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Awareness under anesthesia and the development of posttraumatic stress disorder☆

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Abstract

Failure of general anesthesia to render a patient insensate, termed "awareness," is estimated to affect between 40,000 and 140,000 patients in the US each year. This study investigated the occurrence of post-traumatic stress disorder (PTSD) in subjects who reported a past episode of intraoperative awareness. We inquired about intraoperative and postoperative experiences and studied the relationship between various surgical experiences and currently meeting the diagnosis of PTSD. Sixteen postawareness subjects and 10 postgeneral anesthesia controls completed the Clinician Administered PTSD Scale (CAPS), a standardized clinical rating scale for PTSD, and a questionnaire about peri-operative experiences. Nine of 16 subjects (56.3%), a mean of 17.9 postoperative years, and no controls met diagnostic criteria for current PTSD (X^2= 8.6, df = 1, P<.01). Common intraoperative experiences included an inability to communicate, helplessness, terror, and pain. Postawareness patients had significant postoperative distress related to feeling unable to communicate, unsafe, terrified, abandoned and betrayed. Perioperative dissociative experiences predicted having current PTSD. Being conscious during surgery is a traumatic event that may result in developing chronic PTSD. Further studies should include prospective designs of prevalence and long-term psychological, social, and overall health effects, and ways of preventing and treating awareness-induced PTSD. © 2001 Elsevier Science Inc. All rights reserved.

1. Introduction

The discovery of anesthesia led to advances in the surgical treatment of disease by eliminating the horror and pain of surgical procedures. Failure of general anesthesia to render a patient insensate, termed "awareness," has been recognized since early in the development of anesthesia [1-3]. Current estimates of awareness during general anesthesia range from 0.2% to 0.7% [4,5] or between 40,000 to 140,000 of the 20 million general anesthesia patients each year in the United States [6].

A relatively small number of studies [7-11] and case reports [1,3,12-17] describe a variety of psychiatric complaints following awareness during anesthesia that can be understood as symptoms of posttraumatic stress disorder (PTSD). However, none have investigated if these patients met formal diagnostic criteria for PTSD.

PTSD may develop following a traumatic event and is characterized by three symptom complexes: 1) re-experiencing, 2) avoidance, and 3) physiological hyperarousal [18]. Patients who suffered awareness during anesthesia [1,3, 7-17] have been described as recalling fragments of their surgery in nightmares and flashbacks in which they re-experience paralysis, suffocation, pain, or conversations between surgical personnel. Postawareness patients have been reported to avoid hospitals, doctors, television programs with hospital themes, and even going to sleep. Commonly reported hyperarousal symptoms include easy startle, hypervigilance, and irritability.

In the early 1960s, Meyer and Blacher [7] described a "traumatic neurosis" as a consequence of being conscious during surgery. They noted that their postawareness patients

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were no longer alert and affable, but were suffering a "frozen immobility," expressionless, mute, and staring, indifferent to and unaware of their surroundings. This state gradually abated as patients spoke of recalling vivid fragments of the operative process. The authors identified partial or intermittent unconsciousness while subjected to surgery and bereft of all motor power as the cause of the traumatic neurosis.

Blacher [13], in 1975, described six case studies of a "traumatic neurosis" following awareness during anesthesia. His patients complained of nightmares, generalized anxiety, irritability, and a preoccupation with death. They were reported to have a rapid resolution of symptoms following acknowledgement that the patient was indeed awake during surgery, but there was no long-term follow-up to determine the stability of either the post-traumatic symptoms or the improvement after the acknowledgement of what had happened. Following this case report, it became a common clinically accepted belief that patients who were conscious during surgery did not suffer significant long-term consequences.

Nearly 20 years later, Moerman, Bonke, and Oosting [8] interviewed 18 women and 8 men about the psychological consequences of awareness during anesthesia and about their intraoperative experiences. Subjects were interviewed from a few hours after surgery to 19 years later. No standardized assessment tools were used. Subjects were only asked, "Did you suffer any consequences?"

Eighteen patients (70%) reported at least one unpleasant aftereffect. These included sleep disturbances, dreams and nightmares, flashbacks, daytime anxiety, and a fear of anesthesia. Intraoperative pain during surgery predicted having a postoperative psychological complaint. The most commonly reported intraoperative experience was being in a state of panic. Subjects also endorsed hearing sounds or voices, paralysis, helplessness, pain, visual images of light and of surgical personnel, suffocation and sense of impending death. Subjects reported believing they had been left alone or unattended, or that an anesthetic accident had occurred. Twenty of the 26 subjects attempted to signal the surgical team, but found it impossible to communicate. Following surgery, 18 patients informed hospital staff that they had been awake during surgery.

As part of the Moerman et al. study [8], experienced anesthesiologists performed chart reviews of 12 cases and 24 matched controls. Using routine clinical parameters for awareness during anesthesia [elevated blood pressure (>30 mmHg) or heart rate (>30 beats/min) over baseline in accordance with Evan's PRST scale], anesthesiologists were unable to reliably distinguish subjects and controls.

Schwender et al. [9], using a similar study design, interviewed 30 women and 15 men, a mean of 9.6 years (range 0.1-30 years) after surgery. Twenty-two (49%) endorsed at least one unpleasant aftereffect, such as sleep disturbance, fear of anesthesia, and nightmares whereas three subjects reported needing psychiatric treatment for PTSD.

All subjects reported hearing intraoperative sounds or conversations. Other common experiences were having pain, being touched, fear, visual perceptions, and feeling helpless. Sixty-nine percent attempted to alert the surgical team in vain during surgery, whereas postoperatively nearly 90% reported being awake during surgery to their physician, nurse, or to a family member. Subjects reporting psychiatric sequelae had significantly more helplessness and severe panic while awake during their surgical procedure.

Ranta et al. [6], in a prospective study of 2612 surgical patients, reported that 19 (0.7%) experienced awareness under anesthesia. Nurses interviewed patients in the recovery room to assess for intraoperative recall. Five patients were immediately identified as having experienced awareness and enrolled for psychiatric assessment. None of these subjects met diagnostic criteria for PTSD; one subject reported an exacerbation of a pre-existing depressive disorder. A retrospective chart review identified an additional fourteen patients with documented evidence of awareness (interruption of anesthesia, movement). These patients did not report an awareness experience or were noted to be incoherent in the recovery room and were lost to follow-up. The low rate of enrollment limits the usefulness of this data.

The current study is the first to use a validated structured clinical interview for PTSD. We sought 1) to investigate whether patients who had experienced awareness under anesthesia currently met formal diagnostic criteria for PTSD, 2) to assess intraoperative experiences of subjects, and 3) to compare postoperative experiences of postawareness subjects and postanesthesia surgical controls and 4) to determine if any intraoperative or postoperative experiences predicted having current PTSD.

2. Methods

2.1. Setting

Interviews were conducted at Boston University Medical Center, a large urban academic medical center, the Trauma Center, and in community settings. Community settings were necessary because many potential subjects cancelled as they faced the prospect of visiting a hospital.

2.2. Subjects

Sixteen subjects were recruited from advertisements in newspapers, fliers in hospitals, self-referred following print and television news stories, or referred by an anesthesiologist. Subjects were men and women 18 years of age or older who had prior surgery under general anesthesia and reported experiencing awareness under anesthesia. Three subjects were younger than 18 at the time of the surgery. The type of anesthesia was verified by medical record or report from the subject's anesthesiologist, if available, or by patient's detailed description of intubation or extubation. Because review of the medical record is an invalid indicator of aware-

ness under anesthesia [9], the patient's detailed descriptions of intraoperative experiences, such as feeling the incision, experiencing intubation, or describing intraoperative events, were used to determine whether the subject experienced awareness under anesthesia.

Ten controls, men and women 18 years or older, responded to advertisements seeking postgeneral anesthesia patients. Although nearly all controls had both recent and remote surgery, they were unable to provide detailed memories of remote surgery, in contrast to the study subjects who reported vivid detailed memories of their remote surgical experiences. This is consistent with the literature that shows that while nontraumatic memories degrade over time, memory for traumatic events remain vivid [19,20]. Thus, controls were queried about recent general anesthesia surgical experiences and were age matched to cases. Although this may have selected for a higher potential postsurgical stress in controls, it provided for a control population with detailed memories of their surgical experience.

Study subjects and controls were excluded if it could not be established that a general anesthesia was used, if he or she were involved in litigation or receiving disability relating to his or her surgery or awareness experience. Other exclusion factors included psychosis, active substance abuse, history of self-mutilation, or suicide risk. Patients who met inclusion criteria were seen for an initial interview where written informed consent was obtained and demographic information, a surgical history, and trauma history were collected.

2.3. Instruments

Subjects and controls were administered the Clinician Administered PTSD Scale (CAPS) [21] by trained interviewers. The CAPS, a validated structured clinical interview, is targeted to a specific event, which meets DSM-IV stressor criterion [experiencing a threat to one's body integrity and responding with helplessness or terror [18]]. The CAPS assesses the frequency and intensity of 17 core and 8 associated symptoms of PTSD, as well as, a level of functional impairment. CAPS scores range from 0-136 with scores of 45 or above meeting DSM-IV diagnostic criteria with symptoms of moderate severity [21].

In this study, the CAPS was targeted to the most stressful aspect of surgery for subjects and controls. All subjects reported that the awareness event was the most stressful aspect while controls addressed the life-threatening nature of the diagnosis or illness. Life threatening illnesses, such as cancer, may meet the stressor criterion, and have been reported to cause PTSD [22-26]. Subjects were asked about symptoms such as nightmares, flashbacks of their surgery, and avoidance of further contact with hospitals or doctors.

Subjects and controls completed the Surgical Experience Questionnaire (SEQ) a self-report measure developed for this study to assess the nature of the intraoperative experiences (subjects only) and postoperative (subjects and controls) experiences in the first postoperative month (Available from JE Osterman). The SEQ is based on a Likert scale from 0 (not at all) to 4 (extremely) and assesses the patient's experiences including physical states, emotions, thoughts, and beliefs.

2.4. Data analysis

Data were analyzed by using two-tailed t tests and Chi squares to assess difference in the characteristics of the comparison groups. Significance was set with a p value of $<.05$. Pearson correlations were used to determine the relationship between intraoperative and postoperative experiences and a current diagnosis of PTSD.

3. Results

Table 1 summarizes the demographic data, surgical experiences, and CAPS scores of subjects and controls. Subjects ($N=16$) and controls ($N=10$) did not differ significantly by gender or mean age, but did significantly differ in the number of years since surgery (17.9 for subjects vs. 1.4 for controls; $t[24]=-4.07$, $P<.001$) and therefore, age at the time of surgery (30.7 for subjects vs. 52.5 for controls ($t[24] = 3.98$ $P=.001$).

Subjects had significantly higher current PTSD symptom severity than controls, as indicated by mean current total CAPS scores of 52.2 ($SD=30.1$) and 2.8 ($SD=4.9$), respectively ($t[24]=3.98$, $P=.001$). Based on the CAPS 45 or above, 9 of 16 (56.3%) of subjects and none of the controls met diagnostic criteria for PTSD with functional impairment ($X^2=8.6$, $df=1$, $P<.01$).

The most common intraoperative experience (Table 2) was being unable to communicate, for which all subjects scored 4 (extremely). Other common and intense intraoperative experiences included helplessness, terror, feeling unsafe, fear of pain, pain, paralysis, that he or she could not longer mentally escape, feeling abandoned and betrayed by his or her doctors and nurses.

A comparison of postoperative experiences reveal that subjects reported significantly more postoperative distress than controls (see Table 2). The most common and intense experiences reaching significance were feeling unsafe and helplessness, followed by feeling abandoned by his or her doctors and nurses, feeling betrayed by his or her doctors and nurses, terror, and an inability to communicate.

Mean intraoperative and postoperative experiences were compared between subjects with and without current PTSD with three factors reaching significance. Intraoperative experiences "that you left your body at some point" ($P<.045$) and "that at some point you could mentally escape from what was happening to you" ($P<.008$) as well as the postoperative feeling "that you left your body at some point" ($P<.049$) were significant predictors of developing chronic PTSD.

Table 1
Awareness during anesthesia and PTSD: demographics, surgical experiences, and CAPS scores

Subjects	Current age*/ gender*	Type of surgery	Postoperative Years**	Current CAPS score***	Intraoperative experiences
1	38/female	Partial abdominal hysterectomy	.25	96	Felt paralyzed, helpless, terror, trapped, burning/cutting pain, desperate to escape, heard talking and beeping noises.
2	39/female	Removal of cardiac tumor	31	92	Felt cutting, pressure of surgeon's hand, moderate pain, felt abandoned and betrayed, wanted to escape, petrified, heard talking and beeping noises.
3	68/female	Laminectomy	13	81	Felt paralyzed, tried desperately to move, felt scraping, pain in back and down leg, heard laughter, talking, scraping/ clinking noises.
4	46/male	Herniorraphy	38	77	Felt suffocation, being intubated, panic, terror, helpless, unable to escape, abandoned, betrayed.
5	40/female	Laparoscopic tubal ligation	3	75	Felt suffocation, paralysis, severe abdominal pain, desperate to escape, heard "gossip" and laughter, believed she was dying, intermittently escaped into a pleasant dream.
6	29/male	Inadvertent administration of pancuronium	1	73	Felt progressive paralysis, terror, thought would die, felt intubation, pain, tongue sliced, heard panic in doctor's voices, tried to tell them he was dying.
7	48/female	Appendectomy	32	67	Felt paralysis, abdominal pain, helpless, abandoned, fear of pain, heard talking.
8	46/female	Hemorrhoidectomy	14	65	Felt cutting and tearing pain, humiliated, violated, helpless, terror, abandoned, betrayed, heard talking.
9	43/male	Spinal fusion	8	57	Felt pain in hip (site of bone harvest) and neck, paralysis, terror, desperate to escape, heard talking.
10	55/Female	Cesarean Section	22	41	Felt skin being cut, felt unsafe, terror, paralysis, heard talking and laughing.
11	55/female	Scar revision/abdominal hernia	22	29	Felt paralysis, terror, burning pain, unable to breathe, felt intubation, thought was dying, heard talking.
12	51/female	Radical mastectomy	23	27	Precise, localized, intense pain, agony, terror, shock, felt self being cut open, felt abandoned and betrayed, helpless, heard talking.
13	51/female	Cesarean Section (extubated prematurely)	23	19	Felt she was dying, couldn't breathe, heard doctors comment on her blue color of her nails, heard their panic, felt terror, helpless.
14	55/female	Laparoscopic gynecologic	12	16	Felt twisting of her "stomach," suffocation, terror, heard mumbling "she's aware"
15	42/female	Laparoscopic gynecologic	1	11	Felt mild pain for a few seconds, anesthesiologist talking to her, telling her they knew she was awake and would help, felt she had no control but trusted her doctors.
16	62/female	Cesarean section	36	9	Felt restrained, helpless, felt unsafe, felt her doctors did not care, gurgling noises and talking.
Controls					
1	61/male	Prostectomy for prostate cancer	2	15	N/A
2	36/male	Excision of spinal cord tumor	1	5	N/A
3	48/female	Colon resection/rule out colon cancer	2	3	N/A

(continued on next page)

Table 1 *(continued)*

Subjects	Current age*/ gender*	Type of surgery	Postoperative Years**	Current CAPS score***	Intraoperative experiences
4	77/female	Colon resection/rule out colon cancer	1	2	N/A
5	48/female	Hip replacement	1	0	N/A
6	60/male	Repeat herniorraphy	2	0	N/A
7	37/male	Lipoma removal	<1	0	N/A
8	72/female	Cardiac by-pass	2	0	N/A
9	45/female	Laparoscopic myemectomy	3	0	N/A
10	55/female	Colon resection/colon cancer	1	0	N/A

* P=NS; ** P<.001; *** P<.001.
N/A=not applicable.

4. Discussion

More than half (56.3%) of our subjects met DSM-IV diagnostic criteria for PTSD years (mean 17.9) after suffering awareness. The National Comorbidity Survey showed that once people have suffered from PTSD for six years or longer, it is unlikely that the disorder will go into remission [27].

The study subjects described suffering a range of awareness experiences, from hearing conversations, to severe pain and being unable to communicate or otherwise escape the horrible experience. As in other patients' reports of awareness [3,7,12-17], our subjects described feeling trapped in an immobile body. It is noteworthy that animal models of inescapable stress provide a widely accepted paradigm for understanding the development of PTSD in humans exposed to overwhelming stress [28,29].

Detailed descriptions of subjects' experiences reflect the overwhelming nature of being awake during surgery, as illustrated by subject 5.

> I couldn't understand why I couldn't move—every fiber in my body fought to escape the pain, the horror, and sheer terror of being cut open and awake. Cutting, pulling, tugging, and then a leap in pain as air covered my guts, now wrenching and twisting as if thousands of small soldiers were marching upon them. Unspeakable, horrifying pain followed, inflicted against a background of socializing, gossip, and laughter. I tried to escape only to give up and surrender—repeating this over and over again. At times, I would mercifully escape momentarily into a pleasant dream—my body aware of the operation, yet the pain more distant—only to be pulled back to the true horror of what was happening to me by the pain. I was so very alone,

Table 2
Surgical Experience Scale[a]

Experience	Mean Intraoperative (subjects)	Mean Postoperative (subjects)	Mean Postoperative (controls)	Significance of postoperative experiences[b]
Inability to communicate	4.00	2.30	0	P<.001
Feeling unsafe	3.50	3.10	0.50	P<.001
Terror	3.50	2.50	0.40	P<.01
Helplessness	3.86	3.10	1.30	P<.01
Fear of pain	3.43	2.40	1.90	P=NS
Pain	3.07	2.40	2.40	P=NS
Paralysis	2.93	0.30	0	P=NS
That there was some point that you could no longer mentally escape from what was happening to you	2.93	1.10	0	P=.01
Feeling abandoned by your doctors and nurse	2.86	2.70	0.30	P<.001
Feeling betrayed by your doctors and nurses	2.57	2.50	0.03	P<.001
That you were dead or dying	1.86	0.90	0	P<.05
That you left your body at some point	1.29	1.10	0	P<.05
That at some point you could mentally escape from what was happening to you	1.00	1.20	0	P=.001

[a] Based on scale of 0=not at all, 1=a little, 2=somewhat, 3=very, 4=extremely.
[b] Chi square between subject and control.

disconnected from all that was human knowing that my torturers, my betrayers, must be inhuman for who could inflict such pain and terror—and laugh. I was defeated, helpless, not understanding how this could happen struggling to survive, yet wishing to die.

Then, it was over, just as suddenly as it began. Gone from my thoughts until it struck again days later as horrifying images and terror that rose from the depths of my being. I was once again in the grips of horror, again not comprehending, again trapped, again struggling to survive, yet wishing for death.

Most post awareness subjects reported lapsing in and out of consciousness, picking up fragments of the surgery, conversations and bodily sensations while struggling to move, escape, and communicate. These memories reappeared later as vivid images, sensations, isolated thoughts, and intense emotions that are characteristic of PTSD. As the subjects slowly became capable of creating a narrative memory that captured what had happened to them, these vivid fragments usually persisted. The control group, on the other hand, did not suffer from PTSD and did not have vivid, detailed recall of their surgeries.

As in prior retrospective studies of awareness during anesthesia [7-10], our interviews varied from months to years (3 months to 36 years) following awareness. Retrospective studies of other traumatized populations, [holocaust survivors [30], war veterans [31,32,33] and survivors of child abuse [34]], routinely are assessed for memory and psychiatric symptoms many years after the target event. Studies of memory in child abuse victims [35] and in people with PTSD after rape and motor vehicle accidents [36] found that memories of traumatic events are qualitatively different from everyday memories. Their traumatized subjects reported precise images, smells, and physical sensations that they claim are as clear as they were years or decades before, when the original trauma occurred.

The longitudinal study of psychological and physical health of 200 Harvard undergraduates who participated in the second world war seems to accurately illustrate how PTSD affects the memories of traumatic events [33]. These men were interviewed in 1945 and again 45 years later. By 1990, those who did not have PTSD told stories that were considerably different from their original accounts. In contrast, time had not modified the memories of those who developed PTSD. While it is "normal" to distort one's memories, the essence of PTSD is that its sufferers are unable to leave the event behind.

Subjects had significantly more immediate postoperative distress than the control group, reporting they felt unsafe, helpless, terrified, and unable to communicate. Problems in communicating may prevent postawareness patients from eliciting support from family, friends, and medical care providers, thus leaving them alone to deal with their feelings of helplessness, terror, and lack of safety.

We found that three perioperative dissociative experiences, mentally escaping during surgery or an intraoperative or postoperative out of body experience, predicted developing PTSD. Peritraumatic dissociation has been identified as a predictor of chronic PTSD in several traumatized populations including soldiers [32,37] and civilians [38,39]. Meyer and Blacher's [12] poignant descriptions of postawareness patient as suffering "frozen immobility" with their expressionless, mute, and staring faces and indifference to and lack of awareness of their surroundings are characteristic of dissociation. Many subjects in this study described themselves as "the living dead" or "zombies." They described having out of body experiences during the early postoperative period feeling that everything was "distant" or "unreal" and they were "going through the motions."

Patients suffering from dissociation often appear calm and unaffected by the traumatic event and do not attract attention on busy surgical services. Their heart rates, rather than elevated, are often reduced, most likely due to parasympathetic activity [40]. With current medical practice dictating rapid discharges and day surgery increasingly common, patients with postawareness dissociation are unlikely to be identified as having suffered awareness. Instead, they may be considered merely slightly "groggy."

This study, as well as previous studies, [5,7,8] raise questions of how to identify patients who suffered awareness during anesthesia as they may suffer from dissociation, incoherence, or amnesia. Many patients described avoidance of hospitals and doctors, confirming the clinical impression that patients who were awake during surgery may avoid medical care to avoid reminders of their trauma event.

Thus, recognizing and treating of postawareness psychiatric complications present significant clinical challenges. Algorithms for the prevention and detection of awareness must be developed. Assessment, as described by Osterman and van der Kolk [3] must be part of postoperative protocols as an ongoing process, beginning in the recovery room and continuing through the postoperative visit with the surgeon. In addition, postawareness psychiatric complications must be considered patients with postoperative psychiatric complaints. Therapeutic interventions must include validation and support from the surgical and anesthesia teams, as well as one or more of the proven effective treatments for PTSD [41,42].

Our study group was a sample of convenience drawn from postsurgical volunteers and therefore does not shed light on the prevalence of PTSD in patients who suffer awareness during general anesthesia. Assessing our study group for a current diagnosis of PTSD only may well have underestimated the prevalence of an array of lifetime psychiatric complications. While other studies reporting 50% [8] and 70% [7] of postawareness consequences accepted a wide range complaints in response to the open-ended question, 'Did you suffer any consequences?', this study is the first to identify post-traumatic stress disorders as a complication of being conscious while undergoing surgery.

Further study of awareness under anesthesia should include prospective study designs to refine its prevalence, deepen understanding of its psychological impact, measure

long-term social and healthcare utilization, morbidity, and mortality and develop effective treatment.

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