A Consensus Statement on the Use of Ketamine in the Treatment of Mood Disorders

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IMPORTANCE Several studies now provide evidence of ketamine hydrochloride’s ability to produce rapid and robust antidepressant effects in patients with mood and anxiety disorders that were previously resistant to treatment. Despite the relatively small sample sizes, lack of longer-term data on efficacy, and limited data on safety provided by these studies, they have led to increased use of ketamine as an off-label treatment for mood and other psychiatric disorders.

OBSERVATIONS This review and consensus statement provides a general overview of the data on the use of ketamine for the treatment of mood disorders and highlights the limitations of the existing knowledge. While ketamine may be beneficial to some patients with mood disorders, it is important to consider the limitations of the available data and the potential risk associated with the drug when considering the treatment option.

CONCLUSIONS AND RELEVANCE The suggestions provided are intended to facilitate clinical decision making and encourage an evidence-based approach to using ketamine in the treatment of psychiatric disorders considering the limited information that is currently available. This article provides information on potentially important issues related to the off-label treatment approach that should be considered to help ensure patient safety.

The American Psychiatric Association Council of Research Task Force on Novel Biomarkers and Treatments found that the data from 7 published placebo-controlled, double-blind, randomized clinical studies on ketamine hydrochloride infusion therapy in the treatment of depression comprising 147 treated patients provide “compelling evidence that the antidepressant effects of ketamine infusion are both rapid and robust, albeit transient.”1-10 Reports of ketamine’s unique antidepressant effects, combined with frequent media coverage promulgating the potential benefits of ketamine treatment, have generated substantial interest and optimism among patients, families, patient advocacy groups, and clinicians alike. This interest has led to a rapidly escalating demand for clinical access to ketamine treatment and an increasing number of clinicians willing to provide it. However, many in the field suggest that caution should be used with this approach, as the numbers of patients included in these published studies and case series remain relatively small (the eTable in the Supplement compares other recently developed treatments), and ketamine treatment for mood disorders has not been tested in larger-scale clinical trials to demonstrate its durability and safety over time.1,2,9 Moreover, the treatment approach has not been subject to the scrutiny of a US Food and Drug Administration review or approval for an on-label psychiatric indication, and, despite more than 45 years of clinical experience with ketamine as an anesthetic agent, there are no postmarketing surveillance data on the use of ketamine for any psychiatric indication to provide information on its safety and effectiveness.

The relatively unique nature of this situation presents an urgent need for some guidance on the issues surrounding the use of ketamine treatment in mood disorders. This review by the American Psychiatric Association Council of Research Task Force on Novel Biomarkers and Treatments Subgroup on Treatment Recommendations for Clinical Use of Ketamine is intended to complement the recent American Psychiatric Association meta-analysis1 and other recent reviews1,2,9 and aims to provide an overview and expert clinical opinion of the critical issues and considerations associated with the off-label use of ketamine treatment for mood disorders. Because relatively limited high-quality, published information on this topic exists, to our knowledge, this report is not intended to serve as a standard, guideline, clinical policy, or absolute requirement. The main intent of the report is to highlight the current state of the field and the critical issues to be considered when contemplating the use of ketamine for treatment-resistant depression. Use of this report cannot guarantee any specific outcome and is not endorsed or promulgated as policy of the American Psychiatric Association.
Patient Selection

There are no clearly established indications for the use of ketamine in the treatment of psychiatric disorders. However, the selection of appropriate patients for ketamine treatment requires consideration of the risks and benefits of the treatment in the context of the patient’s severity of depression, duration of current episode, previous treatment history, and urgency for treatment. To date, the strongest data supporting ketamine’s clinical benefit in psychiatric disorders are in the treatment of major depressive episodes without psychotic features associated with major depressive disorder. Even these data are limited by the fact that most of these studies evaluated efficacy only during the first week following a single infusion of ketamine. However, emerging studies suggest that repeated dosing can extend the duration of effect for at least several weeks. Although some limited data on the use of ketamine in treating other psychiatric diagnoses exist, we do not believe there is sufficient data to provide a meaningful review of the assessment of risks and benefits of ketamine use in these disorders at present.

In addition to diagnostic considerations, appropriate patient selection requires an assessment of other medical, psychological, or social factors that may alter the risk to benefit ratio of the treatment and affect the patient’s capacity to provide informed consent. For these reasons, we recommend that each patient undergo a thorough pretreatment evaluation process (Table) that assesses several relevant features of the patient’s past and current medical and psychiatric condition before initiating ketamine treatment. We also recommend that an informed consent process be completed during this evaluation. Rationale for the suggestions listed in the Table are provided in eBox 1 in the Supplement.

Clinician Experience and Training

There are considerable differences in the experience and clinical expertise of the clinicians currently administering ketamine to patients for the treatment of mood disorders. At present, there are no published guidelines or recommendations outlining the specific training requirements that clinicians should complete before administering ketamine that are lower than those used in anesthe- sia. In attempting to balance the needs for treatment availability and patient safety, one must consider the information available regarding the use of ketamine at the relevant dose range in similar patient populations to formulate an advisory on clinical credentialing for ketamine administration for the treatment of mood disorders.

The peak plasma ketamine hydrochloride concentrations of 70 to 200 ng/mL seen with the typical antidepressant dose of 0.5 mg/kg delivered intravenously (IV) during 40 minutes (0.5 mg/kg per 40 minutes IV) do not produce general anesthetic effects. The concentrations are well below the peak plasma ketamine hydrochloride concentrations generally used for surgical anesthesia (2000-3000 ng/mL) and below the concentrations associated with awakening from ketamine hydrochloride anesthesia (500-1000 ng/mL). Reporting on 833 ketamine infusions in healthy individuals resulting in peak plasma ketamine concentra-
The data available from these studies and other case reports in the literature suggest that the dose of ketamine hydrochloride typically used in the treatment of mood disorders (0.5 mg/kg per 40 minutes IV) does not appear to have significant effects on the respiratory status of healthy individuals or patients with depression who are otherwise generally medically healthy. However, ketamine treatment could have meaningful effects on blood pressure and heart rate for some patients. Considering the potential risks associated with ketamine hydrochloride administration at the dose of 0.5 mg/kg per 40 minutes IV, it is recommended that clinicians delivering the treatment be prepared to manage potential cardiovascular events should they occur. Based on this information, we suggest that a licensed clinician who can administer a Drug Enforcement Administration Schedule III medication (in most states this is an MD or DO with appropriate licensing) with Advanced Cardiac Life Support certification should provide the treatments.

Because it is also possible for patients to experience prominent transient dissociative or even psychoticomimetic effects while being treated with ketamine, clinicians should also be familiar with behavioral management of patients with marked mental status changes and be prepared to treat any emergency behavioral situations. Furthermore, it is suggested that an on-site clinician be available and able to evaluate the patient for potential behavioral risks, including suicidal ideation, before discharge to home. Finally, treating clinicians should be able to ensure that rapid follow-up evaluations of patients’ psychiatric symptoms can be provided as needed.

In addition to the minimal general training requirements, it is also recommended that clinicians develop some level of experience with the specific method of ketamine administration before performing the procedure independently. Precise delineation of required experience and documentation of this experience should be based on local community standards of practice and/or clinical practice committees. Reports such as the Statement on Granting Privileges for Administration of Moderate Sedation to Practitioners Who Are Not Anesthesia Professionals, published by the American Society of Anesthesiologists, can be used to inform the development of these standards.

**Treatment Setting**

Although the administration of ketamine at peak plasma concentrations similar to those produced by a dose of 0.5 mg/kg per 40 minutes IV has proven to be relatively safe to date, the potentially concerning acute effects on cardiovascular function and behavior suggest that the clinical setting should provide sufficient means of monitoring the patient and providing immediate care if necessary. Although there are relatively low levels of evidence to support the use of any specific monitoring methods in reducing the risks of ketamine treatment with doses that are lower than those used in anesthesia, it should be expected that such a facility have a means of monitoring basic cardiovascular (electrocardiogram, blood pressure) and respiratory (oxygen saturation or end-tidal CO2) function. It should also be expected that there would be measures in place to rapidly address and stabilize a patient if an event should arise. These measures would include a means of delivering oxygen to patients with reduced respiratory function, medication, and, if indicated, restraints to manage potentially dangerous behavioral symptoms. Moreover, there should be an established plan to rapidly address any sustained alterations in cardiovascular function, such as providing advanced cardiac life support or transfer to a hospital setting capable of caring for acute cardiovascular events. Patients deemed at higher risk for complications based on pretreatment evaluation should be treated at a facility that is appropriately equipped and staffed to manage any cardiovascular or respiratory events that may occur.

**Medication Delivery**

**Dose**

Most clinical trials and case reports available in the literature have used the ketamine hydrochloride dose of 0.5 mg/kg per 40 minutes IV that was cited in the original report by Berman et al. Limited information is available regarding the use of different routes of delivery and doses of ketamine. A meta-analysis of 6 trials assessing the effects of the standard dose of 0.5 mg/kg per 40 minutes IV and 3 trials assessing very low doses of ketamine hydrochloride (50-mg intranasal spray, 0.1-0.4 mg/kg IV, and 0.1-0.5 mg/kg IV intramuscularly or subcutaneously) reported that the dose of 0.5 mg/kg per 40 minutes IV appears to be more effective than very low doses in reducing the severity of depression. However, there is substantial heterogeneity in the design of the clinical trials, and the total number of participants included in that analysis is very few, markedly limiting the ability to draw any firm conclusions from this report.

Although there is now a growing number of reports examining the effects of various doses and rates of ketamine infusion, including studies showing lower doses and reduced infusion rates to be effective and studies showing higher doses and extended infusion rates to have clinical benefit, at present we believe that insufficient information was provided in those studies to allow any meaningful analysis of any specific dose or route of treatment compared with the standard dose of 0.5 mg/kg per 40 minutes IV. Considering the lower-level evidence for doses and routes of administration other than 0.5 mg/kg per 40 minutes IV, if alternative doses are being used, that information should be presented to the patient during the informed consent process, and appropriate precautions should be made in managing any increased risk associated with the changes in ketamine administration. However, the use of alternative doses and routes of administration could be appropriate for individual patients under specific conditions.

One example of a rationale for dose adjustment is related to the dosing of ketamine for patients with a high body mass index (calculated as weight in kilograms divided by height in meters squared). The fact that greater hemodynamic changes were observed in patients with a body mass index of 30 or higher who were receiving a dose of 0.5 mg/kg per 40 minutes suggests that adjusting the ketamine dosing to ideal body weight (using the person’s calculated ideal body weight and not actual body weight to determine dosing) may be an appropriate step to help ensure safety for patients with a body mass index of 30 or higher. However, there is currently very limited information supporting this approach.

**Delivery Procedure**

To help best ensure patient safety and to minimize risks, it is strongly advised that site-specific standard operating procedures be developed and followed for the delivery of ketamine treatments for major depressive episodes. The standard operating procedure should contain predosing considerations covering the following: (1) confir-
mation of preprocedural evaluation and informed consent; (2) assessment of baseline vital signs, including blood pressure, heart rate, and oxygen saturation or end-tidal CO$_2$; (3) criteria for acceptable baseline vital signs before initiation of medication delivery (eBox 2 in the Supplement); and (4) incorporation of a “time-out” procedure in which the name of the patient and correct dosing parameters are confirmed.

Standard operating procedures should also include specifically defined ongoing assessments of patients’ physiological and mental status during the infusion process, including the following: (1) assessment of respiratory status (ie, oxygen saturation or end-tidal CO$_2$); (2) assessment of cardiovascular function (blood pressure and heart rate, reported on a regular basis); (3) assessment of the level of consciousness (ie, Modified Observer’s Assessment of Alertness/Sedation Scale$^{30}$) or other documented assessment of responsiveness; and (4) delineation of criteria for stopping the infusion (eBox 3 in the Supplement) and a clear plan for managing cardiovascular or behavioral events during treatment.

Immediate posttreatment evaluations, assessments, and management should ensure that the patient has returned to a level of function that will allow for safe return to his or her current living environment. This assessment should include documentation of return to both baseline physiological measures and mental status. It is also critical to ensure that a responsible adult is available to transport the patient home if the treatment is being administered on an outpatient basis. Recommendations regarding driving and use of heavy machinery, as well as use of concomitant medications, drugs, or alcohol, should also be reviewed before discharge. It is also important to review follow-up procedures and ensure that the patient has a means of rapidly contacting an appropriately trained clinician if necessary.

Follow-up and Assessments

**Efficacy Measures of Short-term Repeated Administration**

The existing data surrounding the benefits of repeated infusions of ketamine remain limited.$^{13}$ Although an increasing number of small case series evaluate the efficacy of repeated ketamine administration for the treatment of major depressive episodes, there is a very small number of randomized clinical trials in the literature.$^4$ The lack of clinical trials in this area makes it difficult to provide suggestions on the frequency and duration of treatment with even moderate levels of confidence. Most studies and case reports published to date on this topic have examined the effects of less than 1 month of treatment.$^{32,26,31-34}$

A recent randomized, placebo-controlled clinical trial (using saline as the placebo) of 68 patients with treatment-resistant major depressive disorder examined the efficacy of ketamine, 0.5 mg/kg per 40 minutes IV, both 2 and 3 times weekly for up to 2 weeks and found both dosing regimens to be nearly equally efficacious (change in mean [SD] Montgomery-Åsberg Depression Rating Scale total score for ketamine 2 times weekly, $-18.4$ [12.0] vs placebo, $-5.7$ [10.2]; and ketamine 3 times weekly, $-17.7$ [7.3] vs placebo, $-3.1$ [5.7]).$^{13}$ After 2 weeks of treatment, patients treated with ketamine 2 times weekly showed a 69% rate of response and 37.5% rate of remission vs placebo, at 15% and 7.7%, respectively, and those treated with ketamine 3 times weekly had a 53.8% rate of response and 23.1% rate of remission vs placebo, at 6% and 0%, respectively. In the ensuing open-label phase of the study, patients were allowed to continue with active medication at the dose frequency they were originally assigned for an additional 2-week period. At the end of 4 weeks of treatment, the 13 patients who received ketamine 2 times weekly and continued to receive the additional 2 weeks of treatment had a mean 27-point reduction in the Montgomery-Åsberg Depression Rating Scale score compared with a 23-point decrease for the 13 patients who received ketamine 3 times weekly. Although this was clearly not a definitive study, it is the best evidence currently available, to our knowledge, to suggest that twice-weekly dosing is as efficacious as more frequent dosing for a period of up to 4 weeks. In general, most of the available reports describing the effects of repeated treatments showed the largest benefits occurring early in the course of treatment, but some reports did show some cumulative benefit of continued treatment.$^{31}$

Very limited data exist to suggest a clear point of determining the futurity of treatment, but there are a few reports of patients responding after more than 3 infusions. Based on the limited data available, patients should be monitored closely using a rating instrument to assess clinical change to better reevaluate the risk to benefit ratio of continued treatment. In addition, only 1 report suggests that an increased dose of ketamine (beyond 0.5 mg/kg per 40 minutes) may lead to a response to treatment in patients who had previously not responded.$^{28}$ Equally few data are available to suggest a standard number of treatments that should be administered to optimize longer-term benefit of the treatment.

**Efficacy of Longer-term Repeated Administration**

To our knowledge, there are extremely limited published data on the longer-term effectiveness and safety of ketamine treatment in mood disorders. This literature is confined to a few case series that do not allow us to make a meaningful statement about the longer-term use of ketamine.$^{35,36}$ Several clinics providing such treatments are currently using a 2- or 3-week course of ketamine delivered 2 or 3 times per week, followed by a taper period and/or continued treatments based on empirically determined duration of responses for each patient. However, there remain no published data that clearly support this practice, and it is strongly recommended that the relative benefit of each ketamine infusion be considered in light of the potential risks associated with longer-term exposure to ketamine and the lack of published evidence for prolonged efficacy with ongoing administration. The scarcity of this information is one of the major drawbacks to be considered before initiating ketamine therapy for patients with mood disorders and should be discussed with the patient before beginning treatment.

**Safety Measures and Continuation of Treatment**

Based on the known or suspected risks of cognitive impairment$^{37}$ and cystitis$^{38}$ associated with chronic high-frequency use of ketamine and the known substance abuse liability of the drug, assessments of cognitive function, urinary discomfort, and substance use$^{39}$ should be considered if repeated administrations are provided (eBox 4 in the Supplement).

Considering the known potential for abuse of ketamine$^{40}$ and recent reports of abuse of prescribed ketamine for the treatment of depression,$^{41}$ clinicians should be vigilant about assessing the potential for patients to develop ketamine use disorder. Close clinical follow-
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Future Directions

The rapid onset of robust, transient antidepressant effects associated with ketamine infusions has generated much excitement and hope for patients with refractory mood disorders and the clinicians who treat them. However, it is necessary to recognize the major gaps that remain in our knowledge about the longer-term efficacy and safety of ketamine infusions. Future research is needed to address these unanswered questions and concerns. Although economic factors make it unlikely that large-scale, pivotal phase 3 clinical trials of racemic ketamine will ever be completed, there are several studies with federal and private foundation funding aiming to address some of these issues. It is imperative that clinicians and patients continue to consider enrollment in these studies when contemplating ketamine treatment of a mood disorder. It is only through these standardized clinical trials that we will be able to collect the data necessary to answer some of the crucial questions pertaining to the efficacy and safety of the drug. A second means of adding to the knowledge base is to develop a coordinated system of data collection on all patients receiving ketamine for the treatment of mood disorders. After such a registry is created, all clinicians providing ketamine treatment should consider participation.

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Group Information: The American Psychiatric Association (APA) Task Force on Novel Biomarkers and Treatments members include: Charles B. Nemeroff, MD, PhD (University of Miami Miller School of Medicine); William McDonald, MD (Emory University School of Medicine); Linda Carpenter, MD (Butler Hospital, Brown University); Ned Kalin, MD (University of Wisconsin School of Medicine); William McDonald, MD (Emory University School of Medicine); Linda Carpenter, MD (Butler Hospital, Brown University); Ned Kalin, MD (University of Wisconsin School of Medicine and Public Health); Carolyn Rodriguez, MD, PhD (Stanford University); Mauricio Tohen, MD, DrPh, MBA (University of New Mexico); and Allik Widge, MD, PhD (Massachusetts General Hospital, Harvard University).
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REFERENCES


