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## Incidence of recall, nightmares, and hallucinations during analgosedation in intensive care

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**Abstract** *Objective:* To define the incidence of recall and dreams during analgosedation in critically ill patients. *Design:* Prospective clinical study. *Setting:* Anaesthesiological intensive care unit (ICU) in a university hospital. *Patients and participants:* Two hundred and eighty-nine critically ill patients, who either arrived intubated and sedated at the ICU or required intubation, mechanical ventilation, and sedation during their ICU stay. *Interventions:* none. *Measurements and results:* The patients were interviewed 48–72 h after discharge from the ICU. By a structured interview they were asked whether they recalled any event before they had regained consciousness at the ICU. Moreover they were asked for dreams. Descriptive statistics: 64.7% of all patients did not recall any event, before they regained consciousness. However, 17% ( $n=49$ ) of all patients indicated that they remembered the tracheal tube or being

on the ventilator, before they woke up. Some patients (21.1%) reported dreams or dreamlike sensations. Some patients (9.3%) recalled nightmares, while 6.6% reported hallucinations. *Conclusions:* Critically ill patients reported a high incidence of recall for unpleasant events, which they thought to have taken place before they regained consciousness. The patients, who stayed longer than 24 h at the ICU, indicated vivid memory for nightmares and hallucinations. Further studies are suggested to evaluate: 1) whether there is an impact of the present findings on outcome; and 2) whether clinical scores for sedation or neurophysiological monitoring help to define the exact time, when recall happens, in order to guide therapeutic intervention.

**Keywords** Recall · Dreams · Hallucinations · Intensive care · Critically ill patients · Sedation · Analgesia

### Introduction

Recollection about the time spent in the intensive care unit (ICU) in critically ill patients who require sedation and assisted ventilation became a research focus over the course of recent decades. Several personal observations and an increasing number of group studies dealing with the recollection of patients have been published. Early reports date back to the 1960s and 1970s, when in post-cardiotomy patients psychiatric complications and the impact of environmental stressors were described [1, 2].

Recent studies on patients' reactions during intensive care management have focused on various aspects such as ventilator-associated factors, pain, environmental stressors or patients' emotional response [3, 4, 5, 6, 7]. Long-term follow up studies in ICU patients indicate that a vivid recollection of unpleasant memories (being on the ventilator, being in pain or having nightmares) persists in some patients and results in an impairment of psychosocial functioning [8, 9, 10].

The level of sedation that is deemed optimal during critical care treatment with mechanical ventilation has

markedly changed during recent decades [3, 11, 12]. Specific guidelines are rarely used in the every day routine. Sedation and analgesia in the ICU setting generally aim at protecting patients from the numerous stressful and noxious stimuli, as well as to provide anxiolysis, nocturnal sleep and, sometimes, amnesia. It is also used to decrease sympathetic tone and oxygen consumption in critical conditions, to indirectly stabilise haemodynamics, and to treat agitation and motor activity, which are potentially harmful. Some 20 years ago, patients had to be deeply sedated and even paralysed in order to tolerate mechanical ventilation [11]. Newer ventilatory modes are now partly controlled by the patient or mimic more physiological breathing patterns, thus permitting a lower level of sedation. It is not known, however, whether the altered concept of sedation results in an increased memory for unpleasant events during intensive care [13].

Different questionnaires have been used to assess memory in patients after intensive care, in short-term and in long-term follow-up studies [6, 14, 15]. In the present study, we focus on the question whether the patients recalled any event before they regained consciousness at the ICU. From studies with anaesthetised patients it is known that wakefulness (awareness) during general anaesthesia with explicit recall is of great concern to the patients. The incidence and possible sequelae of subsequent recall of intra-operative events have been highlighted [16, 17]. In ICU patients it is not known whether they in fact experience wakefulness during sedation. The purpose of the present prospective investigation was to evaluate the incidence of wakefulness and dreams in critically ill patients. In order to assess the specific situation of ICU patients adequately, we modified the standard interview technique, which is used to explore awareness in anaesthetised patients [18, 19].

## Materials and methods

The study was approved by the local Ethics Committee. Patients who had been admitted to the ICU ANITO at the Department of Anaesthesiology of the University Hospital Eppendorf (a tertiary care and trauma centre of the University of Hamburg) in 1998 were included in the study if they were sedated and mechanically ventilated on arrival at the ICU, or if they required sedation and intubation during their intensive care treatment. Only those patients were included in the study who were at least 18 years old, and who were able to communicate in German or English, and who had given written informed consent to participate.

Patients were excluded from consideration for the present study, if they had a previous history of a psychiatric disorder or if they were in a persistent state of mental confusion after their transfer to a general ward.

A female medical student (5th year), who was especially trained and not involved in the ICU treatment, interviewed the patients on the 2nd or 3rd day after they were transferred to the general ward. During the study period the nursing and medical staff of the ICU were not informed to avoid any bias.

The structured interview included a standard set of questions (Table 1, modified from [18, 19]). The patients were asked whether they had any memory for events after loss of consciousness and before mental recovery at the ICU. In case of a positive answer, they were classified as having recall (wakefulness). In addition, all patients were asked whether they remembered any dreams.

As independent factors, we registered demographics, diagnosis, and the SAPSII-score at admission to the ICU. In addition, the duration of the ICU treatment, mechanical ventilation, and sedation were recorded. Medication used for sedation and analgesia, the use of antipsychotic drugs, a patient's previous history of alcohol or drugs, or any remarks about states of confusion made in the patient's every day chart were documented as well.

## Statistics

To evaluate the incidence of explicit recall or dreams in ICU patients during analgosedation the interviewees were categorised based on information provided. Three distinct groups were identified: 1) patients without recall; 2) patients with recall; and 3) patients without recall but dreams. Using the group membership as independent variable, group differences in the recorded informa-

**Table 1** List of questions to evaluate patients' memory (modified from Liu et al. and Ranta et al. [18, 19])

1. What is the last thing you remembered before you lost consciousness (at the ICU, in the operating room or at the accident)?
2. What is the first thing you remember when you woke up again?
3. Do you remember anything in between these two periods?
4. Do you remember any dreams in between?
5. What is the worst thing you remember during your stay at the ICU?
6. What is the most pleasant memory of the ICU?
7. Have you been prepared for your treatment at the ICU?

Additional questions, if question 2 or 3 was answered with "Yes":

1. What kind of sensory perception did you have: auditory, visual or sensory sensations, pain, paralysis?
2. Did you feel or think anything about it?
3. Did you feel anything in your mouth or throat?
4. Did you think you had dreamt?
5. Did you have any idea how long it lasted?
6. Was it day or night?
7. Did you try to contact anybody?
8. Did this event had any consequences for you?
9. Did you talk to anybody from the personnel or your relatives/friends about your experience?
10. Did this experience influence your attitude towards your treatment at the ICU?

tion was tested for significance on an exploratory basis. Due to the heterogeneity of variance non-parametric statistics (Kruskal-Wallis test) were applied. Stepwise logistic regression analysis was used to identify a robust set of predictors for group membership (dichotomised: 0=patients without recall, 1=patients with recall and/or dreams).

## Background

All kinds of surgical patients, who required postoperative intensive care (with the exception of cardiosurgical or neurosurgical patients, who were admitted to other ICUs of the hospital), were admitted to the ICU ANITO.

The ICU is staffed by a senior doctor, one specialist of anaesthesiology, four residents of anaesthesiology (serving in 8-h shift work), and one surgical resident. The ten beds are divided in two bedrooms with big windows, and the nurse/patient ratio is 1:2. The staff also includes two physiotherapists, an ICU technologist, and a secretary. Regular consultations were performed by the surgeons and microbiologists. Neurologists, psychiatrists, and other specialist are consulted whenever needed.

Routine patient management, including analgesic and sedative regimes, was maintained during the study. There were no common sedation guidelines for all patients, but usually propofol – supplemented by opioids – was used in the immediate postoperative course, while midazolam in combination with sufentanil was frequently used in long-term sedation. Clonidine was often used during the weaning periods. Sedation was fine-tuned by the nurses to the target level set three times per day at the ward rounds. In general, a day and night rhythm was pursued.

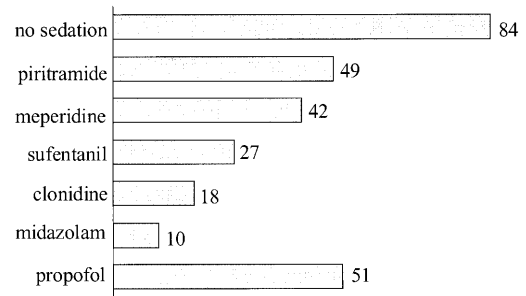
## Results

A total number of 329 patients were approached for the purpose of the study. Data were collected from 289 patients. Nineteen patients refused to participate. Five patients could not be interviewed due to mental confusion. Eleven patients died before the scheduled interview. Five patients could not communicate because of language problems.

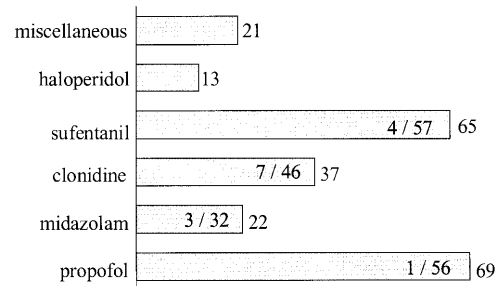
Table 2 summarises demographics and the details about the ICU stay of the 289 patients, whose data were available for the following analyses. Two hundred and twenty patients (76.1%) were elective admissions, while 69 (23.9%) were emergency admissions. All participants were surgical patients except one medical, who required intubation and sedation because of bronchial asthma. Another three patients did not require surgery, because two were readmitted after surgery due to respiratory insufficiency and one patient was transferred from another hospital because of a thoracic trauma. All the other patients

**Table 2** Demographics and parameters of the ICU treatment (median; minimum/maximum)

Patients	n=289
Age	56 (18/76)
Gender	122 female /167 male
SAPS Score	26 (6/58)
ICU stay (days)	1 (0.6/97)
Sedation (days)	0.13 (0/79)
Ventilation (days)	0.3 (0.3/85)



**Fig. 1** Medicaments given for sedation for patients with an ICU stay of less or equal 1 day ( $n=167$ ): numbers indicate the number of patients



**Fig. 2** Medicaments given for sedation for the patients with an ICU stay of more than 1 day ( $n=127$ ): numbers indicate the number of patients. Numbers in the bars indicate the duration (days; median/range) of continuous i.v. drug application

came via the operating theatre to the ICU except one patient, who required surgery later. While 162 patients were transferred to a general ward within the first 24 h, 127 patients remained at the ICU. The medication used for sedation and/or analgesia is shown in Figs. 1 and 2.

The vast majority of the patients (233, i.e., 80.6%) remembered that they had got the information about their admittance to the ICU prior to anaesthesia (90.9% of the patients with elective admission, 49.3% patients with emergency admission). Fifty-six (16.3%) patients did not remember being given any information or were uncertain.

## Recall

One hundred and eighty-seven patients (64.7%) stated that they did not remember anything of the period between loss of consciousness and regaining it during their ICU stay. Among them 16 patients did not even remember having been at the ICU at all (5.5% of all patients). Of all patients, 49 (17%) described some memory of either the tracheal tube, being on the ventilator or the procedure of extubation ( $n=5$ ), before they thought they regained consciousness. This group of patients was classified as having experienced recall/wakefulness. Thirty-two of them stayed less than 1 day at the ICU (i.e., 11% of all

**Table 3** Incidence of recall and dreams

ICU duration	<1 day (n=162)	>1 day (n=127)
Recall (n)	19.8% (32)	13.4% (17)
Dreams	7.5% (12)	38.6% (49)
Nightmares	2.5% (4)	18.1% (23)
Hallucinations	0.6% (1)	14.2% (18)
Miscellaneous	4.4% (7)	6.3% (8)

patients or 19.8% of the patient, who stayed less than one day at the ICU, respectively; Table 3). Thirteen of them did not receive any sedatives or analgesics at the ICU before they were extubated, after being transferred from the operation theatre. Only eight of the patients with wakefulness reported that they remembered dreams, too.

### Dreams

Some of the patients [21.1% (n=61)] indicated that they remembered dreams (Table 3). Twenty-seven (9.9%) reported unpleasant dreams and classified them as nightmares. In addition, 19 patients (6.6%) reported unpleasant hallucinations. Among them, nine patients experienced very frightening true-to-life delusions. Either somebody was trying to kill or kidnap them or they were involved in terrifying military actions. An example of a paranoid delusion, which one patient recalled, is given. However, at the time of the interview most of the patients indicated that they were not sure whether these events really had happened or not. They were reluctant to talk about these experiences and looked anxious being reminded of them. Eight patients reported remembrance of pleasant dreams, while another seven patients did remember emotionally indifferent dreams.

### Example

A 59-year-old male patient suffered from peritonitis that required 67 days of intensive care treatment. He reported on a doctor giving him an i.v. injection in order to kill him. His wife performed a tracheotomy to save his life. At the time of the interview, he was still convinced that this happened in reality. In spite of this experience he expressed his satisfaction with the ICU treatment.

### Results of non-parametric statistics

Based on their reports patients were divided into three distinct groups: group 1=no recall (n=187), group 2=explicit recall (n=49), group 3=dreams/hallucinations (n=53). Patients with dreams and recall (n=8) were allocated to the group 2.

The Kruskal-Wallis tests revealed significant differences between the three groups for age ( $P<0.001$ ), SAPS

**Table 4** Demographic and ICU related factors which differ among patients without recall (group 1), with recall (group 2), and dreams (group 3). Median; minimum and maximum are given

	Group 1 n=187	Group 2 n=49	Group 3 n=53
Age (years)	58 (15/91)	44 (22/72)	59 (26/86)
SAPS-Score	25 (6/58)	25 (6/54)	28 (13/46)
ICU stay (days)	1 (0.8/81)	1 (0.6/14)	7 (1/97)
Sedation (days)	0.02 (0/65)	0.25 (0/14)	4 (0/79)
Ventilation (days)	0.25 (0.1/72)	0.36 (0.1/14)	2 (0.1/85)
Elective admissions	148	39	33
Emergency admissions	39	10	20

score ( $P=0.014$ ), alcohol abuse ( $P=0.024$ ), elective or emergency admission ( $P=0.033$ ), and ICU-treatment-related factors [ICU stay ( $P<0.001$ ), duration of assisted ventilation ( $P<0.001$ ) and sedation ( $P<0.001$ ), duration of sufentanil ( $P<0.001$ ), propofol ( $P<0.001$ ) or clonidine application ( $P<0.001$ ); Table 4]. Patients, who had experienced wakefulness were younger than the patients of the two other groups. Patients who remembered dreams, on the other hand, stayed longer at the ICU and needed longer assisted ventilation and sedation than the patients of the other two groups. Their SAPS scores at admittance tended to be higher than the ones in the other patients.

### Associated factors

A stepwise logistic regression analysis revealed that the duration of the ICU treatment was the best predictor for the occurrence of recall or dream. Compared to the overall correct prediction rate of 63.2% by chance the prediction is improved by 7.2% (70.4%), when ICU days are taken into account. The longer the patients needed intensive care treatment the higher the risk of having recall or dreams was. Predictability was slightly further increased when age was included as a second predictor (72.2% correct prediction). As a tendency, younger patients seem to be more prone to experience recall or dreams.

## Discussion

The design of the present study differed from previous studies in its systematic exploration of patients' experience using a standard questionnaire for evaluating patients after general anaesthesia. Recall (wakefulness) was defined as the ability of the patients to recall any event which they believe occurred during the period between loss and recovery of consciousness. We documented in 17% of the patients symptoms of wakefulness. However, this estimate is not based on objective criteria but on subjective patients' reports. Given the content of their memory, events during the weaning phase from the respirator are most likely to be recalled, when sedation



either was stopped or adjusted to a lower level. While most of the patients only recalled being mechanically ventilated, five patients recalled the extubation and described it as an extremely unpleasant experience. This is in line with the findings of Puntillo et al. who reported on two patients, for whom the removal of the chest tube was extremely painful, "it felt like pulling my guts out" [7]. Novaes et al. indicated in their study that pain, the impossibility to sleep, and having tubes in the nose or the mouth were considered the most severe physical stressors in critically ill patients [6].

There are previous studies evaluating general aspects of memory in ICU patients. Turner et al. documented in a group of 100 medical ICU patients that the most frequently reported unpleasant experience was arterial gas sampling (48% of the patients) and tracheal suctioning (30 of 68 patients) [20]. However, 36 of the patients did not receive any drugs for sedation or analgesia. Bergbohm-Engberg et al. documented a high incidence (37–59%) of recall for the respirator treatment in 304 medical, surgical, and trauma ICU patients [3]. Unfortunately, there was no information about the regimen of sedation. From their subsequent studies they concluded that nursing care might be more efficient in helping patients to cope with the stressful respirator treatment than heavy i.v. sedation or analgesia [21]. This is in line with the study of Russell, who pointed out that psychological problems after discharge from the ICU might have been prevented by improved communication between staff and patients [22]. The patients of the present study did not report spontaneously that they remembered any communication with the ICU staff at the time when they experienced wakefulness. Therefore it remains unclear whether they would benefit from a better communication. In general, at the present time it remains speculative whether experiencing wakefulness, as demonstrated in this study, has an impact on outcome or not.

While explicit recall was more frequent in the patients who stayed less than 1 day at the ICU, long-term critically ill patients reported nightmares, hallucinations, and/or paranoid delusions. This observation is in agreement with previous studies which indicated that states of confusion are a common problem in long-term ICU patients. Pouchard et al. documented delirium or hallucinations in 33 of 43 ventilated medical ICU patients during the weaning phase [15]. The incidence was significantly higher in the patients sedated more than 5 days. Daffurn et al. interviewed 54 ICU patients, either requiring intensive care due to multi-trauma or major abdominal or thoracic surgery [8]. Three months after discharge seven patients remembered nightmares or hallucinations. Jones et al. found a high incidence of memory for hallucinations and nightmares in 159 patients, who stayed longer than 24 h at the ICU [9, 23]. Almost all of their patients were emergency admissions and presented a vivid memory even 2 months after discharge from the ICU. In long-

term survivors of the acute respiratory distress syndrome (ARDS), an incidence between 63% and 75% for nightmares was documented [10, 24]. Puntillo reported on two patients who remembered hallucinations among 22 patients from a medical ICU [7]. However, there are some studies about the patients' recollection about their ICU stay, in which nightmares, hallucinations, and delusional memory were not documented [6, 20, 25]. Certainly this is due to differences in the study designs. Some studies were sampling different ICU patient populations, others used a less precise interview technique. Recently, Jones et al. published promising data about the validation of a new tool to assess memory in ICU patients (ICUM tool), which certainly will be helpful to standardise future research [14].

There are several reasons why patients become prone to psychological disturbances during their ICU treatment. Despite the significant changes in the set-up of ICU environments, the risk of physical or psychoreactive disturbances persists [1, 26]. Early reports date back to 1965 when in postcardiotomy patients psychiatric complications were described [2]. In subsequent studies a new term was created, the ICU psychosis or the ICU syndrome [27]. There is no recent study indicating the incidence of mental disturbances in surgical ICU patients based on a strict psychiatric evaluation. Therefore the true incidence is not known. As early as 1972, Blacher showed in eight of 12 apparently normal patients psychiatric disturbances after cardiomy which he described as the "hidden psychosis" [1]. He stressed the importance of a careful psychiatric examination. However, our findings were based on the patients' reports only. Even more, we had to exclude the patients who died and the patients who were still confused 3 days after discharge from the ICU. Despite this, we demonstrated a high incidence of patients' recollection of nightmares, hallucinations, and paranoid delusions. Thus the real incidence of psychiatric disorders might even be higher.

Long-term follow-up studies of critically ill patients indicated that the quality of life can be impaired by the development of a post-traumatic stress disorder (PTSD). Schelling et al. documented in survivors of the acute respiratory distress syndrome, that patients who reported multiple traumatic episodes (pain, nightmares, respiratory distress) during intensive care, were likely to show the lowest quality of life with maximal impairment in psychosocial functioning [10]. They suggested that the recollection of traumatic ICU experiences might result in PTSD. Subsequently Jones et al. examined the relationship between memory for the ICU and the levels of anxiety after ICU discharge in 45 patients in detail [23]. They suggested that even relatively unpleasant memories of real events during critical illness give some protection from developing anxiety and PTSD-related symptoms. They proposed that the development of PTSD may be related more to recall of delusions alone. However, wheth-

er the patients may benefit from experiencing wakefulness, as was defined in the present study, remains unclear. At least for patients with awareness (wakefulness) during general anaesthesia it has been shown that they may suffer from PTSD afterwards [17]. However, the results of a recent study indicate as an therapeutic option, that delayed neurotic symptoms disappear when repeated detailed information and psychological support was given to the patients [16].

An interesting question for further research is the attempt to objectify the experience of wakefulness by measuring sedation with clinical scoring systems or electrophysiological monitoring [28, 29]. This might help regarding future therapeutic options. However, titrating the optimal level for sedation in the individual case remains a challenge for the intensivist. However, as Heffner pointed out in his editorial on the area of intensive care "You can't get something for nothing" [30].

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