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Alcohol withdrawal syndrome in trauma patients: a study using the Trauma Quality Program Participant User File

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ABSTRACT

Objective To identify the rates and possible predictors of alcohol withdrawal syndrome (AWS) among adult trauma patients.

Methods This is a retrospective review of all adult patients (18 years or older) included in the 2017 and 2018 American College of Surgeons Trauma Quality Program Participant User File (PUF). The main outcomes were rates and predictors of AWS.

Results 1 677 351 adult patients were included in the analysis. AWS was reported in 11 056 (0.7%). The rate increased to 0.9% in patients admitted for more than 2 days and 1.1% in those admitted for more than 3 days. Patients with AWS were more likely to be male (82.7% vs. 60.7%, p<0.001), have a history of alcohol use disorder (AUD) (70.3% vs. 5.6%, p<0.001) and have a positive blood alcohol concentration (BAC) on admission (68.2% vs. 28.6%, p<0.001). In a multivariable logistic regression, history of AUD (OR 12.9, 95% CI 12.1 to 13.7), cirrhosis (OR 2.1, 95% CI 1.9 to 2.3), positive toxicology screen for barbiturates (OR 2.1, 95% CI 1.6 to 2.7), tricyclic antidepressants (OR 2.2, 95% CI 1.5 to 3.1) or alcohol (OR 2.5, 95% CI 2.4 to 2.7), and Abbreviated Injury Scale head score of ≥3 (OR 1.7, 95% CI 1.6 to 1.8) were the strongest predictors for AWS. Conversely, only 2.7% of patients with a positive BAC on admission, 7.6% with a history of AUD and 4.9% with cirrhosis developed AWS.

Conclusion AWS after trauma was an uncommon occurrence in the patients in the PUF, even in higher-risk patient populations.

Level of evidence IV: retrospective study with more than one negative criterion.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Alcohol use disorder is one of the most common mental disorders worldwide with reported rates up to 50% in trauma patients. The incidence of alcohol withdrawal syndrome (AWS) in hospitalized patients is estimated to be approximately 1%.

WHAT THIS STUDY ADDS

⇒ This study reports current rates of AWS in hospitalized trauma patients using national data, the risk factors for AWS as well as the incidence of AWS in high-risk populations.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Prophylaxis for AWS is frequently used in trauma patients. Results of this study may allow clinicians to tailor prophylaxis only to higher-risk populations.

INTRODUCTION

Alcohol use disorder (AUD) is one of the most common types of mental disorders worldwide. According to the most recent National Epidemiologic Survey on Alcohol Related Conditions III, the lifetime prevalence of AUD in the USA is 29.1%, with highest rates in respondents who were male, younger than 65, white or Native American, and of the lowest income level.[1] AUD was also associated with other substance use disorders, mood disorders, and personality disorders.[1] Rates of AUD are even higher in hospitalized patients, with some studies estimating rates above 40%. Specifically, hospitalized trauma patient populations have been observed to have AUD rates greater than 50% in some studies.[2]

Alcohol withdrawal syndrome (AWS) is a complication of cessation of alcohol consumption in patients with extended periods of use. According to the 2016 WHO definition, AWS occurs 6 hours to 48 hours after cessation of alcohol consumption and abates after 2 days to 5 days when uncomplicated. It is characterized by tremor, sweating, anxiety, agitation, depression, nausea, and malaise. Complicated/severe AWS can also present with grand mal seizures, hallucinations, and, in rare circumstances, delirium tremens (DT).[2] DT, although only accounting for 5% of severe AWS, can lead to electrolyte abnormalities, fluid shifts, rhabdomyolysis, autonomic dysregulation, respiratory failure, cardiac failure, and even death.[3]

The purpose of this study was to evaluate the rates and predictors of AWS among adult trauma patients using the American College of Surgeons Trauma Quality Program Participant User File (PUF) database.

METHODS

The 2017 and 2018 Trauma Quality Program Participant User Files (TQP-PUFs) (Committee on Trauma, American College of Surgeons, NTDB Admission Year 2018, Chicago, Illinois, USA) were the data sources for this study. The TQP-PUF, which has replaced the previously available National Trauma Data Bank (NTDB) Research Dataset,

represents an annual representative dataset of all US trauma centers that submit to the NTDB under the American College of Surgeons and contains data on adult and pediatric patients from level I to IV and undesignated trauma centers. The TQP-PUF were combined and analyzed for all traumatic injuries among adults aged 18 years or older.

Patient factors, including demographics, comorbidities, results of toxicology screens, rates of severe injury (Abbreviated Injury Scale (AIS) score ≥3), and Injury Severity Scores (ISSs), as well as hospital factors were abstracted. The study used the standard NTDS dictionary definitions. The primary outcome was the reported rate of AWS.

Statistical analysis was performed using IBM SPSS Statistics V.26 using analysis of variance and χ^2 as appropriate; statistical significance was assumed for p values of <0.05. Multivariable logistic regression was performed to determine the independent predictors of AWS after initially selecting potential independent variables using univariate analysis with the criteria p value of <0.2.

RESULTS

A total of 1 677 351 adult patients were included in the statistical analysis. Overall, AWS was reported in 0.7% of patients (n=11 056). This rate increased to 0.9% and 1.1% when length of stay (LOS) reached 2 and 3 days, respectively. Patients classified as having AWS were more likely to be male (82.7% vs. 60.7%, p<0.001), white (79.9% vs. 73.6%, p<0.001), or Native American (2.1% vs. 0.1%, p<0.001).

The overall incidence of AUD in this patient population was 6% (n=101 283). Patients with AWS were more likely to have AUD (70.3% vs. 5.6%, p<0.001) and have a positive blood alcohol concentration (BAC) on admission (68.2% vs. 28.6%, p<0.001). Furthermore, patients with AWS were more likely to have a higher average ISS (12.3 vs. 9.4, p<0.001) and to require blood transfusion within the first 4 hours of admission (6.4% vs. 4.4%, p<0.001) (table 1).

Using multivariable logistic regression analysis, we identified several predictors for developing AWS after trauma. History of AUD (OR 12.9, 95% CI 12.1 to 13.7), cirrhosis (OR 2.1, 95% CI 1.9 to 2.3), positive toxicology screens for barbiturates (OR 2.1, 95% CI 1.6 to 2.7), tricyclic antidepressants (OR 2.2, 95% CI 1.5 to 3.1), alcohol (OR 2.5, 95% CI 2.4 to 2.7) and AIS head score of ≥3 (OR 1.7, 95% CI 1.6 to 1.8) were the strongest predictors for AWS. Conversely, only 2.7% of patients with a positive alcohol screen, 7.6% with history of AUD and 4.9% with cirrhosis developed AWS.

Table 1 Comparison of adult trauma patients with AWS versus non-AWS

	AWS	Non-AWS	P value
Age (years)	54.81±12.2	53.69±21.3	0.001
Gender (male)	82.73336	60.7231	<0.001
ISS	12.3±8.6	9.4±8.4	<0.001
AUD	70.28127	5.612015	<0.001
Positive BAC	68.15758	28.60293	<0.001
Native American	2.089174	0.092179	<0.001
Asian	0.750656	1.881973	<0.001
Black	9.044044	14.26652	<0.001
White	79.94031	73.6246	<0.001
Latino	9.364237	11.22124	<0.001
Need for blood transfusion within 4 hours	6.357603	4.391881	<0.001

.AUD, alcohol use disorder; AWS, alcohol withdrawal syndrome; BAC, blood alcohol concentration; ISS, Injury Severity Score.

DISCUSSION

This study of the largest trauma database in the USA shows that AWS is a relatively uncommon occurrence—even in higher-risk patient populations such as those with AUD or cirrhosis—a finding that is consistent with previous smaller studies. Our study identified the strongest predictors of developing AWS after trauma are history of AUD or cirrhosis, positive BAC on admission, positive toxicology for barbiturates or tricyclic antidepressants, and AIS head score of ≥3.

The severity of AWS is most often determined using the Clinical Institute Withdrawal Assessment for Alcohol (CIWA-Ar) scale. This assessment evaluates parameters such as nausea/vomiting, tremors, anxiety, agitation, sweating, orientation, headache, tactile, auditory, and/or visual disturbances to assign a score.[4] Scores greater than or equal to 10 generally indicate patients with moderate withdrawal who may benefit from medication therapy. A score of 20 or higher is indicative of severe withdrawal. The limitation with the CIWA-Ar scale is that it has not been validated in critically ill patients due to the subjective nature of some of the parameters assessed and the need for patient participation. Consequently, some institutions use other scales such as the modified Minnesota Detoxification Scale (mMINDS) for critically ill patients with AWS. The mMINDS avoids some of the subjective components of the CIWA-Ar assessment and replaces them with objective measures such as heart rate, diastolic blood pressure, and presence of seizures. The correlation between these two assessments is strong, especially at scores of 10 or less. Thus, a hybrid protocol was developed by Yale New Haven Hospital for patients with moderate or severe AWS. Patients requiring initial admission to the intensive care unit with two consecutive low mMINDS scores are transitioned to the CIWA-Ar scale for further assessments when they transfer to a general hospital unit. This protocol not only allows patients to be assessed with the appropriate scoring system but also gives some insight into downgrading level of care.[5 6]

A large systematic review and meta-analysis from 2014 sought to identify predictors of severe AWS in all patients. The strongest predictor of DT or alcohol withdrawal seizures was a previous history of one of these events. Furthermore, baseline thrombocytopenia and hypokalemia were predictive of progression to DT.[7] Our study, specifically focusing on trauma patient populations, identified additional predictors unique to the trauma patient, including history of AUD or cirrhosis, positive BAC, positive drug screen for barbiturates or tricyclic antidepressants, and AIS head score of ≥3.

Trauma patient populations have a higher prevalence of AUD and therefore an overall higher risk of developing AWS. Current national guidelines recommend screening for AUDs among all trauma patients.[8] One previous study of three US trauma centers showed a rate of AWS 0.88% of all trauma patients. While the overall rate was low, the incidence of severe AWS (CIWA-Ar score >20) was high in that patient population, with 53% being classified as having severe AWS. That study also identified baseline CIWA-Ar score of 10 or more and age greater than or equal to 55 to be predictors of DT. Furthermore, in patients with severe AWS, severe head injury also predicted progression to DT. Hospital LOS, intensive care unit LOS, and complications of AWS differed by severity of AWS, but mortality did not, except for patients who progressed to DT who had an overall mortality of 11.1%.[9]

There are limitations with the current study. The first limitation is that these data were reported by many individual trauma center registries and are therefore difficult to completely standardize. For instance, the lower prevalence of AUD reported compared with previous studies could be due to lack of a universal definition and/or screening for AUD in the adult trauma population even though the NTDB Data Dictionary uses *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition, criteria. This relative subjectivity likely affects the diagnosis of AWS to a lesser degree as CIWA-Ar and mMINDS are relatively universally accepted scoring systems for AWS. The second limitation is the difficulty in discerning AWS in the setting of concurrent TBI and/or cirrhosis with hepatic encephalopathy, which can present in similar manners. Furthermore, the CIWA-Ar scale relies on patient participation and communication of their symptoms; patients with altered sensorium may not be adequately assessed. The third limitation is that this study does not classify the severity of AWS, which is clinically significant as more severe cases are likely to have a larger impact on outcomes than mild cases. Finally, the Program PUF registry does not account for treatment or even prophylactic medication regimens for AWS, which could alter CIWA-Ar and mMINDS scoring and potentially artificially decrease the number of recorded patients with AWS in the database.

In some trauma centers, prophylaxis for AWS is administered broadly to all patients with either history of alcohol use and/or positive alcohol test on admission. The results of this study demonstrate that perhaps only a small portion of this population develops AWS and suggest that a more tailored approach may be warranted especially since prior studies have identified that only 5% of patients with AWS develop DT. Full understanding of the rates of AWS in trauma patients and who necessitates prophylaxis will require a prospective, ideally multicenter, observational study that is designed specifically to capture data on AUD, signs and symptoms of AWS including their timing and severity, as well as any therapy implemented for prophylaxis. Such study could then be used to develop a scoring system to identify the highest-risk patients and study earlier interventions for AWS such as phenobarbital monotherapy and evaluate their impact on outcomes such as mortality and LOS.[10] Conversely, another area of study would be to focus on identifying patients who are at low risk of developing AWS and who may not warrant more intensive monitoring and/or prophylactic treatment. This can then be further tested in a prospective study that would randomize this lower-risk population to prophylaxis versus observation.

CONCLUSION

AWS after trauma was an uncommon occurrence in the adult patients in the PUF database. There are certain predictors of patients who may be at higher risk of developing AWS, but rates remain low even in these high-risk populations. The rates may be lower than previously recorded estimates due to several factors, so further investigations are warranted, especially prior to making recommendations to change current practices.

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REFERENCES

1 Grant BF, Goldstein RB, Saha TD, Chou SP, Jung J, Zhang H, Pickering RP, Ruan WJ, Smith SM, Huang B, *et al*. Epidemiology of DSM-5 alcohol use disorder: results from the national epidemiologic survey on alcohol and related conditions III. *JAMA Psychiatry* 2015;72:757–66.
2 Maldonado JR, Sher Y, Ashouri JF, Hills-Evans K, Swendsen H, Lolak S, Miller AC. The " prediction of alcohol withdrawal severity scale" (PAWSS): systematic literature review and pilot study of a new scale for the prediction of complicated alcohol withdrawal syndrome. *Alcohol* 2014;48:375–90.
3 Wood E, Albarqouni L, Tkachuk S, Green CJ, Ahamad K, Nolan S, McLean M, Klimas J. Will this hospitalized patient develop severe alcohol withdrawal syndrome? *JAMA* 2018;320:825.
4 Sullivan JT, Sykora K, Schneiderman J, Naranjo CA, Sellers EM. Assessment of alcohol withdrawal: the revised clinical Institute withdrawal assessment for alcohol scale (CIWA-ar). *Br J Addict* 1989;84:1353–7.
5 Littlefield AJ, Heavner MS, Eng CC, Cooper DA, Heavner JJ, Kurtz JM, Pisani MA. Correlation between mminds and CIWA-ar scoring tools in patients with alcohol withdrawal syndrome. *Am J Crit Care* 2018;27:280–6.
6 Heavner JJ, Akgün KM, Heavner MS, Eng CC, Drew M, Jackson P, Pritchard D IX, Honiden S. Implementation of an ICU-specific alcohol withdrawal syndrome management protocol reduces the need for mechanical ventilation. *Pharmacotherapy* 2018;38:701–13.
7 Goodson CM, Clark BJ, Douglas IS. Predictors of severe alcohol withdrawal syndrome: a systematic review and meta-analysis. *Alcohol Clin Exp Res* 2014;38:2664–77.
8 Kodadek LM, Freeman JJ, Tiwary D, Drake MD, Schroeder ME, Dultz L, White C, Abdel Aziz H, Crandall M, Como JJ, *et al*. Alcohol-Related trauma reinjury prevention with hospital-based screening in adult populations: an eastern association for the surgery of trauma evidence-based systematic review. *J Trauma Acute Care Surg* 2020;88:106–12.
9 Salottolo K, McGuire E, Mains CW, van Doorn EC, Bar-Or D. Occurrence, predictors, and prognosis of alcohol withdrawal syndrome and delirium tremens following traumatic injury. *Crit Care Med* 2017;45:867–74.
10 Ammar MA, Ammar AA, Rosen J, Kassab HS, Becher RD. Phenobarbital monotherapy for the management of alcohol withdrawal syndrome in surgical-trauma patients. *Ann Pharmacother* 2021;55:294–302.