

# Late Psychological Symptoms after Awareness among Consecutively Included Surgical Patients

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**Background:** Awareness during general anesthesia can cause late psychological symptoms. Selection bias may have affected the results in previous retrospective studies. The authors used prospective consecutive collection to recruit patients with previous awareness.

**Methods:** In a cohort of 2,681 consecutive patients scheduled to undergo general anesthesia, 98 considered themselves to have been aware during previous surgery. Six patients died before inclusion, and another 13 were excluded (4 cases of stroke or dementia, 7 declined to participate, and 2 could not be located). Seventy-nine patients were interviewed by telephone, and medical records were checked in uncertain cases. The interview followed a structured protocol, including seven late symptoms (anxiety, chronic fear, nightmares, flashbacks, indifference, loneliness, and lack of confidence in future life). Three persons independently assessed the interviews for classification, to determine whether awareness had occurred.

**Results:** Four cases were performed using regional anesthesia, and another 29 were not considered as awareness by the assessors. Therefore, the final analyses included 46 patients. Twenty (43%) had experienced pain, and 30 (65%) described acute emotional reactions during the awareness episode. Fifteen (33%) patients had experienced late psychological symptoms afterward. In 6 of those cases, the symptoms lasted for more than 2 months, and 1 patient had a diagnosis of post-traumatic stress disorder. Acute emotional reactions were significantly related to late psychological symptoms ( $P < 0.05$ ).

**Conclusion:** The method for recruiting awareness cases in studies on late psychological symptoms may affect the result. The authors found fewer and milder problems, despite a similar degree of initial problems as in previous studies.

AWARENESS with explicit recall during general anesthesia causes dissatisfaction,<sup>1</sup> discomfort, and also long-term psychological symptoms.<sup>2–5</sup> The first study on awareness, published in 1961, found an incidence of 1.2%.<sup>6</sup> Since then, the incidence of awareness has decreased, with a reported incidence during the past 15 yr of between 0.1% and 0.4%.<sup>1,7–11</sup> Two recent studies concluded that the incidence of awareness may be decreased by 80% if the Bispectral Index were used.<sup>12,13</sup> Nevertheless, the large number of patients given general

anesthesia will generate a considerable number of awareness cases every year.

Late psychological symptoms after awareness were described in 1961.<sup>14</sup> Since then, post-traumatic stress disorder (PTSD) has been defined and identified as a complication of awareness.<sup>2</sup> To date, five studies that address the incidence of late psychological symptoms after awareness have been published. Four of those were retrospective, and the only prospective study included no more than nine interviews.<sup>2–5,15</sup> These studies reported a high incidence of late psychological symptoms (range, 39–84%), and in one study, 56% of patients developed PTSD, although the definition of symptoms and diagnoses in these studies were not uniform. Because awareness cases are difficult to find, advertising, referral, and closed claims analyses have been used for retrospective inclusion. However, these methods for recruiting patients may have allowed for selection bias in previous retrospective studies and led to biased outcomes. Avoidance or lack of interest to participate may have resulted in missed cases, or alternately, it may have resulted in overrecruiting of dissatisfied patients and those who seek economic benefit.

To minimize selection bias, we used a prospective consecutive interview after surgery, to recruit patients who considered themselves to have experienced awareness during any previous anesthesia. The aim of the study was to assess the incidence and general severity of immediate and delayed problems due to awareness.

## Materials and Methods

### Patients

Two thousand six hundred eighty-one consecutive patients, from January 2001 to May 2002, who had undergone general anesthesia 1–3 days earlier, were interviewed according to Brice *et al.*<sup>16</sup> One additional question was added to the interview: whether they had experienced awareness earlier in life. Ninety-eight patients (3.7%) considered themselves as having been aware during previous general anesthesia. These patients were considered eligible for further exploring about long-term consequences of awareness. The study was ethically approved by the institutional review board at Linköping University, Linköping, Sweden.

Six patients died before inclusion. A letter with information, including content and arrangement of the interview, was sent to the remaining 92 patients. Of these, 4 were excluded because of stroke or dementia, 7 declined to participate, and 2 patients could not be

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**Table 1. Interview Structure**

Interview Heading	Subheading	Answers	Score
1. Personal data	Sex	Male/female	
	Age	Years	
	Awareness year	Years	
	Awareness age	Years	
	Number of operations before awareness	Number	
	Number of awareness	Number	
	Preoperative nervousness	Yes/no	
	Type of operation	Name	
	Use of muscle relaxants	Yes/no	
	Hospital name	Name	
2. Detailed description of the awareness episode		Unprompted own story	
3. Sensory perception during the awareness episode	Auditory	Yes/no	
	Visual	Yes/no	
	Tactile	Yes/no	
	Pain	Semiquantitative	0–2
	Paralysis	Yes/no	
4. Acute emotions during the awareness episode	Helplessness	Semiquantitative	0–2
	Acute fear	Semiquantitative	0–2
	Panic	Semiquantitative	0–2
			Total max 6
5. Cognition during the awareness episode	Understanding what was happening	Yes/no	
	Trying to communicate	Yes/no	
	When realized that they had been aware	Immediate–delayed	
6. Late psychological symptoms after awareness	Anxiety	Semiquantitative	0–2
	Chronic fear	Semiquantitative	0–2
	Nightmares	Semiquantitative	0–2
	Flashbacks	Semiquantitative	0–2
	Indifference	Semiquantitative	0–2
	Loneliness	Semiquantitative	0–2
	Lack of confidence in future life	Semiquantitative	0–2
			Total max 14
7. Handling of the knowledge of having been aware	Contacted medical help?	Yes/no	
	Diagnose?	Name	
	Post-traumatic stress disorder diagnosis?	Yes/no	
	Changed opinion about surgical medical care?	Yes/no	
	Reluctant to latest operation?	Yes/no	
	Told anyone about the awareness experience?	Yes/no	
	If told anyone: Their reaction?	Description	

reached. Therefore, 79 patients were interviewed by telephone after informed consent.

### Interview

The duration of each telephone interview was approximately 45 min. A structured protocol divided into seven sections, similar to that of Schwender *et al.*,<sup>5</sup> was used. The different sections were personal data, detailed own description of the awareness episode, sensory perception, acute emotions and cognition during the awareness episode, late psychological symptoms afterward, and handling of the knowledge of having been aware. Each section was subdivided (table 1). In uncertain cases, medical records were obtained, if possible, and checked.

### Data Analysis and Statistics

Three coworkers with experience from awareness studies independently assessed the interviews for awareness classification. The classification decision was unanimous in all cases but three. In those three cases, a 2 to 1 majority was considered as awareness after discussion. The out-

come measures for the parameters were either yes or no responses, except for three. The three parameters measuring acute emotions, the seven measuring late psychological symptoms, and the pain parameter were also semiquantified: 0 = none, 1 = light to moderate, and 2 = severe. This gives a maximum total severity score of 6 for acute emotions and 14 for late psychological symptoms (table 1). Acute emotions and late psychological symptoms were also classified as no (total score = 0) and yes (total score = 1–14). Because of the small numbers, logistic regression was not considered appropriate. The Fisher exact test (two-tailed) was used on parameters considered as interesting in advance, namely: sex, relaxant anesthesia, pain during surgery, acute emotions during the awareness episode, and late psychological symptoms.

## Results

### Patient Characteristics

Four of the 79 possible cases were performed using regional anesthesia. Another 29 patient stories were not

Table 2. Patients Classified as Not Being Awareness Cases

Patient No.	Operation Year	Age at Operation, yr	Sex	Operation	Perception
31	1988	32	F	Breast implant	Woke up. Someone touched her breast. Heard voice asking her PID. Could talk and told her PID.
37	1948	10	F	Adenoid abrasion	Woke up sitting. Bleeding. Difficult to breathe. Vomiting.
41	1968	17	M	Appendectomy	Saw the OR lamp.
97	2001	29	M	Shoulder arthroscopy	Woke up. Tachycardia. Heard nurse calling doctor. (2/1)
292	1988	52	F	Aortic aneurysm	Heard nurse say "We breathe for you" and "She has 28°C." Laid in an ICU bed.
416	1986	30	M	Laryngoscopy	Felt tube. Hard to breathe. Nurse talked to him.
736	1995	28	M	Appendectomy	No memories from surgery. Remember surgical wound dressing.
988	1982	22	F	Cholecystectomy	Several hours of trance-like state in the PACU.
1279	1990	30	F	Abortion	Heard doctors talking about her operation. After completed surgery.
1335	1997	73	F	Laparotomy	Remembered herself screaming continuously.
1380	1999	75	M	Cholecystectomy	Heard "We must have more blood." No blood given.
1419	1950	24	F	Repair after delivery	Death experience with both the devil and God.
1469	2001	60	M	Cholecystectomy	Heard voices and saw doctor and nurse. He was dancing with the nurse and surgical instruments.
1750	2001	27	F	Laparotomy	Heard surgical instruments and saw nurse. After completed surgery.
1765	1961	18	M	Excision of skin tumor	Heard voices and saw light. PACU?
2028	2000	41	F	Laparoscopy	PACU. Dream about screaming and being paralyzed.
2049	1982	24	F	Gynecologic laparotomy	Felt endotracheal tube at emergence. Tried to wave arms, maybe managed.
2120	1982	36	F	Uterus myoma	Light and sounds when waking up.
2121	1991	22	F	Placenta extraction	Dream about her delivery.
2216	0	0	F	Abdominal surgery	No memories from surgery.
2254	1996	34	M	Evulsio	Heard nurse talking about "waking up."
2279	1986	19	F	Appendectomy	Postoperative dreams about being paralyzed. No memories.
2306	1992	10	F	Adenoidectomy	PACU. Agitated and screaming.
2390	1953	7	M	Myringotomy	Strange hypnotic stage. Light circles with doctor in the middle.
2442	1935	10	M	Tonsillectomy	Remembered being put to sleep.
2572	1961	12	F	Adenoidectomy	Dream about scary world and death.
2601	1985	34	F	Laparoscopy	Dream about being left and dying.
2648	1980	43	F	Cholecystectomy	Felt endotracheal tube at emergence.
2687	1980	35	F	Thyroidectomy	Felt endotracheal tube at emergence.
Patients whose surgery was performed during regional or local anesthesia					
893	1980	36	F	Hallux rigidus	LA + sedation
1031	1994	24	F	Cesarean delivery	Epidural with suboptimal function
1342	1978	24	M	Vasectomy	LA + sedation
2287	1998	83	F	Hip replacement	Spinal anesthesia

(2/1) = The three assessors were not unanimous; ICU = intensive care unit; LA = local anesthesia; OR = operating room; PACU = postanesthesia care unit; PID = patient identification number.

considered as awareness by the three assessors (table 2). These experiences included perioperative nightmares, memories before or after surgery, and recollections too diffuse for awareness classification. Therefore, the final analysis included 46 awareness cases (table 3).

#### Personal Data

There were 14 men and 32 women. The mean age when the awareness episode occurred was 31 yr (range, 6–62 yr). Five patients were children at the time of awareness (age < 18 yr). The median awareness year

Table 3. Patients Classified as Awareness Cases

Patient No.	AW Year	Age at AW, yr	Sex	Operation	Perception	Acute Emotion Score	Late Symptom Score
34	1952	27	F	Dilatation and curettage	Felt localized touch and pain.	2	0
39	1965	22	F	Cholecystectomy	Felt localized touch and pain. Paralyzed.	2	4
276	1983	45	F	Hysterectomy	Localized severe pain. Saw the nurse. Strong pulse in the head. (2/1)	6	5
331	2000, 2001	40, 41	F	Breast + oophorectomy	Heard doctors talk and the sound from the pulse oximeter. Saw and heard the nurse. Touch but no pain. Paralyzed. "I will die."	6	12
508	1983	22	F	Gynecologic laparoscopy	Felt tube and ventilation. Paralyzed. Heard the nurse.	5	0
536	1993	50	M	Reflux op (Nissen)	Felt pressure and surgery inside. Saw nurse.	0	0
567	1991	38	F	Cesarean delivery	Heard "Now she sleeps," and later "We must give more."	0	0
579	1989	40	F	Thyroid	Felt the tube and suffocation. Paralyzed. Heard voices. Saw light.	6	0
589	1978	32	F	Meckel	Heard "Let's start" and surgical instruments. Paralyzed.	6	0
642	1985	38	F	Nasal septum	Heard "Just a little left" and felt operation in the nose.	1	1
725	1981	33	M	Laryngoscopy	Saw the nurse upside down. She talked calmly to him. Paralyzed.	5	2
755	1982, 1990	30, 38	F	Cesarean delivery + Caldwell-Luc	Comments about her freckles. Felt surgery. Paralyzed.	6	5
818	1997	59	M	Coronary artery bypass grafting	Heard communication between surgeons. Moderate pain from sternotomy.	0	0
879	1988	25	F	Laparotomy	Heard cheerful talking. Paralyzed. Maximal pain.	1	0
1073	1974	30	F	Cholecystectomy	Felt intubation + short surgical instrumentation. Paralyzed. Severe pain.	6	4
1118	1979	20	F	Caldwell-Luc	Felt the tube. Heard the surgeon. Paralyzed.	5	0
1148	1986	23	F	Gynecologic laparotomy	Saw the nurse. She talked calmly to her.	2	2
1185	1983	39	M	Trauma wound repair	Heard talk. Severe pain due to surgery.	1	1
1219	1964, 1966	28, 30	F	Breast × 2	Heard voices and surgical instruments. Paralyzed. Suffocation feeling.	6	0
1229	2001	62	M	Scar-hernia repair	Felt surgery. Saw light.	0	1
1310	1995	43	F	Middle-ear reconstruction	Heard conversation between surgeon and nurse. Felt surgical instruments. Paralyzed.	1	0
1361	1935	12	M	Fracture stabilization	Severe short pain.	0	0
1370	1976	21	F	Cesarean delivery	Severe pain. Heard the baby cry. Paralyzed.	4	0
1381	1991	35	F	Cholecystectomy	Severe pain. Paralyzed. Felt the tube. Heard voices.	2	0
1420	1997	43	F	Endoscopic retrograde Cholangiopancreatography	Heard conversation. Felt the instrument in throat. Pain. Paralyzed.	3	0
1434	1995	31	F	Cesarean delivery	Felt cricoid pressure. Pain on skin incision.	6	5
1589	1965	24	F	Cesarean delivery	Pain on skin incision. Felt the baby being lifted out.	0	0
1608	1963	20	F	Cholecystectomy	Felt pain and tearing in abdomen.	0	0
1761	1985	39	M	Laryngoscopy	The mouth full with instruments. Suffocation feeling. Heard "He's waking up."	2	0
1768	1955	18	F	Fracture stabilization	Felt severe pain.	1	0
1805	1964	16	M	Adenoid abrasion	Heard talking and instruments. "We must tie his arms."	0	0
1950	1997	48	M	Cholecystectomy	Saw operation lamp and mirror image from the wound. Felt surgical instruments.	2	0
2016	1975	29	F	Cesarean delivery	Felt painful skin incision. Heard surgeon say "It's a boy."	0	0
2066	1945	13	M	Evulsion	Severe pain. Tied to wrists and ankles.	4	0
2107	1982	45	F	Breast	Severe localized pain. Paralyzed. Heard voices.	6	4
2112	1964	11	F	Trauma wound repair	Heard voices. Felt suturing.	0	0
2126	1979	29	F	Colectomy	Heard voices. Saw wall. Felt movement in abdomen.	0	0
2163	1968	41	M	Excision of abscess	Heard surgeon's voice. Felt surgical instruments.	0	0
2164	1968	25	F	Cholecystectomy	Heard surgeon's voice. Saw lamp.	0	10
2356	1971	32	F	Cesarean delivery	Heard voices. Felt wound closure.	0	0
2371	1990	29	F	Nasal septum	Heard surgeon and nurse. Saw light. Paralyzed. (2/1)	6	1
2432	1948	26	F	Appendectomy	Heard voices. Felt surgical instruments.	0	0
2433	1955	19	M	Nasal septum	Heard voices. Felt surgical instruments.	0	0
2451	1966	49	F	Dilatation and curettage	Felt surgical instruments. Severe pain.	5	0
2522	1976	6	M	Adenoidectomy	Heard voices and suction sound.	6	2
2714	1979	20	M	Shoulder	Heard and saw nurse. Paralyzed.	4	0

(2/1) = The three assessors were not unanimous; AW = awareness.



**Table 4. Awareness Patients with Any Late Mental Symptom**

Patient No.	Anxiety	Chronic Fear	Nightmares	Flashbacks	Indifference	Loneliness	Lack of Confidence in Future Life	Total	Duration, Characteristics
39	0	0	2	2	0	0	0	4	20 yr. 1–2 times/yr.
276	1	0	2	2	0	0	0	5	5 yr. "Black holes."
331	2	1	2	2	2	2	1	12	Still going on.
									PTSD diagnosed.
642	1	0	0	0	0	0	0	1	A few days.
725	0	0	1	1	0	0	0	2	2 weeks. 2–3 times.
755	1	0	2	2	0	0	0	5	2 months.
1073	0	1	2	1	0	0	0	4	3 weeks.
1148	1	1	0	0	0	0	0	2	In connection with medical care.
1185	0	0	1	0	0	0	0	1	3 weeks.
1229	1	0	0	0	0	0	0	1	Think about it now and then.
1434	1	0	2	2	0	0	0	5	2 yr. At bedtime once a week.
									Panic disorder.
2107	1	0	2	1	0	0	0	4	2 month.
2164	2	2	2	1	1	1	1	10	10 yr.
									Schizophrenia diagnosed. Still medicating.
2371	1	0	0	0	0	0	0	1	Latest years. Mild.
									Family related.
2522	0	0	2	0	0	0	0	2	15 yr. 1–2 times/month.
Total	12	5	20	14	3	3	2	59	

PTSD = post-traumatic stress disorder.

was 1980 (range, 1935–2001). Three patients had experienced awareness on more than one occasion. Muscle relaxants had been used in at least 35 cases (76%). In another 4 older cases, where medical records could not be found, the use of muscle relaxants could not be confirmed. Eleven patients considered themselves as having been nervous before the operation.

#### *Sensory Perception during the Awareness Episode*

Auditory ( $n = 33$ ; 70%) and tactile ( $n = 32$ ; 72%) perceptions were the most common. Twenty patients (46%) had experienced pain, and 14 scored their pain as severe. Seventeen patients had felt paralyzed, and another 12 were not able to tell because they had not tried to move. Visual memories were described in 18 cases (39%). All patients had some kind of sensory perception.

#### *Acute Emotions during the Awareness Episode*

Twenty-six patients experienced helplessness (15 severe and 11 moderate). Acute fear was expressed in 25 cases (15 severe and 10 moderate), whereas panic was disclosed by 20 patients (17 severe and 3 moderate). In total, 30 patients (65%) stated they had experienced an acute emotional reaction (table 3).

#### *Cognition during the Awareness Episode*

Thirty-seven patients claimed that they had understood what was going on, and 31 had tried to communicate.

Eight patients had delayed understanding that they had been aware (range, 1 day to 2 yr).

#### *Late Psychological Symptoms Afterward*

Thirty-one patients denied any late symptom at all (total score 0). In the remaining 15 cases (33%), three of the seven classified late symptoms dominated. These were nightmares ( $n = 11$ ), anxiety ( $n = 10$ ), and flashbacks ( $n = 9$ ) (table 4). The median total severity score was 4 (range, 1–12). Only 8 patients (17%) had a total score above 2. Nightmares and flashbacks accounted for 34 of total 59 points from late symptoms. No obvious trend indicating that the severity of late psychological symptoms after awareness has changed over the years studied was identified. The duration of late symptoms varied, and in 9 patients, they faded within 2 months. In 6 patients, the symptoms persisted for years, albeit in 4 of those patients, the symptoms were restricted to nightmares and flashbacks. The remaining 2 patients had more severe mental problems (total scores of 12 and 10, respectively) and underwent psychiatric care.

#### *Handling of the Knowledge of Having Been Aware*

Thirty-nine patients had told someone about their awareness experience, often family and relatives, but 23 also told the medical staff (surgeon, anesthetist, or nurse). Thirteen of the 39 patients who described their awareness experiences were greeted with skepticism.

**Table 5. Studies on Late Psychological Symptoms after Awareness**

Study	Late Psychological Symptoms, %
Moerman <i>et al.</i> <sup>3</sup>	69
Schwender <i>et al.</i> <sup>5</sup>	49
Osterman <i>et al.</i> <sup>2</sup>	56
Domino <i>et al.</i> <sup>4</sup>	84
Lennmarken <i>et al.</i> <sup>15</sup>	39
Current study	33

During subsequent surgeries, 19 patients (41%) reported a lack of trust in medical staff, but only 4 (9%) had kept this attitude before their most recent surgery. Four patients had contacted medical help because of mental illness. The first had a diagnosis of PTSD. She had been exposed to extreme mental stress earlier in her life. Apart from experiences from two military battles, she had also been raped. The second had a diagnosis of schizophrenia. She was referred from the surgical ward to closed psychiatric care because of psychosis after the gallbladder operation during which she was aware. It is worth noting that she had not told anyone about her awareness experience before she was identified in our study. The third patient had a panic disorder, and the diagnosis of the fourth case was unclear.

#### *Relations between Outcome Parameters*

Acute emotions during the awareness episode, but not sex, pain, or relaxant anesthesia, were significantly related to late psychological symptoms ( $P < 0.05$ ).

## Discussion

In consecutive patients presenting for surgery, we found a smaller proportion of patients with late psychological symptoms after awareness, as compared with previous investigations using other methods for inclusion (table 5). Thirty-three percent of our patients scored at least one point in late symptoms (table 4). In 9 of those 15 cases, the symptoms disappeared within 2 months, whereas the remaining 6 patients had symptoms for years, which is worth taking into consideration. In 4 of these 6 patients, nightmares and flashbacks were the only remaining symptoms. These were insufficient for a diagnosis of PTSD. Two patients with persistent symptoms had contacted psychiatric care. One of these patients had been diagnosed with PTSD, and the other had been diagnosed with schizophrenia. We do not know of any data suggesting that awareness can cause schizophrenia. Although two of our cases developed severe mental problems after their episodes of awareness, it is far from clear that their psychiatric diagnoses can be attributed to the awareness episodes.

Sixty-five percent of the patients had reacted emotionally in the operating room; an experience suggested as

constituting a risk for late psychological symptoms.<sup>5,15</sup> Because our incidence of immediate emotional reactions is at least at the same level as in previous studies, this cannot explain our lower incidence of late psychological symptoms. Among the examined parameters in our study, only acute emotional reactions were statistically related to late psychological symptoms.

The most probable explanation for our low incidence of late psychological symptoms, and the relatively less pronounced severity, is the method by which we identified this study population. Prospective identification of awareness patients is laborious. Of the published studies on symptoms after awareness, only one small study was prospective.<sup>15</sup> Previous retrospective studies have used advertisement, referral, and closed claims analysis for assessing late psychological symptoms.<sup>2-5</sup> Advertisement may mainly appeal to patients with some persisting symptom or interest in their own medical history, whereas patients experiencing avoidance may remain undiscovered. Therefore, inclusion by advertisement may lead to underestimation, as well as overestimation, of the chance to come out well after awareness. Referral requires that the patient has told someone in the medical staff about their awareness experience, which in our study was the case in only 50% of the patients. Referral can also be based on the fact that a patient has contacted medical help because of mental illness, another source of sample bias. Closed claims analysis presumes active action from the patient, and this can also be associated with a wish for economic compensation.

Our results indicate that patients may not disclose an awareness experience spontaneously, previously reported by Osterman *et al.*<sup>2</sup> It was more common to tell family members than medical personnel. Thirteen of our patients were met by skepticism when they told their awareness story.

The 46 cases in our study constitute a mix of different ages, operations, and diagnoses. Five of the patients were children. This finding demonstrates that awareness is not restricted to high-risk surgery or high-risk patients.<sup>17</sup> The year in which the episode of awareness occurred varied. The median year was 1980 (range, 1935–2001). Despite the fact that many of the awareness episodes in this study happened several years ago, the unprompted own description (table 1, number 2) clearly revealed most answers to our questions spontaneously. Many patients reported that they could remember “like it happened yesterday.” van der Kolk *et al.*<sup>18,19</sup> have described that memories tend to be of different quality. Personal traumatic memories are often in some aspects permanent and do not tend to fade over the years as more ordinary memories do. This may be of importance to the quality of the interviews despite that some of the episodes happened many years ago. In accordance with our own previous findings, 17% had delayed explicit memories.<sup>9</sup>

Because awareness often leads to dissatisfaction and concern during subsequent anesthetics, it is not surprising that 41% reported that they were uncomfortable in anticipation of their next anesthesia, the one after being aware. With time and additional personal experience of successful anesthesia, this attitude faded, and before their most recent operation, only 9% maintained similar negative feelings, indicating reversibility.

It is interesting to notice that 33 (42%) of 79 patients being interviewed falsely considered themselves to be awareness victims before the interview.

### Limitations

We did not make any attempt to reach the seven patients who declined to participate in the study. Avoidance is a well-known behavior in patients with stress disorders, and we do not know whether this was the case in these seven patients. However, they could have denied ever having experienced awareness in the first interview, if avoidance was their primary goal. It should also be noted that they have consented to further anesthesia. There may also be other patients with grave avoidance behavior due to awareness, who will not show up for further anesthesia even if they badly need to. Finally, long-term memory may certainly be clouded in some cases.

### Conclusion

Selection bias may affect the incidence and severity of late psychological symptoms in retrospective studies. We interviewed consecutive patients consenting for surgery about previous awareness and found initial problems comparable to those in previous studies, but a considerably lower incidence and less pronounced severity of late psychological symptoms. The method for recruiting patients in studies on late psychological symp-

toms after awareness may affect the apparent severity significantly.

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