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Intercurrent complications in chronic alcoholic men admitted to the intensive care unit following trauma

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Abstract *Objective:* A chronic alcoholic group following trauma was investigated to determine whether their ICU stay was longer than that of a non-alcoholic group and whether their intercurrent complication rate was increased. *Design:* Prospective study. *Setting:* An intensive care unit. *Patients:* A total of 102 polytraumatized patients were transferred to the ICU after admission to the emergency room and after surgical treatment. Of these patients 69 were chronic alcoholics and 33 were allocated to the non-alcoholic group. The chronic-alcoholic group met the DSM-III-R and ICD-10 criteria for alcohol dependence or chronic alcohol abuse/harmful use. The daily ethanol intake in these patients was ≥ 60 g. Diagnostic indicators included an alcoholism-related questionnaire (CAGE), conventional laboratory markers and carbohydrate-deficient transferrin. *Measurement and results:* Major intercurrent complications such as alcohol withdrawal syndrome (AWS), pneumonia, cardiac complications and bleeding disorders were documented and defined according to internationally accepted criteria. Patients did not differ significantly between groups regarding age, TRISS and APACHE score on admission. The rate of major intercurrent complications was 196% in the chronic alcoholic vs 70% in the non-alcoholic group ($P = 0.0001$). Because of the increased intercurrent complication rate, the ICU stay was significantly prolonged in the chronic-alcoholic group by a median period of 9 days. *Conclusions:* Chronic alcoholics are reported to have an increased risk of morbidity and mortality. However, to our knowledge, nothing is known about the morbidity and mortality of chronic alcoholics in intensive care units following trauma. Since chronic alcoholics in the ICU develop more major complications with a significantly prolonged ICU stay following trauma than non-alcoholics, it seems reasonable to intensify research to identify chronic alcoholics and to prevent alcohol-related complications.

Key words Alcoholism · Trauma · Intensive care unit · Complications · Infection · Alcohol withdrawal syndrome

Introduction

Alcohol has a greater influence on the frequency of trauma-related death than on the mortality associated with any other disease process [1–3]. Up to 70% of multiple-injured patients in the emergency care department are under the influence of alcohol [4]. The relative risk for admission to the hospital due to chronic alcohol misuse increases with the amount of ethanol consumed daily [5]. The prevalence of chronic alcoholics in traumatized patients is reported to be between 50 and 60% [3, 4, 6].

The wide-ranging effects of acute and chronic alcohol consumption have a significant impact on the initial management of multiple-injured patients. Subsequent intensive care may be complicated by the development of alcoholism-related complications such as bleeding disorders, cardiopulmonary insufficiency and the development of alcohol withdrawal syndrome (AWS) [7–11]. In general wards, the morbidity and mortality are reported to be 2–4 times higher in chronic alcoholics [4, 9, 10]. Tønnesen et al. [8] reported in a retrospective study that the postoperative morbidity after osteosynthesis of malleolar fractures was 33% in chronic alcoholics vs 9% in non-alcoholics.

Patients in the ICU carry the highest rate of nosocomial infections, bacteremia, sepsis and related complications. Overall hospital-acquired pneumonia occurs in 11% of hospitalized patients, but in a previous study on patients admitted to the ICU following trauma, 44% developed a hospital-acquired pneumonia [12, 13]. In this ICU patient population the mechanism, severity and hemodynamic instability on admission remained significant for the prognosis [12, 13]. The development of hospital-acquired pneumonia was associated with a significant morbidity, as demonstrated by an increase in mechanical ventilation and intensive care stay. The probability of hospital-acquired pneumonia directly increased [12, 13] with the number of days mechanical ventilation was required. This may be due to therapy, e.g., for AWS.

Frequently invoked reasons for an increased complication rate in ICU patients are abnormal immunity, invasive monitoring and multiple procedures. It is crucial to realize that bacteremia can range from no consequence to catastrophic events such as multiple organ dysfunction and death. The reasons for different clinical courses are poorly understood, but it becomes clear that it is the host's response rather than the microorganism that will determine these different courses [14]. The severity of a preexisting illness has been demonstrated to be strongly associated with the risk of developing nosocomial infections [15, 16]. It seems that patients who have already received an initial insult such as multiple trauma are prepared for an overwhelming and potentially deleterious response to bacteremia [17].

Chronic alcoholics are reported to have an altered immune system [18, 19] which may play a role in the development of intercurrent complications during ICU stay. Altered cytokine levels have also been implicated in the development of pneumonia and the degree of pulmonary dysfunction [16]. However, there are corroborating data that cytokines are also involved in noninfectious pulmonary injury (i.e., ARDS) following traumatic injury [20–22].

We investigated whether the ICU stay was prolonged in chronic alcoholics following trauma and whether the intercurrent complication rate during the ICU stay was increased in this population.

Patients and methods

Patients

In this prospective clinical trial 102 traumatized male patients admitted to emergency care and transferred for further medical care to the ICU were included. The patients' relatives gave written informed consent to participate in this institutionally approved study (review board: Ethical Committee of the Benjamin Franklin Medical School, Free University Berlin). The study was conducted over a period of 2.5 years.

The patients' basic characteristics such as age, height, weight, Trauma Score and Injury Severity Score (TRISS) [23], Acute Physiology and Chronic Health Evaluation score (APACHE II) [24], and multiple organ failure score (MOF) [25] were documented (Table 1). Excluded from the study were women, and patients under 18 years of age. Women were excluded because a pilot study to calculate the strength of this study showed that the prevalence of alcoholism in traumatized women is lower. Therefore, excluding women also excluded the possibility of relating any observed differences between groups to gender differences.

Diagnosis of chronic alcohol abuse and alcohol dependence

The patients' histories and the results of the alcoholism-related questionnaire (CAGE) [26] were taken from the patients or the relatives. The CAGE questionnaire is short, precise and clinically practicable. Buchsbaum et al. [27] found a good correlation between the CAGE questionnaire and the DSM-III-R [28] criteria for alcohol dependence. All chronic alcoholics met the DSM-III-R and ICD-10 criteria for alcohol abuse/harmful use or dependence [28–30]. Alcohol-dependent patients were either treated with pharmaco-prophylaxis to counteract AWS in the ICU or, if AWS developed, were managed accordingly. Patients with a daily ethanol intake ≤ 25 g and a CAGE = 0 were considered to be at no risk of developing postoperative alcoholism-related complications, and they served as controls. The investigator responsible for the alcoholism-related history was blinded to the documentation of the intercurrent complications during ICU stay.

Overall, a total of 250 consecutive patients were seen in the emergency room. In 51 cases the patients or their relatives did not give consent to participate in this study. In 36 cases the patients withdrew the initial consent of their relatives. A group of 47 patients were excluded due to the uncertainty of the alcoholism-related history. Another group of 14 patients were excluded a priori since they were situational drinkers, i.e., they did not meet the DSM-III-R and ICD-10 criteria for alcohol abuse/harmful use or dependence [28–30], although their daily ethanol intake exceeded 25 g.

Laboratory markers

Blood for the carbohydrate-deficient transferrin (CDT) kit was drawn in a separate vacutainer Becton Dickinson Inc., Meylan Cedex, France). The blood was immediately centrifuged at 3000 RPM for 10 min. The serum was then cooled to −80 °C. CDT was determined by microanion exchange chromatography (MAEC) and subsequent turbidimetry [31]. In brief, buffering and separation of the iron-saturated samples were performed on a disposable two-compartment microcolumn. For rapid quantitation of CDT in the microcolumn elution, a latex-enhanced turbidimetric immunoassay was employed. On the microcolumn, the iron-saturated sample was exhaustively equilibrated to the elution buffer (20 mmol l^{-1} 2-*N*-morpholoino-ethanesulfonic acid, pH 5.65) during the passage through the upper sephadex G-25 compartment. The lower DEAE-sepharose compartment completely retained oligosialotransferrins, whereas the asialo- and monoasialotransferrins were quantitatively eluted. The transferrin content of the elution was then quantitated on a Cobas Mira analyzer using unidisperse latex particles coated with human transferrin IgG as a turbidimetric reagent. The analyzer directly calculated CDT concentration values from a calibration curve that remained stable for at least 4 weeks [31]. A CDT above 9 mg/l was defined as pathologically elevated [11].

Conventional laboratory parameters, such as mean corpuscular volume (MCV), aspartate amino-transferase (ASAT), alanine-aminotransferase (ALAT) and γ-glutamyl-transferase (GGT), were obtained according to clinical routine.

Experimental protocol

Blood sampling was performed via intra-arterial pressure line upon admission. Fluid administration (crystalloids, colloids, proteins, transfusions) was recorded. Diagnoses, intensive care treatment (i.e., medications), operations, and length of ICU stay were documented. Vital signs, laboratory markers, and post-traumatic complications were also documented. Pneumonia requiring mechanical ventilation, sepsis, cardiac complications, bleeding disorders, AWS and death were considered major intercurrent complications. Antibiotic prophylaxis with cefotiam was given to every patient upon admission to the ICU. The antimicrobial regimen was changed according to the susceptibility of the isolated organism during the ICU stay. If the patient developed pneumonia and no organism was isolated, cefotaxim and gentamicin were administered, and if required, surgical drainage was performed.

Infections were determined with respect to the CDC criteria [32]. All patients with pneumonia had a new pulmonary infiltrate as evidenced by the chest x-ray (CXR), recent onset of purulent sputum or a change in character of the sputum, and rales or dullness to percussion on examination present in an area corresponding with the infiltrate. Organisms isolated from specimens obtained by endotracheal suctioning or bronchial alveolar lavage are listed in Table 2. Sepsis was defined according to the Society of Critical Care Medicine Consensus Conference [33].

A bleeding disorder was diagnosed if the patient required transfusions or if the patient had to be operated on due to persistent bleeding. Cardiac complications included a new onset of bradycardia below 40 beats per minute, which was associated with hypotension, tachycardia above 180 beats per minute, new blocks, malignant arrhythmias (e.g., complex ventricular premature beats), congestive heart failure with pulmonary or peripheral edema, angina (new ECG changes with reversible ST segment horizontal or downslopping shift of >0.1 mV from baseline lasting >1 min and separated from the next episode by >1 min plus chest pain with at least three of the following characteristics: substernal or precordial location, precipitation by stress, duration <15 min, resolution after sedation or nitroglycerin treatment) and myocardial infarction (ECG changes plus positive laboratory markers plus clinical definition).

Table 1 Basic patient characteristics and alcoholism related history (*CAGE* alcoholism-related questionnaire)

	Units	Chronic alcoholics ($n = 69$)	Non-alcoholics ($n = 33$)	
Age	(years)	42 (18–87)[a]	43 (18–87)	NS
Weight	(kg)	79 (55–106)	82 (66–108)	NS
Height	(cm)	181 (164–191)	179 (165–193)	NS
Daily ethanol intake	(g/d)	260 (60–620)	5 (0–20)	$P = 0.0000$
CAGE[b]		3 (3–4)	0 (0–0)	$P = 0.0000$
Nicotine abuse		35/69 (50%)[c]	11/33 (33%)	NS
Chronic obstructive Lung disease		4/69 (6%)	1/33 (3%)	NS
Congestive heart failure		4/69 (6%)	1/33 (3%)	NS
Coronary artery disease		2/69 (3%)	1/33 (3%)	NS
Hypertension		6/69 (9%)	3/33 (9%)	NS
Diabetes mellitus		4/69 (6%)	1/33 (3%)	NS
Liver disease		7/69 (10%)	1/33 (3%)	NS
Polyneuropathy		8/69 (12%)	1/33 (3%)	NS
Gastritis		6/69 (9%)	1/33 (3%)	NS

[a] median (range)
[b] CAGE
[c] frequency

Table 2 Intercurrent major complications. *AWS* alcohol withdrawal syndrome, *CIWA-Ar* Clinical Institute Withdrawal Assessment for alcohol scale, PaO_2 arterial oxygen tension; FIO_2 inspired oxygen fraction; VO_2 oxygen consumption; DO_2 oxygen delivery; *PTT* partial thromboplastin time

	Units	Chronic alcoholics ($n = 69$)	Non-alcoholics ($n = 33$)	
Major complications		135/69 (196%)	23/33 (70%)	$P = 0.0000$
Death		16/69 (23%)	4/33 (12%)	NS
AWS		42/69 (61%)	0/33 (0%)	$P = 0.0000$
CIWA-Ar		35 (21–61)[a]	6 (0–19)	
Pneumonia	(%)	31/69 (45%)	8/33 (24%)	$P = 0.0454$
Period after admission	(d)	6 (3–14)	4 (3–26)	
Mechanical ventilation	(d)	13 (2–35)	15 (2–50)	
PaO_2/FIO_2 (worst)	(mmHg)	152 (52–383)	144 (66–248)	
Organisms isolated:		18/31	5/8	
Pseudomonas aeruginosa		7	2	
Staphylococcus aureus		4	1	
Hemophilus influenzae		2	0	
Other gram-negative		2	1	
Other gram-positive		1	0	
Yeast		2	1	
Sepsis		19/69 (28%)	4/33 (12%)	NS
Period after admission	(d)	4 (2–23)	6 (5–10)	
Lactate (max)	(mmol/l)	3.6 (2.3–8.9)	4.1 (3.1–7.3)	
Dopamine (max)	($\mu g\,kg^{-1}\,min^{-1}$)	3.0 (2.8–17.7)	3.2 (2.9–10.4)	
Dobutamine (max)	($\mu g\,kg^{-1}\,min^{-1}$)	9.8 (4.2–15.5)	10.2 (4.8–15.6)	
Norepinephrine (max)	($\mu g\,kg^{-1}\,min^{-1}$)	0.93 (0.15–6.84)	0.86 (0.12–6.15)	
$V0_2$ (min)	($ml\,min^{-1}\,m^{-2}$)	100 (47–143)	83 (44–150)	
$D0_2$ (max)	($ml\,min^{-1}\,m^{-2}$)	929 (827–989)	867 (563–1477)	
PaO_2/FIO_2 (worst)	(mmHg)	165 (60–429)	190 (66–337)	
Cardiac complications		11/69 (16%)	4/33 (12%)	NS
Period after admission	(d)	4 (2–14)	3 (1–15)	
Congestive heart failure		3/11	3/4	
Arrhythmias		8/11	2/4	
Bleeding disorder		16/69 (23%)	3/33 (9%)	NS
Period after admission	(d)	4 (1–17)	5 (3–6)	
Hemoglobin (min)	(mmol/l)	8.6 (6.9–10.3)	9.2 (7.5–10.9)	
Hematocrit (min)	(%)	32.0 (21.9–40.9)	33.5 (22.8–37.2)	
Transfusion	(ml)	750 (250–5500)	500 (250–4500)	
Operation		9/16	1/3	
Thrombocyte count (min)	(g/l)	80 (18–133)	66 (18–114)	
Prothrombin index (min)	(%)	55.0 (30–76)	43.5 (34–53)	
PTT (max)	(sec)	42 (28–73)	44 (28–69)	

The differential diagnosis of AWS was made by an accepted algorithm [34]. A shortened 10-item scale [the revised Clinical Institute Withdrawal Assessment for Alcohol scale (CIWA-Ar)], was used for clinical quantitation of the severity of AWS [35]. Diagnosis was confirmed by a participating neurology consultant. Symptoms and therapeutic regimens were documented in the study protocol.

Statistical analysis

All data was expressed as median and range. Sensitivity was calculated as the ratio of the number of chronic alcoholics with positive tests to the total number of all chronic alcoholics [36]. Specificity was calculated as the ratio of non-alcoholics with a negative test, to the number of all non-alcoholics [36]. The odds ratio (OR) with a 95% confidence interval (CI) was given to report the occurrence of complications and death. The 95% CI was calculated according to the method of Woolf [37, 38]. If the number of patients in any group was 0 (e.g., in the case of AWS), the best estimate of the difference between groups was given with a 95% CI [39]. Statistical analysis was performed by the Wilcoxon signed rank sum test for determining intergroup differences. The χ^2-test was used to compare dichotomous variables. If the number of patients in any group was <5, then the Fisher exact test was used to compare dichotomous variables. A two-tailed $P \leq 0.05$ was considered significant.

Results

Chronic alcoholics ($n = 69$) and non-alcoholics ($n = 33$) differed in the alcoholism-related history (Table 1), blood-alcohol concentrations, GGT and CDT on admission to the ICU (Table 3). Sensitivity and specificity of CDT and GGT were 55% and 31%,

Table 3 Laboratory markers on admission to the ICU (*BAC* blood alcohol concentration, *CDT* carbohydrate-deficient transferrin, *MCV* mean corpuscular volume, *GGT* γ-glutamyltransferase, *ASAT* aspartate amino-transferase, *ALAT* alanine amino-transferase)

	Normal range	Units	Chronic alcoholics ($n = 69$)	Non-alcoholics ($n = 33$)	
Hb	(8.3–11.5)	(mmol/l)	10.6 (7.7–17.2)[a]	10.8 (6.5–15.4)	NS
Hct	(40.0–48.0)	(%)	31.3 (21.9–49.9)	30.0 (19.3–43.3)	NS
BAC	(0.0–0.3)	(‰)	1.2 (0.4–5.2)	0.0 (0.0–0.3)	$P = 0.0092$
CDT	(0–9)	(mg/l)	9.4 (4.8–32.5)	3.5 (2.0–8.9)	$P = 0.0000$
MCV	(76–96)	(fl)	91.8 (81.4–103.8)	90.4 (80.7–95.3)	NS
GGT	(5–30)	(U/l)	17.0 (3–252)	12.5 (5–31)	$P = 0.0445$
ASAT	(5–17)	(U/l)	29 (4–859)	19 (8–106)	NS
ALAT	(5–23)	(U/l)	21 (2–529)	14 (5–228)	NS

[a] median (range)

Table 4 Trauma and health evaluation on admission to the ICU (*TRISS* Trauma Score and Injury Severity Score, *ISS* Injury Severity Score, *RTS* Revised Trauma Score, *TS* Trauma Score, *APACHE* Acute Physiology and Chronic Health Evaluation Score, *MOF* Multiple Organ Failure Score)

	Chronic alcoholics ($n = 69$)	Non-alcoholics ($n = 33$)	
TRISS	0.921 (0.008–0.997)[a]	0.934 (0.008–0.997)	NS
ISS	23.5 (4–45)	22.0 (4–48)	NS
RTS	6.05 (1.85–7.84)	6.15 (2.09–7.84)	NS
TS	11.0 (5–16)	12.5 (6–16)	NS
APACHE II (admission)	16 (4–37)	16 (2–24)	NS
Mechanical ventilation	69/69 (100%)	33/33 (100%)	NS
MOF (admission)	4 (0–8)	4 (0–8)	NS

[a] median (range)

respectively. Groups did not differ in their TRISS, APACHE II or MOF scores on admission to the ICU (Table 4). All patients had blunt trauma except for three patients in the chronic-alcoholic group and one patient in the non-alcoholic group. Mean arterial pressure did not differ between groups on admission to the trauma center [chronic-alcoholic group median: 62 mmHg (range: 21–76 mmHg), non-alcoholic group median: (66 mmHg (23–75 mmHg), $P = 0.4913$). Blood transfusions before admission to the ICU were 0 ml (median; range: 0–9750 ml) in chronic alcoholics and 0 ml (median; range: 0–8250 ml) in the non-alcoholic group ($P = 0.7732$).

During their ICU stay the chronic-alcoholic group developed more intercurrent complications with a prolonged ICU stay (Fig. 1, Table 2). Tracheobronchitis was significantly more frequent in the chronic-alcoholic group (52/69 = 75%) compared to the non-alcoholic group (15/33 = 45%; $P = 0.0031$; OR = 3.8, 95%CI: 1.6–9.2). Major complications such as AWS and pneumonia significantly differed between groups (Table 2), whereas sepsis, bleeding disorders, and the mortality differed in tendency, but were not significantly different between groups (Table 2; number of patients in each group required to achieve a power of 0.8 in sepsis: 126; in bleeding disorders: 138, in mortality: 620).

For the incidence of AWS the best estimate of the intergroup difference was 61% (95% CI: 49–73%). The

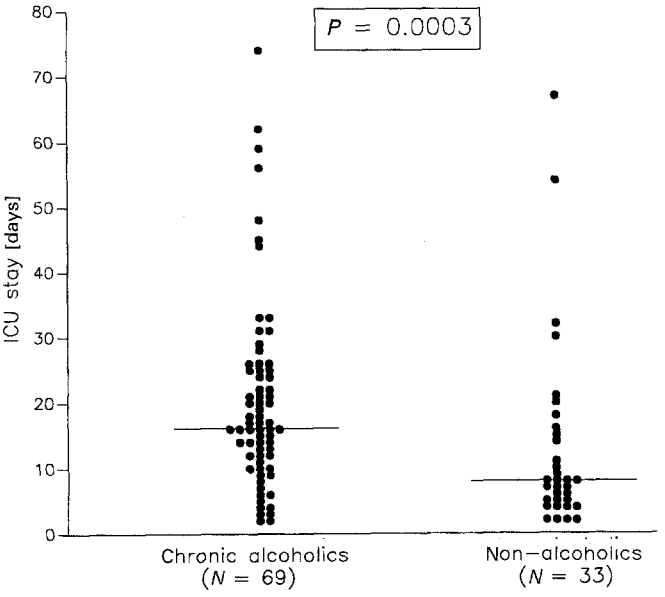

Fig. 1 Intensive care unit (ICU) stay for chronic alcoholics and non-alcoholics. — = median

OR for the occurrence of pneumonia was 2.5 (95% CI: 1.7–3.9). In contrast to the statistical analysis obtained by the χ^2-text for sepsis and bleeding disorders, which did not significantly differ between groups, the OR with

their respective 95% CI showed significant results for sepsis (OR = 2.6; 95% CI: 1.3–5.2) and bleeding disorders (OR = 3.0; 95% CI: 1.4–6.4). For the cardiac disorders (OR = 1.3; 95% CI: 0.6–2.8) and mortality (OR = 2.2; 95% CI: 0.7–7.1) the results obtained did not show significant results.

Discussion

Chronic alcoholics are at risk of developing significantly more major intercurrent complications, which require prolonged ICU treatment. In this study the ICU stay for the chronic alcoholic group was prolonged with a median difference of 9 days. The cost in our ICU is about $1500 USD per patient per day. The complication rate was about three fold increased in the chronic alcoholic group during ICU stay, which is in the range observed in surgical, but not ICU wards. However, the overall complication rate in the ICU compared to surgical, but not ICU wards, was three to eightfold increased [7, 8, 12, 13, 16, 40, 41].

One of the major and life-threatening complications associated with alcohol dependence is AWS, which can be prevented by pharmaco-prophylaxis [11]. In this study only 15 patients received pharmacoprophylaxis and did not develop AWS whereas 42 patients developed AWS i.e., only 22% were detected by clinical routine. This finding is in accordance with a study by Moore et al. [42] who reported in surgical patients that only 23% were detected by the faculty physicians.

The majority of the patients who developed AWS had hallucinations or delirium. Five patients, however, developed vegetative withdrawal symptoms. Recognition and management of AWS is often delayed in ICU patients, which may result in prolonged therapy. The differential diagnosis of alcohol withdrawal syndrome includes a broad spectrum of common complications, e.g., infection, hypoxemia, bleeding, metabolic and electrolyte disorders, and pain [34]. Cognitive disorders and productive-psychotic symptoms such as hallucinations are more difficult to diagnose in the ICU, particularly in intubated patients.

To prevent or reduce complications, the precise diagnosis is important. Alcoholism-related questionnaires can often not be administered because of trauma and subsequent intubation, and when these tests are administered, it is important to have an experienced investigator, or the results may often not be reliable. Blood-alcohol concentrations only indicate acute abuse. In a previous study in traumatized patients, 76.2% of the patients with positive blood alcohol concentrations and 62.5% of the patients with negative blood alcohol concentrations had a diagnosis of psychoactive drug dependence [6]. Other conventional laboratory markers have also been reported to be lacking in sensitivity and specificity [11, 43], particularly in this patient population [11].

GGT and CDT were highly specific and significantly differed between groups. While sensitivity for GGT was only 31%, CDT was the most sensitive (55%) and specific marker in the patients investigated, as has been found previously in surgical patients [11]. The sensitivity was, however, less than reported previously [11] which may be related to the fact that 87 patients did not give or withdrew their consent to participate in this study. It cannot be excluded that the majority of these patients were chronic alcoholics. Another factor that may influence the degree of sensitivity is that trauma patients require volume substitution and blood transfusion before admission to the ICU, which may also have lowered the sensitivity of the laboratory markers. No laboratory marker, including CDT, can differentiate between chronic alcoholics who will develop AWS and those who will not [11, 43].

Patients who required prolonged treatment due to the development of AWS developed pneumonia in 19 out of 42 cases (45%), which is in the range observed for all chronic alcoholics. Pneumonia is the most common hospital-acquired infection in the ICU [12]. Its impact varies dramatically, depending on the patient population evaluated. In this study, the diagnosis of pneumonia was made using defined criteria for nosocomial infections (CDC) [16]. All patients had new or changing infiltrates, as evidenced by CXR, which has been demonstrated to distinguish surgical ICU patients with pneumonia from those who have only colonized respiratory tracts [44].

When organisms were isolated, proper antimicrobial treatment was administered. Proper antimicrobial selection and sufficient duration of treatment have previously been shown to be associated with a successful outcome for pneumonia [44, 45]. In a previous study by Malangoni et al. [16] it was reported that pseudomonal and staphylococcal pneumonias are especially difficult to treat. In the present study most of the organisms isolated were *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

All patients in the present study were intubated and mechanically ventilated on admission to the ICU, due to traumatic injury. Intubation of the trachea has been reported to result in a seven- to tenfold increase in the incidence of nosocomial pneumonia [40, 41], which may partly explain the higher overall complication rate in the patients investigated than in surgical patients, but not in ICU wards [7, 8]. Craven and colleagues

[46] have shown that mechanical ventilation in a high-risk patient is a risk factor for fatality from pneumonia. The severity of pneumonia, as evidenced by the PaO_2/FIO_2 ratio, did not differ between the investigated groups. When the infectious process was under control, a vigorous attempt was made to wean patients from the ventilatory support. Mechanical ventilation did not significantly differ between the chronic alcoholic group and the non-alcoholic group with pneumonia.

The severity of preexisting illness has also been demonstrated to be strongly associated with the risk of developing nosocomial infections [15]. The chronic alcoholic group and the non-alcoholic group in the present study did not differ regarding preexisting diseases. Other major complications such as cardiac complications and mortality did not significantly differ between groups probably because of insufficient data. There was a tendency for both sepsis and bleeding disorder complications to be different between groups. The statistical analysis by the χ^2-test did not show significant results. However, the odds ratio with their respective 95% confidence intervals showed that the incidence of sepsis and bleeding disorders differed between groups. The imprecision might be the result of the limited sample size. On the other hand, the purpose of this study was to determine whether chronic alcoholics had a prolonged ICU stay following trauma and whether the total complication rate was increased and, therefore, the calculation of the power of this study was limited to its aim.

In conclusion, this study showed that chronic alcoholics had a prolonged ICU stay due to an increased post-traumatic morbidity. AWS was prevented in 15 alcohol-dependent patients by pharmaco-prophylaxis and AWS developed in 42 alcohol-dependent patients. Since there is no laboratory marker that can identify patients who will develop AWS, further studies are required to find diagnostic parameters to detect alcohol-dependent patients. In this study the incidence of tracheobronchitis and pneumonia was significantly higher in chronic alcoholics and sepsis and bleeding disorders occurred more frequently. Therefore, research with respect to alterations in the immune status [18, 19] and platelet dysfunction [47] in chronic alcoholics should be intensified.

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