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# Management of Delirium Tremens

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**Delirium tremens is recognized as a potentially fatal and debilitating complication of ethanol withdrawal. Research thus far has primarily focused on the prevention of delirium tremens.**

Key words: *alcohol, withdrawal, dependence, benzodiazepines, barbiturates, propofol, clonidine, GABA*

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A primary goal in the treatment of delirium tremens (DT) is avoiding further injury associated with its complications. Therefore, early diagnosis and therapeutic intervention are important to limit the complications associated with DT. Precise determination of DT is complicated. Hospital admissions for ethanol detoxification encompass approximately 32% of all admissions, whereas roughly 52% of admissions involve ethanol and an illicit drug. These complicating factors make it more difficult to recognize DT because overt signs and symptoms may overlap with other substance withdrawal [1]. Along with recognizing the diagnostic features of delirium defined by the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.) (*DSM-IV*) listed in Table 1 [2], the clinician can use several other pieces of information to relate the diagnosis to ethanol withdrawal. This should include a history of ethanol use, medical complications associated with ethanol use (ie, liver function tests), and physical exam. Risk factors that serve as possible positive predictors of DT may be found in Table 2 [3],

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and the signs and symptoms of DT are found in Table 3.

Other conditions need to be ruled out before DT is diagnosed, for example, primary intracranial disease such as infection, neoplasm, seizure, or vascular complications; systemic diseases that secondarily affect the brain (eg, cardiopulmonary disease, endocrine/metabolic disease, infection, or nutritional deficiency); exogenous toxic agents other than alcohol; or withdrawal from other medications that may cross the blood-brain barrier. Once DT has been diagnosed, prompt treatment is imperative to prevent further injury.

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## Presentation

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Delirium tremens is a serious complication of ethanol withdrawal, affecting 5% to 10% of patients admitted to the hospital [4]. As its name indicates, the main features of this condition are delirium (marked by increased mental confusion, changes in consciousness, and persistent hallucinations) and tremors. In addition, severe agitation and signs of autonomic hyperactivity (ie, increased heart rate, blood pressure, and respiratory rate) are also associated with DT [5] (Table 3). Delirium tremens is seen approximately 3 to 5 days after a patient's last ingestion of ethanol [6] (Figure 1). The mortality rate of patients who experience DT ranges from 5% to 15% (7). This mortality rate is attributable to the complications associated with the clinical manifestations of the condition. For example, a patient with hallucinations may become destructive and hurt himself or herself, or an otherwise cardiac-healthy individual could die from a myocardial infarction secondary to coronary spasms associated with intense autonomic hyperactivity, a consequence of DT [8]. In most cases, the signs and symptoms associated with DT will persist for about 5 to 10 days, with 62% resolving in 5 days or less [9]. Patients who present with any of these symp-

**Table 1.** Diagnostic Criteria for Substance Withdrawal [2]

- A. Disturbance of consciousness with reduced ability to focus, sustain, or shift attention.
- B. A change in cognition or the development of a perceptual disturbance that is not better accounted for by a preexisting, established, or evolving dementia.
- C. The disturbance develops over a short period of time and tends to fluctuate during the course of the day.
- D. Evidence from the history, physical examination, or laboratory findings that symptoms in Criteria A and B developed during, or shortly after, a withdrawal syndrome.

**Table 2.** Risk Factors for Delirium Tremens [5]

Infectious disease  
Tachycardia at admission  
Withdrawal signs with BAL >1 g/L  
History of epileptic seizures  
History of delirious episodes

DT = delirium tremens; BAL = blood alcohol level.

toms should be evaluated and treated appropriately to prevent further complications and death.

## Pathophysiology

Ethanol disrupts the balance between inhibitory and excitatory pathways of the central nervous system (CNS). Ethanol's primary function as a CNS depressant is the result of modulation of 2 primary sites, the  $\gamma$ -aminobutyric acid type A (GABA<sub>A</sub>) and *N*-methyl-D-aspartate (NMDA) receptors. Ethanol's interaction with each of these receptors influences the body's function while intoxicated and during the withdrawal state.

The GABA<sub>A</sub> receptor is a ligand-gated chloride (Cl<sup>-</sup>) ion channel. When the GABA<sub>A</sub> receptor is activated by the neurotransmitter GABA, the ion channel opens, allowing an influx of Cl<sup>-</sup> ions through the postsynaptic membrane. This leads to an inhibitory effect via hyperpolarization of the nerve ending [10]. When ethanol interacts with the GABA<sub>A</sub> receptor, it augments the GABA activity on the receptor, thus enhancing the opening of the ion channel. This allows for more Cl<sup>-</sup> ions to flow into the nerve terminal [4, 11]. Thus, there is an augmented inhibitory effect without an increase in the affinity or amount of GABA binding to the receptor [12] (Figure 2). During ethanol withdrawal, when there is no ethanol present, the influx of Cl<sup>-</sup> ions decreases relatively with the same amount of GABA binding to the receptor. This results in a

**Table 3.** Signs and Symptoms of Delirium Tremens [7]

Severe agitation  
Tremor  
Disorientation  
Persistent hallucinations (auditory and visual)  
Large increases in heart rate, breathing rate, pulse, and blood pressure

decreased inhibitory effect and thus relative increase in nerve firing. The increase in neural activity may lead to some of the manifestations associated with DT, such as tremors and autonomic stimulation.

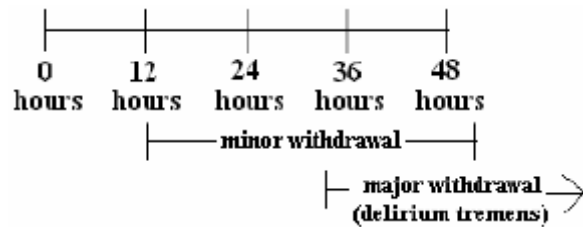
The second receptor affected by ethanol is the NMDA receptor. Ethanol has been shown to inhibit the excitatory function of the NMDA receptor by the excitatory neurotransmitter glutamate [9, 13, 14]. Patients who exhibit chronic alcohol use have an up-regulation of these receptors in the CNS [15]. During alcohol withdrawal, the inhibition is removed, allowing for an increase in excitatory conduction in the affected portion of the CNS. This reaction is potentiated by the increased number of NMDA receptors during up-regulation [15]. This mechanism may account for certain manifestations (ie, increase in heart rate, blood pressure, and tremors) associated with DT.

## Drug Class Evaluation for Use in Delirium Tremens

Management of the withdrawal process coupled with comorbidities and patient specific goals will dictate appropriate pharmacotherapeutic management. Several classes of medications are available for the acute management of DT.

### Benzodiazepines

In the United States, benzodiazepines (BZD) have been established as the medications of choice for prevention and treatment of DT [16-21]. Benzodiazepines modulate the actions of the GABA<sub>A</sub> receptors by increasing the affinity of the neurotransmitter GABA for the receptors [22]. Biochemically, this allows for more Cl<sup>-</sup> ions to cross the terminal membrane and cause an inhibitory effect. The major role of BZD is to substitute the GABA modulating effects that alcohol provided to the patient [23]. This pharmacological inhibitory effect will aid in decreasing symptoms



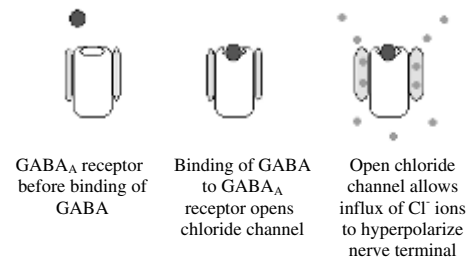
**Fig. 1.** Timeline of alcohol withdrawal [17].

associated with DT. Benzodiazepines have been proven to be safe and efficacious in preventing complications associated with DT [23]. Selection of a BZD in a hospital setting is dependent on several factors including route of administration, onset and duration of action, hepatic function, and inpatient formulary status. Chlordiazepoxide, diazepam, lorazepam, and midazolam are in this class of medications used in an acute withdrawal setting to treat DT [19, 20]. See Table 4 for descriptions of each type of BZD.

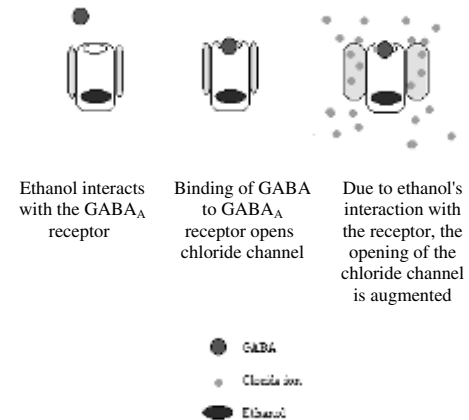
There are no studies showing one BZD to be more efficacious than another [21]. When selecting a BZD in the treatment of ethanol withdrawal, the clinician must consider many factors. All BZDs in Table 4 are available in oral and intravenous dosage forms. Lorazepam may be favorable in some clinical situations because it offers intramuscular administration. Lorazepam does not have active metabolites, making it an attractive choice in patients with decreased hepatic or renal function [6].

Doses of BZD used during DT may exceed that which is considered to be normal. The pharmacologic intent of therapy is to stimulate the production of GABA at a rate that would be considered equivalent to that produced by the ethanol. In 1 case, 2640 mg of intravenous diazepam administered over 48 hours was needed to control a 34-year-old patient admitted to an emergency setting with acute alcohol withdrawal [24]. Genetic differences in patients may contribute to the variable response seen with BZD [25]. In some patients, higher quantity of BZDs may be warranted to achieve the desired sedating effect. After choosing a BZD, the clinician must establish the dosing schedule. Symptom-triggered therapy has been shown to have a better efficacy profile than fixed scheduled dosing in patients admitted for detoxification but not necessarily for treatment of the DT. This method of detoxification may lead to the use of less medication, decreased cost, and, therefore, less sedated patients [26].

#### Normal Conditions:



#### During Ethanol Intoxication:



**Fig. 2.** Binding of  $\gamma$ -aminobutyric acid type A (GABA<sub>A</sub>) during normal physiologic conditions and during ethanol intoxication.

## Haloperidol

Haloperidol is used to control psychiatric symptoms associated with DT such as anxiousness, hallucinations, and combativeness. Haloperidol should be used only as adjunctive therapy with BZD because its mechanism of action does not target the GABA<sub>A</sub> or NMDA receptors [27]. The usual dose is 2 to 20 mg intravenously every 1 hour as needed until the patient is calm [16, 17]. The administration of haloperidol in DT should be as needed and in addition to other primary therapy. Haloperidol's use is warranted if the patient's psychiatric symptoms (ie, hallucinations) are not being controlled with standard BZD therapy. If this medication is deemed to be necessary, data suggest that the medication should be provided via a standing dosage regimen and continued even after the patient's acute psychosis and agitation resolve [25]. Decreased psychosis or agitation should be evaluated using *DSM-IV* guidelines. This is important because a decrease in delirium may only be attrib-

unable to the fluctuations that may occur, and tapering the medication allows for a complete assessment of the patient's mental status. A standing dose of haloperidol will serve as a bridge from acute agitation and psychosis to normal mental status provided that underlying psychiatric illness is not present. Electrocardiographic monitoring is essential while the patients are receiving haloperidol. Haloperidol can prolong the QT<sub>c</sub> interval greater than 450 milliseconds or more than 25% above baseline, increasing the risk of torsade de pointes [16, 27-29].

### Phenobarbital

Theoretically, phenobarbital would be a good choice in the management of DT because of its similar mechanism of action to BZD. Phenobarbital also acts on the GABA<sub>A</sub> receptors in the CNS and increases the affinity of GABA binding to its receptor [22]. This increases the inhibitory effect needed to counteract the excitatory surge during DT. Literature has shown that the incidence of respiratory depression and coma during treatment is much higher with the use of phenobarbital versus BZD [19, 22, 30]. In addition, phenobarbital's long half-life ( $t_{1/2}$  = 80-120 hours) may result in difficulties in titrating an effective dose for sedating and waking a patient, hindering evaluation of the patient's progress.

### Propofol

The use of propofol has been documented in the treatment of refractory DT [31]. McCowan and Marik [31] stated that propofol's mechanism of action includes the modulation of the GABA<sub>A</sub> as well as the NMDA receptors. Propofol has a favorable pharmacokinetic profile, particularly for patients in an intensive care unit setting. Its rapid onset and short half-life make it readily titratable but may also create problems if therapy is abruptly discontinued. Once the propofol infusion has been stopped, patients wake up suddenly and in this setting can still be undergoing the ethanol withdrawal process. Propofol's sedative dose has been established as 20% to 50% of the general anesthetic dose (approximately 0.3-1.25 mg/kg) [31, 32]. The monitoring requirements are more intense than with BZD. Propofol administration may precipitate hypotension and bradycardia. The medication is administered in a lipid emulsion and may adversely affect a patient's lipid panel.

Increases in lipid load may precipitate pancreatitis. Patients who are receiving parenteral nutrition may need to have their formulations adjusted because of the caloric load from the intralipid vehicle present in propofol. Patients on propofol require an increase in monitoring, and the use of propofol should be restricted to critical care environments. Propofol remains an alternative to more traditional courses of therapy.

### Other Agents

Although their use is beneficial, anti-adrenergics,  $\beta$ -blockers, and clonidine treat the symptoms of autonomic hyperactivity, such as increased blood pressure and heart rate, and do not stop the delirium associated with the withdrawal process. These agents should be used as adjunctive therapy in combination with medications affecting the GABA pathway [33].

The use of carbamazepine has been shown to be effective in treating patients in the early stages of alcohol withdrawal; however, its use in the treatment of DT has not been studied. Therefore, its efficacy has not been proven [17]. Clancy [17] chronicled 4 cases where patients initially failed BZD and administration of carbamazepine therapy had an effect. The use of carbamazepine in the treatment of DT has not been studied adequately.

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### Goals of Therapy

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To improve the chance for positive outcomes for the patient with DT, 4 primary goals of therapy must be addressed. It is vital that all goals are evaluated throughout the course of therapy.

### Prompt Diagnosis of Delirium Tremens

Refer to Tables 1 and 2.

### Pharmacotherapy Based on Pharmacology

The second goal of therapy is to select medications that target the main 2 sites of ethanol withdrawal, the GABA<sub>A</sub> and/or NMDA receptors. Understanding the pharmacology of each medication used is important in the selection of pharmacotherapeutic options because different agents will affect the outcomes for the patient. Agents differ in whether they

**Table 4.** Comparison of Different Benzodiazepines [16, 22]

Benzodiazepine	Equipotent Dose (mg)	Half-Life (h)	Onset	Duration	Active Metabolites	Dose for Treatment of Delirium Tremens [13, 17, 18, 36]
Chlordiazepoxide (Librium®)	20	10 ± 3.4	Intermediate	Short-acting/ long-acting metabolites	Yes $t_{1/2}$ = 5-30 h	NA <sup>a</sup>
Diazepam (Valium®)	5	43 ± 13	Very fast	Short (active drug) Intermediate (inactive metabolite)	Yes $t_{1/2}$ = 30-200 h	10-20 mg IV/PO every 1-4 h PRN
Lorazepam (Ativan®)	1	14 ± 5	Intermediate	Intermediate	No	2-4 mg IV/PO every 1 h PRN
Midazolam (Versed®)	2.5	1.9 ± 0.6	Very fast	Very short	No	NA <sup>a</sup>

$t_{1/2}$  = half-life; IV = intravenous; PO = oral; PRN = as needed; NA = not applicable.

a. No documented dose established.

will affect the underlying pathophysiology or just treat the symptoms. Tables 5 and 6 help divide the medications used into 2 categories: primary and adjunctive therapy.

On a pharmacologic basis, benzodiazepines, phenobarbital, and propofol can effectively target these sites, with benzodiazepines and phenobarbital considered primary agents used for therapy. Propofol is frequently used, but the literature does not definitively support its use as it does for benzodiazepines and phenobarbital. Clinically, phenobarbital is second tier to benzodiazepines because of their long half-life and unpredictable prolonged duration of sedation. Adjunct medications may be used to control excessive symptoms but will not stop the progression of the condition.

### Management of the Patient's Sedation

In addition to pharmacokinetic evaluation of the medications, clinicians have the Clinical Institute Withdrawal Assessment of Alcohol Scale-Revised (CIWA-Ar) [34]. The scale consists of a series of questions that evaluate the patient's therapy progression and any therapy changes that may be needed (Table 7). Although this scale has more commonly been used in the earlier stages of alcohol withdrawal and not necessarily in DT, it does offer goals that should be achieved. These goals, such as blood pressure and agitation goals, are the same in a patient experiencing DT and early stages of alcohol withdrawal. This further illustrates the need for the patient to be controlled effectively by sedatives but not to the extent that the clinician cannot determine the patient's progression. An

overly sedated patient cannot be effectively evaluated, thus increasing the chance that the patient remains hospitalized because a medical verdict cannot be determined.

### Management of Pharmacotherapeutic Adverse Reactions and Monitoring Parameters

The fourth and final goal includes management of the complications associated with the medications used to treat DT. Management of these reactions is essential in the course of treatment because adverse drug reactions can have a negative impact on outcomes for the patient. Tables 8 and 9 depict the advantages and disadvantages of each medication as well as monitoring parameters to prevent adverse reactions. For example, use of propofol, a potent general anesthetic, dictates monitoring the patient's triglycerides because the medication's formulation is in a lipid emulsion that increases the patient's lipids and precipitates clinical complications [35].

### Summary

The management of DT in the acute care setting is a complex, ongoing problem. The manifestation of acute alcohol withdrawal may serve as a complicating factor for patients who are acutely ill with multiple comorbidities. Agitation is a key component of DT and may complicate the management of patients in the intensive care unit. The noradrener-

**Table 5.** Medication Pharmacology [20]

Medication	Examples	Receptor Medication Acts On and Location	Interaction With Receptor That Pertains to Delirium Withdrawal	Predicted Outcome
Benzodiazepines	Librium® (chloridiazepoxide), Valium® (diazepam), Ativan® (lorazepam), Versed® (midazolam)	GABA <sub>A</sub> in CNS	BZD binds to BZD site on GABA <sub>A</sub> receptor in CNS. This enhances the binding of the NT GABA to the receptor to increase its inhibitory effect.	Decrease in anxiety and autonomic hyperactivity (ie, BP, HR, tremors) Increase in seizure threshold
Barbiturates	Luminal® Phenobarbital	GABA <sub>A</sub> in CNS	BZD binds to its receptor on the GABA <sub>A</sub> receptor in CNS. This enhances the binding of the NT GABA to the receptor to increase its inhibitory effect.	Decrease in anxiety and autonomic hyperactivity (ie, BP, HR, tremors) Increase in seizure threshold
Antipsychotics	Haldol® (haloperidol)	Unknown	Unknown	Decrease in psychiatric symptoms of DT including anxiousness, hallucinations, and combativeness
Anesthetics	Diprivan® (propofol)	GABA <sub>A</sub> and NMDA in CNS	Activates the GABA <sub>A</sub> receptor to increase conductance of Cl <sup>-</sup> , thus increasing inhibitory effect in the CNS. Inhibits the NMDA receptor, thus decreasing its excitatory effect	Decrease in anxiety and autonomic hyperactivity (ie, BP, HR, tremors) Increase in seizure threshold
β-Blockers	Tenormin® (atenolol)	β <sub>1</sub> in heart	Block binding to β <sub>1</sub> receptors in the heart	Decrease peripheral resistance, heart rate, and blood pressure
α-Adrenergics	Catapres® (clonidine)	γ <sub>1</sub> in periphery	Stimulation of peripheral α <sub>1</sub> -adrenergic receptors causing increase in peripheral vasodilation	Decrease peripheral resistance, heart rate, and blood pressure

GABA<sub>A</sub> = γ-aminobutyric acid type A; CNS = central nervous system; BZD = benzodiazepine; NT = neurotransmitter; BP = blood pressure; HR = heart rate; DT = delirium tremens; NMDA = N-methyl-D-aspartate; Cl<sup>-</sup> = chloride ion.

Table 6. Pharmacokinetics of Primary Medications Used for Treatment of Delirium Tremens [22, 32]

Medication	Half-Life, $t_{1/2}$ (h)	Physiological States Affecting $t_{1/2}$	Usual Sedative-Hypnotic Dose (mg)	Formulations
<i>Benzodiazepines</i>				
Chlordiazepoxide (Librium®)	10 ± 3.4	NA	50-100 qd-qid	O, IM, IV
Diazepam (Valium®)	43 ± 13	↑ in cirrhosis and elderly	5-10 tid-qid	O, IV, IM, R
Lorazepam (Ativan®)	14 ± 5	↑ in cirrhosis and in renal disease	2-4 qd	O, IM, IV
Midazolam (Versed®)	1.9 ± 0.6	↑ in cirrhosis, obese, and elderly	NA	IV, IM
<i>Barbiturates</i>				
Phenobarbital (Luminal®)	80-120	↑ in cirrhosis and elderly	NA	O, IM, IV
<i>Anesthetics</i>				
Propofol (Diprivan®)	1.8	NA	0.3-1.25 mg/kg	IV

qd = daily; qid = 4 times daily; O = orally; IM = intramuscularly; IV = intravenously; tid = 3 times daily; R = rectally; NA = not applicable.

Table 7. Clinical Institute Withdrawal Assessment of Alcohol Scale-Revised (CIWA-Ar) [34]

**Patient:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_ (24-h clock, midnight = 00:00)

**Pulse or heart rate, taken for 1 min:** \_\_\_\_\_ **Blood pressure:** \_\_\_\_\_

**Nausea and vomiting**—Ask “Do you feel sick to your stomach? Have you vomited?” Observation.

0 = no nausea and no vomiting

1 = mild nausea with no vomiting

2

3

4 intermittent nausea with dry heaves

5

6

7 constant nausea, frequent dry heaves and vomiting

**Tactile disturbances**—Ask “Have you any itching, pins and needles sensations, any burning, any numbness, or do you feel bugs crawling on or under your skin?” Observation.

0 none

1 very mild itching, pins and needles, burning, or numbness

2 mild itching, pins and needles, burning, or numbness

3 moderate itching, pins and needles, burning, or numbness

4 moderately severe hallucinations

5 severe hallucinations

6 extremely severe hallucinations

7 continuous hallucinations

**Tremor**—Arms extended and fingers spread apart. Observation.

0 no tremor

1 not visible, but can be felt fingertip to fingertip

2

3

4 moderate, with patient's arms extended

5

6

7 severe, even with arms not extended

**Auditory disturbances**—Ask “Are you more aware of sounds around you? Are they harsh? Do they frighten you? Are you hearing anything that is disturbing to you? Are you hearing things you know are not there?” Observation.

0 not present

1 very mild harshness or ability to frighten

2 mild harshness or ability to frighten

3 moderate harshness or ability to frighten

4 moderately severe hallucinations

5 severe hallucinations

6 extremely severe hallucinations

7 continuous hallucinations



**Table 7.** (continued)**Paroxysmal sweats**—Observation.

- 0 no sweat visible
- 1 barely perceptible sweating, palms moist
- 2
- 3
- 4 beads of sweat obvious on forehead
- 5
- 6
- 7 drenching sweats

**Visual disturbances**—Ask “Does the light appear to be too bright? Is its color different? Does it hurt your eyes? Are you seeing anything that is disturbing to you? Are you seeing things you know are not there?” Observation.

- 0 not present
- 1 very mild sensitivity
- 2 mild sensitivity
- 3 moderate sensitivity
- 4 moderately severe hallucinations
- 5 severe hallucinations
- 6 extremely severe hallucinations
- 7 continuous hallucinations

**Anxiety**—Ask “Do you feel nervous?” Observation.

- 0 no anxiety, at ease
- 1 mild anxious
- 2
- 3
- 4 moderately anxious, or guarded, so anxiety is inferred
- 5
- 6
- 7 equivalent to acute panic states as seen in severe delirium or acute schizophrenic reactions

**Headache, fullness in head**—Ask “Does your head feel different? Does it feel like there is a band around your head?” Do not rate for dizziness or lightheadedness. Otherwise, rate severity.

- 0 not present
- 1 very mild
- 2 mild
- 3 moderate
- 4 moderately severe
- 5 severe
- 6 very severe
- 7 extremely severe

**Agitation**—Observation.

- 0 normal activity
- 1 somewhat more than normal activity
- 2
- 3
- 4 moderately fidgety and restless
- 5
- 6
- 7 paces back and forth during most of the interview, or constantly thrashes about

**Orientation and clouding of sensorium**—Ask “What day is this? Where are you? Who am I?”

- 0 oriented and can do serial additions
- 1 cannot do serial additions or is uncertain about date
- 2 disoriented for date by no more than 2 calendar days
- 3 disoriented for date by more than 2 calendar days
- 4 disoriented for place/or person

Total CIWA-Ar score \_\_\_\_\_

Rater's initials \_\_\_\_\_

Maximum possible score 67

The CIWA-Ar is not copyrighted and may be reproduced freely. This assessment for monitoring withdrawal symptoms requires approximately 5 min to administer. The maximum score is 67 (see instrument). Patients scoring less than 10 do not usually need additional medication for withdrawal.

Table 8. Advantages and Disadvantages of Each Medication in Delirium Tremens

Medication/Class	Advantages	Disadvantages
Benzodiazepines	Targets DT underlying pathophysiology GABA <sub>A</sub>	May cause oversedation; addictive properties
Haloperidol	Effectively controls the psychiatric symptoms (ie, hallucinations)	Can precipitate torsade de pointes if QT <sub>c</sub> > 450 ms or >25% from baseline
Phenobarbital	Targets DTs underlying pathophysiology GABA <sub>A</sub>	Greater chance of sedation and respiratory depression; addictive properties
Propofol	Targets DT underlying pathophysiology GABA <sub>A</sub> and NMDA	Negative effects on patient's lipid panel and associated complications (ie, cardiac implications and pancreatitis)
β-Blockers	Effectively control the symptoms of DT (ie, HR, BP)	May cause hypotension; do not target underlying pathophysiology
α-Adrenergics	Effectively control the symptoms of DT (ie, HR, BP)	May cause hypotension; do not target underlying pathophysiology

DT = delirium tremens; GABA<sub>A</sub> = γ-aminobutyric acid type A; QT<sub>c</sub> = ; NMDA = N-methyl-D-aspartate; HR = heart rate; BP = blood pressure.

Table 9. Monitoring Parameters and Common Adverse Drug Reactions

Medication/Class	Monitoring Parameters
Benzodiazepines	Oversedation (sleepiness, lethargy)
Haloperidol	ECG: D/C med if QT <sub>c</sub> > 450 ms or > 25% from baseline QT <sub>c</sub> (arrhythmias, extrapyramidal effects, neuroleptic malignant syndrome)
Phenobarbital	Respiratory depression, oversedation (fatigue, lethargy, coma)
Propofol	Changes in lipid panel (hypotension, bradycardia)
β-Blockers	Monitor blood pressure (hypotension, bradycardia)
α-Adrenergics	Monitor blood pressure (hypertension, tachycardia, anxiety, tremors)

ECG = electrocardiogram; D/C = discontinue.

gic component of acute alcohol withdrawal often poses complications for patients with underlying cardiovascular comorbidities. Whether the clinician is aggressively managing a DT patient with agitation in a complex medical environment such as a critical care unit or balancing the cardiovascular uncertainty of the withdrawal process, DT poses many medical challenges that, if not managed effectively, can lead to an increased length of hospital stay, increased cost of managing patients with sedative medications, and the potential of dealing with benzodiazepine withdrawal. Occasionally, the sequelae present in the management of acute alcohol withdrawal are complicated by other substance abuses such as narcotics, illicit drugs, or tricyclic antidepressants in a failed suicide attempt. An accurate history may be unattainable yet is vitally important for diagnosis and treatment of the appropriate withdrawal syndrome. Often in critical care settings, agitated patients with a remote drinking history are empirically treated for alcohol withdrawal. Hours or sometimes days later, with the use of medication, the syndrome resolves. Using BZD and anti-noradrenergic agents such as clonidine

along with the previously discussed additional supporting agents in an aggressive manner in the intensive care unit may help the clinician navigate the ethanol withdrawal process. It is imperative for the clinician to closely monitor this syndrome.

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