The ingestion of zolpidem and other hypnotic sedative medications for the treatment of insomnia has been associated with sleepwalking and other complex behaviors including sleep eating and sleep driving. When ingested during the daytime, hypnotic sedatives impair cognition, memory, and motor performance. There are also reports of a high frequency of blood levels of hypnotic sedatives in drivers apprehended for driving under the influence (DUI). An advisory letter was sent and reported amnesia for 3 to 5 hours. In some cases, the episodes began during daytime wakefulness because of accidental or purposeful ingestion of the zolpidem and are considered automatisms. Other cases began after ingestion of zolpidem at the time of going to bed and are considered parasomnias. Risk factors for both wake and sleep-related automatic complex behaviors include the concomitant ingestion of other sedating drugs, a higher dose of zolpidem, a history of parasomnia, ingestion at times other than bedtime or when sleep is unlikely, poor management of pill bottles, and living alone. In addition, similar size and shape of two medications contributed to accidental ingestion in at least one case.

**Conclusions:** Sleep driving and other complex behaviors can occur after zolpidem ingestion. Physicians should assess patients for potential risk factors and inquire about parasomnias. Serious legal and medical complications can occur as a result of these forms of automatic complex behaviors.

**Keywords:** Zolpidem, sleep driving, automatism, parasomnia

**Citation:** Poceta JS. Zolpidem ingestion, automatisms, and sleep driving: a clinical and legal case series. J Clin Sleep Med 2011;7(6):632-638.

**BRIEF SUMMARY**

**Current Knowledge/Study Rationale:** Sleep driving has been noted to occur after the ingestion of hypnotic sedatives. The nature and cause of this complex behavior is not widely appreciated by clinicians.

**Study Impact:** This unique series describes in detail the timing of drug ingestion, patient rationale, and medication blood levels in cases of sleep driving and other complex behaviors. Because of these details, clinicians can better understand and assess risk factors, differential diagnosis, and legal ramifications for zolpidem-associated complex behaviors.

Although complex behaviors and sleep driving after zolpidem ingestion have been described, the timing of the ingestion and the legal ramifications of the behaviors are not commonly appreciated by the clinician. A recent review has highlighted the lack of specific clinical information in legal case series presently available in the literature and called for more detailed histories of sedative-related DUIDs. It also raised the question of whether physician and patient education could help prevent sedative-related DUIDs. The case series presented here describes in detail a clinical study of daytime zolpidem-induced automatism, and identifies potential risk factors for these occurrences.
Zolpidem Associated Automatisms and Parasomnias

Table 1—Clinical cases

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>BMI</th>
<th>Zolpidem ingestion</th>
<th>Behavior</th>
<th>Dose (mg)</th>
<th>Other medications</th>
<th>Sleep Disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>M</td>
<td>26</td>
<td>Accidental during daytime</td>
<td>Automatism</td>
<td>20</td>
<td>Prednisone</td>
<td>None</td>
</tr>
<tr>
<td>50</td>
<td>M</td>
<td>24</td>
<td>Accidental during daytime</td>
<td>Automatism</td>
<td>10</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>43</td>
<td>M</td>
<td>27</td>
<td>Accidental during daytime</td>
<td>Automatism</td>
<td>10</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>28</td>
<td>F</td>
<td>30</td>
<td>Accidental during daytime for one week</td>
<td>Daily confusion</td>
<td>10</td>
<td>Sertraline</td>
<td>None</td>
</tr>
<tr>
<td>38</td>
<td>F</td>
<td>28</td>
<td>Daytime ingestion for headache</td>
<td>Inebriation, amnesia</td>
<td>5–10</td>
<td>Bupropion, Venlafaxine</td>
<td>None</td>
</tr>
<tr>
<td>65</td>
<td>F</td>
<td>22</td>
<td>Usual bedtime dose</td>
<td>Sleep driving; no accident</td>
<td>10</td>
<td>Ergotamine</td>
<td>Snoring, no OSA</td>
</tr>
<tr>
<td>49</td>
<td>F</td>
<td>31</td>
<td>Usual bedtime dose</td>
<td>Sleepwalking, took bath and flooded apartment</td>
<td>15</td>
<td>Temazepam, Carbamazepine</td>
<td>OSA on CPAP but poor adherence</td>
</tr>
<tr>
<td>54</td>
<td>M</td>
<td>27</td>
<td>Usual bedtime dose</td>
<td>Sleep eating nightly</td>
<td>15</td>
<td>None</td>
<td>PLMS</td>
</tr>
</tbody>
</table>

CLINICAL CASES

Clinical Patient 1: Acute Mental Status Change With Amnesia

A 65-year-old man presented for neurologic evaluation 2 days after a spell of strange behavior with amnesia while on vacation in rural Kenya. During breakfast he was observed by his wife to suddenly stop talking and to “stare off.” He was able to give short and slow verbal responses to her questions such as a soft “yes” or “OK.” He remained in this quiet, awake, but poorly responsive state for over an hour, and was then transported by jeep and by plane to a hospital in the capitol. About four hours after onset he began to ask spontaneous questions about where he was and what was going on, and he became more appropriate. He was examined in hospital and found to have a normal physical examination, brain CT scan, EKG, blood counts, and chemistries. He returned to his normal mental and physical state later that day, but with no memory of events between breakfast and the hospital. He flew home to San Diego and was again examined. He had recently been diagnosed with polymyalgia rheumatica and was on a tapering dose of prednisone (now 2 pills of 10 mg). Because of insomnia associated with the steroid, he had been prescribed zolpidem 10 mg tablets. He was found to have a normal ESR and TSH. An EEG, repeat EKG, brain MRI, and carotid duplex Doppler were normal. Upon further questioning, he had put all his pills in the same bottle for the trip to Africa. He realized that he had taken two 10 mg zolpidem tablets instead of two prednisone tablets on the morning of the illness.

Clinical Case 2: Zolpidem For Headache

A 38-year-old woman and homemaker presented with daily headache for 5 years. She had a history of chronic migraine with medication overuse. She had failed prophylactic treatments with topiramate, amitriptyline, propranolol, and botulinum toxin injections. Depression and anxiety were adequately controlled on bupropion and venlafaxine.

For about 4 years she had been taking zolpidem 5 or 10 mg to treat headache in the late afternoon. She would do this on days when her children were safe (such as with the nanny) and when the headache was severe—which was almost every day. She took some care to lock the doors and to remain in the house. After zolpidem ingestion she would stay awake and do chores such as preparing dinner for the family. She would occasionally nap, but usually would remain awake and then go to sleep at about 9 or 10 PM. The husband would arrive home and find her to be clumsy and unsteady, and she seemed inebriated. She would leave dishes strewn about and pots on the stove. He was extremely upset about her zolpidem ingestion because the next day she never remembered activities or conversations from the evening.

Substitute treatment with oral alprazolam and rapidly dissolving clonazepam were partially effective but did not adequately relieve the headache pain. She reverted to using zolpidem again. The prescribing physician was advised of the problem.

Other Clinical Cases

Table 1 shows the 2 cases described above, 3 additional cases of accidental daytime ingestion, and 3 cases of sleep-related complex behavior including one case of sleep driving. Doses of zolpidem and other medications, as well as whether the event was a daytime automatism or was sleep-related, are indicated. All cases of accidental daytime ingestion presented because of unexplained change in behavior with amnesia. Two of the daytime accidental cases were physicians (50-year-old male and 43-year-old male) who routinely put all their pills in one bottle. These patients had 3 to 5 h of amnesia, confusion, ataxia, and were looked after by spouses until the spell passed. The 28-year-old woman accidentally took her sleeping pill in the morning and her antidepressant at night for several days and was brought in by family because of confusion and ataxia. In this case, the similar shape and color of Ambien 10 mg and Zoloft 100 mg led to the accidental ingestion.

The 65-year-old woman went to bed and then drove without incident to a fast food restaurant parking lot about 20 miles from her home and slept there until morning. There is no definite information on timing of the ingestion or the driving. The 49-year-old woman who flooded her apartment was also taking temazepam and had been prescribed positive airway pressure for obstructive sleep apnea (OSA), but adherence was poor. The last clinical case was a 54-year-old man who presented with weight gain after experiencing sleep eating with amnesia almost every night one hour after he took his zolpidem and retired. He was found to have generalized anxiety and severe periodic limb
movements in sleep (PLMS). Treatment with ropinirole, low
doses of clonazepam, and a cognitive behavioral program al-
lowed him to stop zolpidem and the sleep eating disappeared.

LEGAL CONSULTATIONS

Legal cases were defended by San Diego County court-
appointed public defenders. The author was compensated for
expert witness evaluation of records and testimony for the de-
fense. Table 2 summarizes these cases.

Legal Case 1, December 2007

At 3 AM, a Toyota Sequoia struck several parked cars. Police
followed skid and gouge marks for 5 blocks to an alley and
found the vehicle. The driver appeared intoxicated, diaphoretic,
and agitated. He would not follow commands and was hand-
cuffed on the ground while kicking and screaming.

The 42-year-old defendant later stated that he took his usual
sleeping pills at about 11 PM and remembered nothing until
being in custody. At the initial police interview, after he had
calmed down, he said that possibly he had driven to see his
friend. He thought he might have hit a light post, but did not
remember hitting vehicles or driving for several blocks on the
right front wheel rim. The forensic toxicology screen was posi-
tive for zolpidem 25 ng/mL and for cannabinoids. The defen-
dant was HIV positive and was receiving medical marijuana.

The author’s written opinion was that the defendant had suf-
f ered an episode of zolpidem-associated sleep driving and that
he was not in control of his behavior. Further, I did not think
that he could have anticipated this problem since he had been
taking zolpidem for some time, had gone to bed as usual, and
was not otherwise intoxicated. He had not been alerted to the
possibility of such behavior by his doctor or his pharmacist.
Charges of felony DUI and resisting arrest were reduced, and
the case was settled.

Legal Case 2, July 2008.

At 2:50 AM, a police officer noticed an automobile stopped
at a green light. He pulled behind the car, but the car did not
proceed through the light even after the use of the air horn.
After activating the police car lights and siren the car began
to move. The vehicle was weaving left and right at 40 MPH
in both lanes and several times almost hit the curb. The ve-
cle turned, continued to weave at 52 MPH, stopped at a red
light, waited for the green, and then made a U-turn. Two pa-
roll cars were now behind the vehicle, which was moving at
speeds up to 60 MPH. After another U-turn the vehicle hit the
curb and flattened the right front tire. The driver was taken
into custody and was noted to have trouble following com-
mands, was swaying while walking, had red watery eyes, and
was not making sense while speaking. He said that he was tak-
ing pain medications.

The 33-year-old defendant later made the statement that he
had been prescribed Ambien CR in 2007 when on temporary
disability from work with back pain. He took the medication
consistently for over a year with no problems and then tapered
and stopped the medication for the last month. He again de-
veloped insomnia, so he went to his doctor on the day of the ac-
cident and was prescribed Ambien CR 6.25 mg tablets. He was
told that if one pill did not work to take another. He picked up
his prescription at 4 PM and took one Ambien CR at approxi-
ately 9:30 PM and went to bed. He was not getting drowsy
so he went downstairs to take another pill and to get a bite to
eat. The next thing he remembers was being arrested in front
of his car. Upon release from jail in the morning, he was sur-
prised to find he had no wallet; just shorts, flip flops, and a tank
top. When he returned home he counted the remaining pills and
there were 23 of 28, suggesting that he had in fact taken 5 Am-
bien CR (31.25 mg).

The toxicology report from a blood sample drawn soon after
the arrest, probably at about 4 AM, showed diphenhydramine
and a zolpidem level of 252 ng/mL, consistent with a dose at 10
PM and additional doses after 11 PM.

I testified to the jury that the defendant was under the in-
f luence of zolpidem when he left his residence and began to
drive. His behavior and rapid improvement to a normal state
were typical of zolpidem effect. The jury found the defendant
not guilty on all counts, including Evading Police and DUI
Drugs. Some of the jurors were not as interested in whether or
not the defendant was actually advised of or read the warnings
about sleep-related complex behaviors because sleep driving
would seem to be so rare a condition that he could not have
anticipated it. Many jurors found it persuasive that he had
effect on him such as his wallet or cell phone,
and that he was driving a route that he took every day—per-
haps more likely to occur during an automatism. They also
believed that he could have taken the extra pills after the first
dose had taken effect.

Table 2—Legal defendants

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Behavior</th>
<th>Dose (mg)</th>
<th>Level (ng/mL)</th>
<th>Other Medications</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>M</td>
<td>Sleep driving</td>
<td>10</td>
<td>25</td>
<td>Medical marijuana</td>
<td>HIV positive; settled for lesser charge.</td>
</tr>
<tr>
<td>33</td>
<td>M</td>
<td>Sleep driving</td>
<td>31.25</td>
<td>252</td>
<td>Diphenhydramine</td>
<td>No memory of extra doses. Acquitted</td>
</tr>
<tr>
<td>34</td>
<td>F</td>
<td>Sleep driving</td>
<td>N/A</td>
<td>428</td>
<td>None</td>
<td>Took extra pills because of anxiety. Settled for lesser charge.</td>
</tr>
<tr>
<td>33</td>
<td>M</td>
<td>Sleep driving</td>
<td>12.5</td>
<td>78</td>
<td>Alcohol</td>
<td>Previous DUI. Previous sleep eating. Pled guilty to DUI.</td>
</tr>
<tr>
<td>54</td>
<td>M</td>
<td>Sleep driving</td>
<td>12.5</td>
<td>80</td>
<td>trazodone, paroxetine, gabapentin, levetiracetam</td>
<td>Took at 8 am for first time. Mistrial; settled for lesser charge.</td>
</tr>
<tr>
<td>34</td>
<td>F</td>
<td>Sleep driving</td>
<td>10</td>
<td>140</td>
<td>Alcohol</td>
<td>Drove to Burger King. Guilty of DUI</td>
</tr>
</tbody>
</table>
Legal Case 3, May 2008

At 11 PM a police officer noticed a (34-year-old) woman driving about 40 MPH on the freeway drifting back and forth between lanes. She exited and stopped at a green light. As the light turned to yellow she proceeded. She later stopped at a red light but behind the limit line. She stayed at this location through one entire light cycle before proceeding and then struck a raised median with her vehicle. She continued and eventually turned into a parking lot. She was interviewed on the scene. She said that she was driving from home to her Bible study class. She said that she had one beer and that she took Lamictal. Her field sobriety tests showed that she was swaying and could not stand on one leg. There was no nystagmus. She was considered as DUI, handcuffed, and arrested. She was transported to headquarters to obtain a chemical sample.

The toxicology report showed a zolpidem level of 428 ng/mL and no other substances.

The statement from the defendant was that she remembered nothing after about 10 PM until she was in police custody. She had had dinner with her boyfriend at about 7 PM and had one beer. She decided against going to her Bible study class, but then got into an argument with her boyfriend. When alone at about 9 PM she was very anxious and even panicky. She believed that she followed the recommendation from her doctor to take two alprazolam and two zolpidem if she was having a panic attack and couldn’t sleep. Her Bible was found in the car and she had parked at the Bible class location.

My written report expressed the opinion that the defendant was under the influence of a high level of zolpidem at the time of the arrest, had followed her physician’s instructions, and that her behavior was consistent with an episode of zolpidem-associated sleep driving. The Public Defender was able to settle the case for a lesser charge (misdemeanor reckless driving).

Legal Case 4, April 2009

At approximately 8 PM the 33-year-old defendant’s vehicle struck another car, sideswiped two parked cars, and then caused a head-on collision. The occupants of the other vehicle were seriously injured. The defendant was seen to be acting strangely (e.g., climbed out of the window of the car and staggered). He had also run a red light, was driving without headlights on, and did not stop his vehicle despite several impacts. At the hospital his zolpidem level was 78 ng/mL, his blood alcohol level was 0.23%, and field breathalyzer had been 0.182%.

The statement from the defendant and family members as well as review of his medical records indicated that he had suffered from insomnia for at least 7 years and had often been prescribed zolpidem, either 10 mg or Ambien CR 12.5 mg, using about 30 per month. An alcoholic with previous DUI conviction, the medical records indicated that he was not using alcohol in recent years. He and his family stated that in the past he had often had sleepwalking and sleep eating after taking zolpidem. His family also stated that since the previous DUI, he staunchly avoiding driving if he had been drinking.

On the afternoon before his arrest he had four rum and cokes. He wanted to sleep from about 5 or 6 PM until midnight, because the agreement with his wife was that he would take care of their newborn twins starting at midnight. He remembered taking one Ambien CR 12.5 mg at about 6 PM, and next remembers being in the hospital.

I opined that the defendant was under the influence of both zolpidem and alcohol at the time he was driving. He had a previous history of sleep eating with zolpidem suggesting a predisposition to zolpidem-associated complex behaviors. He pled guilty to DUI, the case settled and he was sentenced to probation and seven years in state prison, suspended.

Legal Case 5, June 2009

At 11:35 AM, the 54-year-old defendant’s vehicle struck a parked car while turning and then rear-ended a car stopped in traffic. The defendant had wandered off briefly and was unsteady on his feet. He was making nonsensical statements to a witness (needed coffee; did not acknowledge accident) and then underwent a sobriety check by the officer. He was clearly impaired, dysarthric, had poor balance, and had difficulty making coherent sentences. He denied drinking alcohol but admitted to taking prescription drugs including pain killers and a sleeping pill. He said he was going to the store but did not remember driving or having an accident.

He was wearing pajama bottoms and his dog was in the vehicle. He was taken into custody where a blood sample was obtained. The zolpidem level was 80 ng/mL. Other medications found in his blood were trazodone (29 ng/mL), paroxetine (12 ng/mL), levetiracetam (10 mg/L), gabapentin (6 mg/L), and morphine (23 ng/mL [considered negative]). The defendant was HIV positive and had a painful peripheral neuropathy. The medical records indicated that he took Ambien CR 12.5 mg for the first time on the day of the accident.

It was my opinion that zolpidem contributed to his impairment and the accident, and that taking the medication at 8 AM, even though he hoped to sleep, had produced a state of complex automatic behavior. Later statements indicated that this defendant, after a restless and difficult night, “just wanted to get some sleep” and so took the zolpidem at 8 AM. The case went to trial for one day, a mistrial occurred, and a settlement was negotiated for a charge less than felony DUI.

Legal Case 6, October 2009

A 34-year-old woman with no criminal or civil record went through her usual routine and, after putting her 12-year-old son to bed at 9 PM, took zolpidem 10 mg. She next remembers being in police custody with disheveled clothes, no purse, and having crashed her car at 11:15 PM. She hit several parked cars over a two-block range before hers was disabled. She was incoherent and insisted that the damaged car in front of her was not hers because hers “is not crashed like that.” She said that she had had 3 drinks. Her zolpidem level was 140 ng/mL and her breathalyzer alcohol level was 0.11%.

In her statement the defendant remembered putting her son to bed and taking her zolpidem as she had been doing every night for the last few years. Her son said that she later came into his room with a glass in her hand and was talking strangely.

I thought it possible that during a zolpidem-associated complex automatic state (possibly sleepwalking) she had ingested the alcohol without conscious awareness and then had driven. The jury found her guilty of misdemeanor DUI. The prosecution had emphasized the fact that she may have been drinking
The legal cases represent complex behaviors following zolpidem ingestion intended to induce sleep, a situation that could variably be considered an altered state with amnesia (automatism) or a form of parasomnia (sleep driving), or both. It is not possible to know with certainty that the defendants ever actual-
ly slept before driving. Defendants used sleepwalking triggered by zolpidem as a defense for their DUI on the grounds that such activity could not be reasonably anticipated based on what they were told about the medication by the prescribing physician and pharmacist. The body of reports of parasomnia associated with hypnotic sedative use would seem to support such a defense, as opposed to the voluntary ingestion of alcohol.35 Such a defense would seem to be stronger if there is a history of prior parasomnia and if the medication was used properly.

The legal cases provide some details that suggest underlying risk factors as well as real-world prescribing instructions and patient use of sleeping medications. Table 4 lists some of these risk factors. Some cases were more likely a parasomnia in onset because of appropriate timing, dose, and bedtime behavior. In some cases the drug was combined with other medications and with varying doses of alcohol that would increase risk of automatism. The ingestion of additional doses of zolpidem (of which the person had no memory) was established in one case. In another case, the ingestion of high doses of zolpidem when upset may not have induced sleep, allowing for the expression of a state of complex automatic behavior. Similarly, the ingestion of zolpidem at 8 AM, even if exhausted and wearing pajamas, does not guarantee sleep. Lastly, it is clear that patients and physicians may not always communicate about complications of medications and use of alcohol.

One risk factor for zolpidem-associated sleep driving is suggested from this series that had not been previously noted—living alone. I suggest that this is because a spouse might notice certain behaviors and then inform the patient, for example, in the nights before sleep driving when less active parasomnias might occur such as simple sleep talking or sleep eating. The drug could then be stopped or the dose lowered. Alternatively, if there were no preceding minor events, many spouses might notice a bed partner leaving the house and starting up the car at midnight, and disaster might be averted.

**CONCLUSIONS**

As is obvious from the behavior in all cases, sleep driving and daytime automatism must be considered potential serious adverse effects of zolpidem ingestion with high potential for fatality. Physicians should be aware of this possibility and can perhaps minimize the likelihood of occurrence by following certain prescribing principles. These include evaluation and treatment of the underlying cause of the insomnia, assessing patient risk factors prior to prescribing, starting with very low doses, minimizing nights of patient use, asking about minor parasomnia behaviors at follow-up, and emphasizing good sleep habits and regular schedules. A cautious clinician might consider instructing the patient not only to “ingest immediately prior to going to bed,” but add “at your usual bedtime only.” This instruction would be implicit if all physicians included the basics of behavioral treatments and good sleep hygiene with any prescription for hypnotic sedatives.35,36 The degree to which zolpidem-associated sleep driving in an individual case is caused by poor compliance on the part of the patient, is a rare unavoidable side effect of the drug, or is the fault of the physician and pharmacist instruction might only be determined by a jury in the court room.

**Table 4—Potential risk factors for zolpidem-associated automatisms and parasomnias**

1. Concomitant ingestion of alcohol or sedating medications
2. Concomitant sleep disorder such as OSA or PLMS
3. A history of parasomnia
4. Hypnotic sedative ingestion at times other than habitual bedtime
5. Hypnotic sedative ingestion during agitated state with decreased likelihood of sleep
6. Hypnotic sedative ingestion when sleep deprived
7. Poor management of pill bottles
8. Living alone

**REFERENCES**


SUBMISSION & CORRESPONDENCE INFORMATION
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This was not an industry supported study. The author has served as a consultant for San Diego County.