in this analysis were anxiety or nervousness, chronic fears or phobias, dreams or nightmares, flashbacks, and depression. Psychological sequelae were considered present if the patient reported that they had experienced the feeling daily, weekly, or monthly since their surgery. Persistent psychological sequelae were defined as the presence of anxiety or nervousness, chronic fear/phobias, flashbacks, depression, or dreams or nightmares attributed to the explicit recall episode and still being experienced at the time of survey submission.

Additional assessments were made by a panel of three members of the study team (K.B.D., C.D.K., and G.A.M.) using surveys and medical records. Type of anaesthesia was assessed by the study team from medical records and divided into two groups: GA and sedation/RA (monitored anaesthesia care, sedation without an anaesthesia provider, or RA). Patient narratives and records were judged by the panel as explicit recall compared with dreaming. The phase of anaesthesia care during which explicit recall events occurred was determined from the survey and medical records. The Michigan Awareness Classification was assessed by the study team to report levels of sensation.

Levels of sensation were classified as auditory, tactile, pain, paralysis, or pain and paralysis. Categories of 1 (auditory) and 2 (tactile) were combined for analysis. A designation of ‘D’ for distress was used for patient reports of fear, anxiety, suffocation, sense of doom, sense of impending death, or similar reports that indicated emotional distress during the explicit recall experience. In all assessments, agreement between at least two of the three study team members was required for each determination.

Statistical analysis

Explicitly recalled experiences during episodes of unexpected awareness among patients having sedation/RA were compared with those among whom GA was intended using the £ 2 test and Z-test for proportions, and t-test for continuous variables, with $ P<0.05$ required for statistical significance. For tables with expected cell values $<5$, Monte Carlo $ P$-values were calculated by Fisher’s exact test based on 10 000 sampled tables. For tests of differences between sedation/RA and GA patients in five types of psychological sequelae, a $ P$-value of 0.01 was required to correct for multiple testing. All statistical analysis was conducted with IBM SPSS Statistics 18.0.3 for Windows (IBM Inc., Armonk, NY, USA).
Results

Of the 257 subjects enrolled in the Awareness Registry, 181 reported unexpected explicit recall experiences that occurred in 1990 or later, and 83 subjects submitted medical records. Review of medical records identified 27 cases in which the patient had not received GA (epidural, 3; subarachnoid block, 4; sedation by an anaesthesia provider, 10; sedation by a non-anaesthesia provider, 10), and 56 GA cases. All were judged as explicit recall, and there were no cases of dreaming. Six reports of awareness were excluded from analysis of the GA group because they occurred before induction (one) or during emergence (five). As all reports of unexpected explicit recall in the sedation/RA cases were determined to have occurred during the procedure, there were no exclusions in this group.

Characteristics of the patients who reported unexpected explicit recall with sedation/RA are shown in Table 1. Most patients were female, middle aged, and generally healthy (ASA physical status I–II) undergoing elective procedures. Sedative agents administered to the subjects during sedation or RA included midazolam (n = 20, ranging from 1 to 9 mg), fentanyl or another opioid (n = 14), propofol (n = 7), nitrous oxide (50%, n = 1), droperidol (n = 1), no sedation (n = 1), and unknown (n = 4).

Figure 1 indicates the types of sensations reported by the patients as classified by the investigators using the Michigan Awareness Classification Instrument. The sensation of paralysis was reported by 70% of the patients receiving sedation (14 out of 20), and pain, with or without paralysis, was reported by 65% (13 of 20). Five out of seven patients with RA reported paralysis [two without pain (subarachnoid block) and three with pain (epidural)]. The large majority (78%) of sedation/RA patients experienced distress. In contrast, nearly all (96%) of the patients who received GA reported paralysis, 78% reported pain, and 94% experienced distress. A greater proportion of sedation/RA patients experienced only auditory or tactile sensations (19% vs 2% GA, P = 0.03) and a lower proportion experienced paralysis with pain (44% vs 76% GA, P < 0.01).

Figure 2 compares the psychological symptoms after the unexpected explicit recall episode reported by the sedation/RA subjects compared with those who had awareness during GA. More than half (59%) of sedation/RA patients reported at least one psychological symptom attributed to the intraprocedural explicit recall, compared with 82% of GA patients (P = 0.03).

Patient reports of persistent psychological sequelae were similar between the sedation/RA and GA groups (Fig. 3). Overall, 63% of the sedation/RA patients reported that they were still experiencing at least weekly, one or more of the feelings of anxiety or nervousness, chronic fear, flashbacks, and/or depression at the time of the survey completion (years from explicit recall episode to survey completion = median 2 yr, range 6 months to 14 yr, mean 4 yr, SD 4.7). Eighty-two per cent of GA patients reported at least one of these feelings. While the proportion of sedation/RA patients reporting feelings of anxiety or nervousness, chronic fear, flashbacks, and/or depression tended to be lower than the GA patients, ~40% of the sedation/RA group still experienced each of these sequelae.

The survey questions examined other consequences of unexpected explicit recall. Some sedation/RA patients reported a negative impact on their job performance (15%), family relationships (11%), and friendships (11%). Both sedation/RA (33%) and GA (47%) patients reported still feeling very upset about their experience at the time of survey completion.

The survey also explored whether patients had seen a mental health specialist and, if so, whether they had been diagnosed with PTSD. Only half (52%) of patients answered that item on the survey. Using all patients as the denominator, 42% of GA patients and 15% of sedation/RA patients reported being diagnosed with PTSD as a result of their experiences. Medical record confirmation of this diagnosis was not obtained.

Table 1 Explicit recall complaints during sedation/RA: patient characteristics. Sedation/RA, sedation and/or regional anaesthesia; OR, operating room. Percentages based on 27 patients and may sum to >100% due to rounding

<table>
<thead>
<tr>
<th>Type of anaesthesia</th>
<th>Sedation</th>
<th>By anaesthesia provider</th>
<th>By non-anaesthesia provider</th>
<th>Regional</th>
<th>Subarachnoid block</th>
<th>Epidural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at explicit recall experience (range, yr)</td>
<td>22–65</td>
<td>23</td>
<td>1990–2010</td>
<td>4</td>
<td>17 (63%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Surgical procedures</td>
<td>Obstetric</td>
<td>3 (11%)</td>
<td>Non-OR</td>
<td>8 (30%)</td>
<td>Cardiac</td>
<td>1 (4%)</td>
</tr>
</tbody>
</table>

Discussion

This is the first study to demonstrate that self-reported unexpected explicit recall after sedation and RA techniques can be associated with acute and long-term psychological consequences, including PTSD. The intraoperative experiences and the long-term psychological sequelae that patients with unexpected explicit recall after sedation or RA reported to the Anesthesia Awareness Registry were comparable with traditional awareness during GA.

Other investigators have previously noted a misunderstanding or misalignment of expectations with regard to

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the degree of unconsciousness and amnesia that patients had anticipated during sedation or RA and what they actually experienced during their procedures. In a cohort of 2681 consecutive patients undergoing surgery with GA, Samuelsson and colleagues identified 79 patients with a history of possible awareness. Upon further investigation, it became clear that four of the patients reporting explicit recall had not received GA. Although Samuelsson and the current study did not have a denominator by which to compare the incidences of undesired explicit recall in GA and RA/sedation patients, a past study of a large quality control database addressed this issue. Mashour and colleagues demonstrated that self-reports of explicit recall events in patients receiving GA (10 per 44,006 or 0.02%) were not statistically different from the incidence among patients receiving sedation/RA (7 per 22,885 or 0.03%). These findings supported the use of the GA cohort in the current study as a reference group for both phenomenology and psychological sequelae.

Fig 1 Sensations and distress in patients with unexpected explicit recall complaints. Patients with unexpected explicit recall after sedation/RA were more likely to report isolated auditory or tactile sensations and less likely to report pain and paralysis compared with those with awareness during GA (*P<0.03, **P<0.01 for each test by Z-test). Nearly all (94%) of patients who had awareness under GA experienced distress, as did the majority (78%) of sedation/RA patients (P=0.06).

Fig 2 Psychological sequelae of unexpected explicit recall or awareness. Patients with unexpected explicit recall complaints after sedation/RA were less likely to report experiencing anxiety, dreams or nightmares, and chronic fear daily, weekly or monthly since their explicit recall experience compared with those with awareness during GA (*P<0.01 for each by the χ² test).
In a follow-up study, Esaki and Mashour found that the absence of complete unconsciousness was the most frequent expectation and subjective experience of 117 patients who underwent sedation/RA. Given these findings, it appears that a subset of patients undergoing sedation/RA might regard any explicit recall of intraoperative or intraprocedural events as ‘anaesthetic awareness.’ The survey instrument used in the current registry permitted a more detailed exploration of the sensations and sequelae of patients with misperceived ‘anaesthetic awareness’ than was previously possible.

The greater frequency of the combined sensations of pain and paralysis among the subjects receiving GA is not surprising, but the finding of a 70% incidence of paralysis in the sedation group (i.e. 14 out of 20 patients receiving sedation alone, RA patients excluded) is unexpected and difficult to explain. Patients reported an inability to move when there were no neuromuscular blocking medications administered. One explanation for the perceived paralysis is that the safety belts and arm straps commonly used in positioning patients may work in conjunction with the surgical drapes and manual pressure by the surgical personnel to create the impression of absolute immobility. These factors, however, fail to explain what makes these patients different from others that anaesthetists have encountered who during the course of sedation met similar resistance from physical restraints, but were able to speak out and withdraw from the surgical stimulus. Thus, other hypotheses should be considered.

Sleep paralysis is a sleep disorder related to rapid eye movement (REM) sleep occurring in up to 20% of the population and atonia is frequently associated with REM sleep. EEG activity similar to non-REM sleep while suppressing the patterns associated with REM sleep. However, dream recall during sedation and anaesthesia has been described in ~25% of patients. Although there are no frank correlates of REM sleep during GA, patterns of cortical activation have been associated with anaesthetic dreaming. Atonia mechanisms happen at the level of the brainstem and are less amenable to study than cortical phenomenon. Considering the complex and incompletely understood brain activity associated with sedation, atypical or idiosyncratic activation of REM-like atonia by sedative agents remains a possible explanation for the sensation of paralysis in this context.

Although the severity of initial adverse psychological impact was lower among the sedation/RA subjects, over 60% of the group experienced one or more persistent psychological sequelae and 15% reported being diagnosed with PTSD as a result of their explicit recall of intraprocedural events. The diagnosis of PTSD was established by patient report and was not independently verified by medical records or other assessment. The absence of documentation of a formal psychiatric diagnosis, however, does not invalidate an individual’s subjective assessment of the impact of a traumatic personal experience on his/her subsequent psychological health. In addition, the patient’s perception of the importance of the explicit recall episode does not depend solely on an objective evaluation by an expert for an interpretation of its validity.

The association between sedation and the development of PTSD has been investigated for patients in the intensive care unit (ICU) by Jones and colleagues. While there are obvious differences between the relatively brief procedural sedation experienced by patients in this study and...
sedation for the ICU environment, it may be useful to consider the associations reported in these studies. PTSD in the ICU was associated with explicit recall of delusional memories, prolonged sedation, and physical restraint with no sedation. Delusional memories in the ICU studies (e.g. thoughts that the care givers were trying to kill the patient) were contrasted with factual memories, such as explicit recall of the presence of the tracheal tube and care procedures such as suctioning. In contrast to delusional memories, the explicit recall of factual memories was not found to be related to PTSD. It is conceivable that even during brief procedural sedation, a depth of sedation that impairs the patient’s perception of the environment in conjunction with barriers to communication might predispose to the development of PTSD. This may be particularly true for the perception of paralysis, as the experience of paralysis has been strongly associated with psychological sequelae of awareness among patients receiving GA.

There are numerous limitations to this study. The generalizability of the data has to be considered in the light of the fact that the patients in the sedation/RA group were a select group of self-referred volunteers who had unmet expectations concerning amnesia for iniprocedural events occurring during sedation or RA, and who were sufficiently motivated by their experience to volunteer as a subject for the Registry. There may be other patients who have had the same expectation of complete amnesia during sedation/RA, but did not volunteer for this study. Patients who had unmet expectations concerning the degree of amnesia during their procedure may be more interested in the problem of awareness, leading to an increased interest in being part of a study, and a subsequent bias towards the inclusion of more severely affected individuals. There is, however, evidence that some of the most severely affected individuals who have experienced awareness under GA may withdraw from further contact with healthcare professionals. These patients then might only be captured in a prospective study but may not volunteer for a registry such as ours, leading to the opposite bias resulting in under-representation of the most severely affected individuals. While inadequate pain relief (experienced in 55% of the sedation/RA group) may have played a role in patient experiences, the patients specifically volunteered for a study of awareness (defined as awareness during GA with subsequent explicit recall), not a study of inadequate pain relief. Not all of the patients receiving sedation/RA reported distress from their episode of explicit recall, but the subjects who did not have distress contacted the Registry, which stated in multiple places that only patients who had GA were eligible to register. Thus, it is unclear what the net effect of a self-selecting registry might be. The Fifth National Audit Project (NAP5) study on accidental awareness during GA will avoid the bias of subject self-selection, as physicians, nurses, risk managers, attorneys, psychologists, psychiatrists, and other professional personnel will submit cases. In addition, it is more likely to avoid inclusion of patients who underwent sedation or RA.

Other limitations of the study include: retrospective methodology, a small number of subjects limiting power to discern differences in long-term psychological sequelae, inability to interview healthcare providers involved in the reported explicit recall episode, and lack of external validation of the patient questionnaire, although the internal comparison of the sedation/RA group provided internal consistency and validation. The absence of psychometric standardization, validity, and reliability data for the psychological distress items in the self-reported questionnaire raises uncertainty regarding the validity of these data. There is a lack of a preoperative psychiatric evaluation or history that would allow us to ascribe the reported psychological sequelae to the explicit recall experience itself. However, the questionnaire did explicitly ask the subject to report symptoms that they attributed to the explicit recall experience.

Despite these limitations, the occurrence of significant short-term patient distress and long-term psychological sequelae in association with unexpected explicit recall of iniprocedural events during sedation and RA indicates that there is a need for improved physician–patient communication regarding the degree of expected amnesia and sensations that patients may experience during these procedures. Unlike GA, the expectation and goal of anaesthetic care in sedation/RA is not complete unconsciousness. Therefore, the problem is some combination of failure to obtain informed patient consent and failure to address distress occurring during the procedure, not failure to induce complete amnesia. The fast-moving and stressful pre-procedural environment holds great potential for miscommunication. It is impossible to ascertain in our cases whether specific information regarding the anticipated level of consciousness and explicit recall of events was discussed, but not assimilated by the patient, or whether it was never discussed at all.

Szypula and colleagues presented data supporting the importance of the process of obtaining informed consent in their study of closed claims involving RA, indicating that 10% of the litigation claims contained allegations of inadequate consent. Some anaesthetists may be concerned that the unintended effects of a very explicit discussion specifically delineating the types of sensations and memories that a patient might expect during sedation may lead to avoidance of important procedures or lead the patient to choose a suboptimal anaesthetic option. Given the great individual patient variability in response to amnesic, sedative, and analgesic medications, attention to preoperative communication with the patient is as important as the careful administration of these medications. In a study of litigation and inadequate anaesthesia, Mihai and colleagues raised similar concerns regarding the importance of consent in that three of the 60 claims of inadequate RA involved failure to discuss potential adverse outcomes when obtaining informed consent. In the same study, five claims specifically mentioned a lack of interest, concern, or emotional support by the anaesthetist as a factor in the initiation of the lawsuit. The anaesthetist who is not aware of a patient's
unmet expectations for sedation/RA is at particular risk for being perceived as disinterested and unsupportive.

In summary, some patients experiencing unexpected explicit recall of intraoperative events occurring during sedation and RA reported distress and long-term psychological sequelae. The recognition of this problem should focus increased attention on preoperative physician–patient communication concerning the degree of amnesia expected during sedation or RA, and promote efforts to mitigate the sources and consequences of a patient’s psychological distress associated with these experiences.

Supplementary material
Supplementary material is available at British Journal of Anaesthesia online.

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Declaration of interest
K.B.D. is the Chair of the Committee on Professional Liability for the ASA.

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