Understanding Hallucinations and Delusions in Parkinson’s Disease

A Discussion Guide for Healthcare Professionals, Residents, and Caregivers

WARNING: INCREASED MORTALITY IN ELDERLY PATIENTS WITH DEMENTIA-RELATED PSYCHOSIS

See Important Safety Information including Boxed WARNING on page 9 and throughout the eBook. Please read the accompanying full Prescribing Information, which can be found at the end of this book and at NUPLAZIDhcp.com.
What is Parkinson’s disease psychosis (PDP)?

PDP is a non-motor symptom of Parkinson’s disease (PD) that may cause people to perceive or sense things that are not real. The most common symptoms include hallucinations and/or delusions.

### Hallucinations

- **Visual**
  - Usually seeing actual people (living or deceased) or animals

- **Auditory**
  - Often involves hearing voices or music

- **Olfactory**
  - Smelling things that aren’t there

- **Tactile**
  - Includes the feeling of something touching or moving on the skin

- **Illusions**
  - Misidentification of actual stimuli—for example, believing that a belt is actually a snake

- **False sense of presence**
  - The experience that someone is present when nobody is actually there

Hallucinations occur only when a person is awake. They can occur any time of the day or night but are more common in the evening or in dim lighting.

### Delusions

- **Persecution**
  - Beliefs of conspiracy (e.g., being followed, a room being bugged, telephones being tapped)

- **Jealousy**
  - Beliefs of infidelity (e.g., a significant other is having an affair with someone)

- **Reference**
  - Beliefs that insignificant remarks or statements refer to the resident (e.g., walking into a room of people laughing and assuming they are laughing at him/her)

Delusions are not based in reality. An example of this is a resident’s belief that a loved one is trying to harm him or her, even when this is not true.

In nursing facilities, residents may believe the staff or other residents are trying to harm them, too.

More than 50% of people with PD will develop PDP over the course of their disease.

**References**

The causes of PDP

The causes of hallucination and delusions in PD are still not completely understood. Although PD medications may contribute to the risk of PDP, emerging evidence suggests PDP also manifests from the progression of the underlying disease.

- It is generally accepted that dopaminergic therapy used to treat the motor symptoms of PD plays a part in the development of hallucinations and delusions.

- However, hallucinations and delusions can occur in people with PD who are not taking dopamine therapy, and some people who take these medications never experience hallucinations or delusions.

- Changes in the brain related to PD progression may also trigger psychosis.

References:
Risk factors and course of PDP

There is no way to accurately predict which patients will develop PDP. However, there are certain risk factors:

- **Age:** PDP is more likely to occur as people with PD get older.
- **Duration of disease:** The longer a person has been living with PD, the more likely he or she is to experience PDP.
- **Severity of disease:** More severe motor symptoms are linked to the presence of PDP.
- **Dopaminergic medications:** Hallucinations and delusions may be triggered by these medications.
- **Vision disorders:** Hallucinations have been shown to occur more frequently in people with PDP who have vision disorders, such as lower visual acuity, contrast recognition, and types of ocular pathology.

PDP symptoms tend to progress over time. Although hallucinations may not be bothersome initially, they usually increase in severity. In addition, delusions can start to develop. Eventually, the symptoms may become frightening to residents or their caregivers, and residents may display disruptive behavioral changes, including sundowning and other forms of agitation.

Frequently, residents or their families are hesitant to discuss these symptoms because they may be afraid or embarrassed. Remind residents that hallucinations and delusions are common symptoms of PD. Residents may feel more comfortable talking to their healthcare professionals (HCPs) about PDP when they know that providers anticipate these symptoms and that the symptoms can be addressed. It is helpful to stress to the resident and caregivers that the appearance of hallucinations and delusions in PD does not mean the resident is experiencing a new psychiatric illness.

References:
Living with the symptoms of PDP

Non-pharmacologic management of visual hallucinations

People with PDP commonly use non-pharmacologic coping strategies for managing visual hallucinations. Some examples of these include:

- **Visual techniques**: focusing in on the hallucinatory object or on another object, or looking away from the hallucination

- **Cognitive techniques**: using purposeful, self-initiated actions, such as turning on the lights or consciously reminding/reassuring oneself that the hallucination is not real

- **Interactive techniques**: relying on a caregiver to provide comfort and reassurance that a hallucination is not real

Interacting with a resident who has PDP

Hallucinations and delusions are very real to people who are experiencing them. Usually, it is not helpful to argue or try to reason with a person who is having a delusion or hallucination. Caregivers should try to stay calm when someone is having a hallucination or delusion. Some residents may be reassured if a caregiver tells them that others are not seeing or experiencing what the resident is seeing or experiencing.
Managing PDP

Ruling out other causes of psychosis
To properly diagnose and manage PDP, HCPs need to ensure that other underlying medical conditions that could cause psychosis are addressed.\textsuperscript{1,2}

Considering a change in medications
A review of medications can identify those that might cause psychotic symptoms. These medications can include anticholinergics (used for overactive bladder), antihistamines, opioids, benzodiazepines, and tricyclic antidepressants.\textsuperscript{1-3}

In some cases, a change in dopaminergic medication may help with psychotic symptoms; however, decreasing these medications could worsen motor symptoms.\textsuperscript{3-5}

Antipsychotics
Residents with PDP may be candidates for antipsychotic therapy.\textsuperscript{6}

All antipsychotics, including NUPLAZID\textsuperscript{®}, include a boxed warning noting that treatment with antipsychotics is associated with increased death in elderly people who have psychosis related to dementia.\textsuperscript{6} NUPLAZID is not approved for the treatment of people with dementia-related psychosis unrelated to the hallucinations and delusions associated with PD.\textsuperscript{6}

Important Safety Information for NUPLAZID (pimavanserin) 17-mg Tablets

Indication
NUPLAZID is an atypical antipsychotic indicated for the treatment of hallucinations and delusions associated with Parkinson’s disease psychosis.

About NUPLAZID

NUPLAZID is the first and only FDA-approved treatment for hallucinations and delusions associated with PD.¹

Primary endpoint†
Change from baseline in the PD-adapted Scale for Assessment of Positive Symptoms (SAPS-PD) total score at the end of Week 6
- SAPS-PD was adapted from the SAPS to specifically assess and detect meaningful changes in symptoms of psychosis in patients with PD.¹
- A 3-point improvement can mean the difference between daily and occasional symptoms of psychosis.²

Baseline mean values were 15.9 for NUPLAZID and 14.7 for placebo.

In studies, improvement with NUPLAZID was seen throughout the 6-week trial.¹
- Patients (N=199) were at least 40 years old (mean age, 72 years), had a diagnosis of PD established at least 1 year prior to study entry, and had hallucinations and/or delusions that started after the PD diagnosis and that were severe enough to warrant treatment with an antipsychotic.¹,³
  - Fourteen patients discontinued treatment after randomization but prior to first visit post-baseline.³
- The majority of patients were on PD medications at study entry; these medications were required to be stable for at least 30 days prior to study start and throughout the study period.¹

Important Safety Information for NUPLAZID (pimavanserin) 17-mg Tablets

WARNING: INCREASED MORTALITY IN ELDERLY PATIENTS WITH DEMENTIA-RELATED PSYCHOSIS

Elderly patients with dementia-related psychosis treated with antipsychotic drugs are at an increased risk of death. NUPLAZID is not approved for the treatment of patients with dementia-related psychosis unrelated to the hallucinations and delusions associated with Parkinson’s disease psychosis.

How NUPLAZID is taken

**Dosage**

The recommended dose of NUPLAZID is 34 mg taken as two 17-mg tablets together once daily, without titration. NUPLAZID can be taken with or without food.¹

**Drug interactions**

NUPLAZID can interact with drugs that cause QT interval prolongation or with strong CYP3A4 inhibitors and inducers. Make sure to review residents’ current medication lists (prescription and non-prescription) and remind residents to check with their HCP before starting any new medications or supplements.¹

A list of clinically important drug interactions is available in section 7.1 of NUPLAZID’s prescribing information.¹

Important Safety Information for NUPLAZID (pimavanserin) 17-mg Tablets

**Drug Interactions:** Strong CYP3A4 inhibitors (eg, ketoconazole) increase NUPLAZID concentrations. Reduce the NUPLAZID dose by one-half. Strong CYP3A4 inducers may reduce NUPLAZID exposure, monitor for reduced efficacy. Increase in NUPLAZID dosage may be needed.

CYP3A4, cytochrome P450 3A4.

Common adverse events seen with NUPLAZID

The most common adverse events associated with NUPLAZID are peripheral edema, nausea, and confusion. Additional side effects reported with NUPLAZID include hallucinations, constipation, and gait disturbances. A total of 8% (16/202) of NUPLAZID 34 mg-treated patients and 4% (10/231) of placebo-treated patients discontinued because of adverse reactions.

- Hallucination (2% NUPLAZID 34 mg vs <1% placebo)
- Urinary tract infection (1% NUPLAZID 34 mg vs <1% placebo)
- Fatigue (1% NUPLAZID 34 mg vs 0% placebo)

Important Safety Information for NUPLAZID (pimavanserin) 17-mg Tablets

**Contraindication:** NUPLAZID is contraindicated in patients with a history of hypersensitivity reaction to pimavanserin or any of its components. Reactions have included rash, urticaria, tongue swelling, circumoral edema, and throat tightness. NUPLAZID prolongs the QT interval. The use of NUPLAZID should be avoided in patients with known QT prolongation or in combination with other drugs known to prolong QT interval including Class 1A antiarrhythmics or Class 3 antiarrhythmics, certain antipsychotic medications, and certain antibiotics. NUPLAZID should also be avoided in patients with a history of cardiac arrhythmias, as well as other circumstances that may increase the risk of the occurrence of torsade de pointes and/or sudden death, including symptomatic bradycardia, hypokalemia or hypomagnesemia, and presence of congenital prolongation of the QT interval.

**Adverse Reactions:** The most common adverse reactions (≥2% for NUPLAZID and greater than placebo) were peripheral edema (7% vs 2%), nausea (7% vs 4%), confusional state (6% vs 3%), hallucination (5% vs 3%), constipation (4% vs 3%), and gait disturbance (2% vs <1%).

**Renal Impairment:** No dosage adjustment for NUPLAZID is needed in patients with mild to moderate renal impairment. Use of NUPLAZID is not recommended in patients with severe renal impairment.

**Hepatic Impairment:** Use of NUPLAZID is not recommended in patients with hepatic impairment. NUPLAZID has not been evaluated in this patient population.

**Pregnancy:** Use of NUPLAZID in pregnant women has not been evaluated and should therefore be used in pregnancy only if the potential benefit justifies the potential risk to the mother and fetus.

Important Safety Information for NUPLAZID® (pimavanserin) 17-mg Tablets

**WARNING: INCREASED MORTALITY IN ELDERLY PATIENTS WITH DEMENTIA-RELATED PSYCHOSIS**

Elderly patients with dementia-related psychosis treated with antipsychotic drugs are at an increased risk of death. NUPLAZID is not approved for the treatment of patients with dementia-related psychosis unrelated to the hallucinations and delusions associated with Parkinson’s disease psychosis.

**Contraindication:** NUPLAZID is contraindicated in patients with a history of hypersensitivity reaction to pimavanserin or any of its components. Reactions have included rash, urticaria, tongue swelling, circumoral edema, and throat tightness.

**QT Interval Prolongation:** NUPLAZID prolongs the QT interval. The use of NUPLAZID should be avoided in patients with known QT prolongation or in combination with other drugs known to prolong QT interval including Class 1A antiarrhythmics or Class 3 antiarrhythmics, certain antipsychotic medications, and certain antibiotics. NUPLAZID should also be avoided in patients with a history of cardiac arrhythmias, as well as other circumstances that may increase the risk of the occurrence of torsade de pointes and/or sudden death, including symptomatic bradycardia, hypokalemia or hypomagnesemia, and presence of congenital prolongation of the QT interval.

**Adverse Reactions:** The most common adverse reactions (≥2% for NUPLAZID and greater than placebo) were peripheral edema (7% vs 2%), nausea (7% vs 4%), confusional state (6% vs 3%), hallucination (5% vs 3%), constipation (4% vs 3%), and gait disturbance (2% vs <1%).

**Drug Interactions:** Strong CYP3A4 inhibitors (e.g., ketoconazole) increase NUPLAZID concentrations. Reduce the NUPLAZID dose by one-half. Strong CYP3A4 inducers may reduce NUPLAZID exposure, monitor for reduced efficacy. Increase in NUPLAZID dosage may be needed.

**Renal Impairment:** No dosage adjustment for NUPLAZID is needed in patients with mild to moderate renal impairment. Use of NUPLAZID is not recommended in patients with severe renal impairment.

**Hepatic Impairment:** Use of NUPLAZID is not recommended in patients with hepatic impairment. NUPLAZID has not been evaluated in this patient population.

**Pregnancy:** Use of NUPLAZID in pregnant women has not been evaluated and should therefore be used in pregnancy only if the potential benefit justifies the potential risk to the mother and fetus.

**Pediatric Use:** Safety and efficacy have not been established in pediatric patients.

**Dosage and Administration**
Recommended dose: 34 mg per day, taken orally as two 17-mg tablets once daily, without titration.

**Indication**
NUPLAZID is an atypical antipsychotic indicated for the treatment of hallucinations and delusions associated with Parkinson’s disease psychosis.
Understanding Hallucinations and Delusions in Parkinson’s Disease

A Discussion Guide for Healthcare Professionals, Residents, and Caregivers

WARNING: INCREASED MORTALITY IN ELDERLY PATIENTS WITH DEMENTIA-RELATED PSYCHOSIS

See Important Safety Information including Boxed WARNING on page 9 and throughout the eBook. Please read the accompanying full Prescribing Information, which can be found at the end of this book and at NUPLAZIDhcp.com.
Psychosis is a common symptom of Parkinson’s disease (PD).

A person with PD may have hallucinations or delusions. This condition is called Parkinson’s disease psychosis.

<table>
<thead>
<tr>
<th>Hallucinations</th>
<th>Delusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeing things</td>
<td>Having false beliefs</td>
</tr>
<tr>
<td>Hearing things</td>
<td>Feeling out of touch with reality</td>
</tr>
<tr>
<td>Feeling things</td>
<td>Feeling paranoid</td>
</tr>
<tr>
<td>Smelling things</td>
<td></td>
</tr>
<tr>
<td>Sensing people who are not really there</td>
<td></td>
</tr>
</tbody>
</table>

- Hallucinations happen when a person is awake.
- They are more common in the evening or when the lights are dim.
- Delusions are not thoughts a person can control.

More than half of people who have PD will develop Parkinson’s disease psychosis over the course of their disease.
The cause of hallucinations and delusions in PD is complex.

- Changes in the brain may play a role.
- Drugs used to treat PD may cause symptoms of Parkinson’s disease psychosis. However, people with PD who do not take these drugs can also have Parkinson’s disease psychosis.
Understand your risk for Parkinson’s disease psychosis

There is no way to accurately predict which patients will develop Parkinson’s disease psychosis. However, there are certain risk factors:

- Older age
- Having PD for a long time
- Having more severe PD
- Certain PD medications
- Vision issues
- Other health issues

Hallucinations and delusions may not be bothersome at first, but they tend to get worse over time. People with PD should talk to their healthcare provider (HCP) the first time they have symptoms.
Living with Parkinson's disease psychosis

Learning to cope with hallucinations

People with hallucinations may or may not know that the hallucinations are not real. People who know the hallucinations are not real can try a few coping methods:

■ Staring at or concentrating on the hallucination
■ Focusing on an object other than the hallucination
■ Looking away from the hallucination
■ Telling themselves that the hallucinations are not real
■ Turning on the lights
■ Asking someone else to reassure them that hallucinations are not real

Caring for someone with Parkinson's disease psychosis

Loved ones or caregivers may not understand that hallucinations or delusions are very real to person having them. They also may not know how to react when someone has one.

Sharing these tips may help:

■ Hallucinations and delusions are symptoms of PD; they are not separate or new conditions.
■ Try to stay calm when someone is having a hallucination or delusion.
■ Do not argue or try to reason with someone who is having a hallucination or delusion.
■ Some people with Parkinson's disease psychosis may want to be reassured that their hallucinations are not real.
HCPs can help manage Parkinson’s disease psychosis.

HCPs will check for potential causes of hallucinations and delusions.

- Some non-PD medicines may need to be changed or stopped.
- Some PD medicines may need to be changed or stopped.
- The HCP will also confirm that no other health problems are causing the hallucinations and delusions.

HCPs may prescribe an antipsychotic medication.

- Antipsychotics treat hallucinations and delusions.
- NUPLAZID® (pimavanserin) is the first and only FDA-approved treatment for hallucinations and delusions associated with Parkinson’s disease psychosis.
  
  – Other antipsychotic medications have indications that are different than that of NUPLAZID.

Important Safety Information for NUPLAZID (pimavanserin) 17-mg Tablets

**Indication**

NUPLAZID is a prescription medicine used to treat hallucinations and delusions associated with Parkinson’s disease psychosis.

**Increased risk of death in elderly patients with dementia-related psychosis**. Medicines like NUPLAZID can raise the risk of death in elderly people who have lost touch with reality (psychosis) due to confusion and memory loss (dementia). NUPLAZID is not approved for the treatment of patients with dementia-related psychosis unrelated to the hallucinations and delusions associated with Parkinson’s disease psychosis.
About NUPLAZID

- NUPLAZID is a prescription medicine.
- NUPLAZID was tested in people with Parkinson’s disease psychosis.
- In the clinical trial, the majority of people who took NUPLAZID experienced fewer and/or less severe symptoms. After 6 weeks, some people were no longer experiencing any symptoms.
- NUPLAZID has no effect on motor symptoms.

Important Safety Information for NUPLAZID (pimavanserin) 17-mg Tablets

Dosage and Administration
The recommended dose of NUPLAZID is 34 mg once per day, taken as two 17-mg tablets.
How to take NUPLAZID

■ Take two 17-mg tablets of NUPLAZID (34 mg) once per day, at any time, or as prescribed.

■ You can take NUPLAZID with or without food.

■ Make sure your HCP knows all of the medicines you take.

■ Do not start or stop any medicines while taking NUPLAZID without talking to your HCP first.

Important Safety Information for NUPLAZID (pimavanserin) 17-mg Tablets

Other medicines may affect how NUPLAZID works. Some medicines should not be taken with NUPLAZID. Your healthcare provider can tell you if it is safe to take NUPLAZID with your other medicines. Do not start or stop any medicines while taking NUPLAZID without talking to your healthcare provider first.
**Side effects of NUPLAZID**

- The most common side effects of NUPLAZID are swelling in the legs or arms, nausea, and feeling confused.
- Other possible side effects are hallucinations, constipation, and changes in normal walking.
- These are not all the possible side effects of NUPLAZID.

**Important Safety Information for NUPLAZID (pimavanserin) 17-mg Tablets**

**NUPLAZID may cause serious side effects including:**

**QT Interval Prolongation:** NUPLAZID may increase the risk of changes to your heart rhythm. This risk may increase if NUPLAZID is taken with certain other medications known to change heart rhythm. **Tell your healthcare provider about all the medicines you take or have recently taken.**

It is important to talk to your healthcare provider about the possible side effect of changes to your heart rhythm. Call your healthcare provider right away if you feel a change in your heartbeat.

Do not take NUPLAZID if you have certain kinds of heart conditions such as:

- An irregular heartbeat
- A slow heart rate

Before taking NUPLAZID, tell your healthcare provider if you have:

- Reduced kidney function. NUPLAZID is not recommended if you have severe kidney problems.
- Reduced liver function. NUPLAZID is not recommended if you have liver problems.

The **most common side effects** of NUPLAZID include swelling in the legs or arms, nausea, confusion, hallucination, constipation, and changes to normal walking. These are not all the possible side effects of NUPLAZID. For more information, ask your healthcare provider about this medicine.

Tell your healthcare provider if you are pregnant or plan to become pregnant. It is not known if NUPLAZID may harm your unborn baby.

It is not known if NUPLAZID is safe and effective in people under 18 years of age.
Important Safety Information for NUPLAZID® (pimavanserin) 17-mg Tablets

Increased risk of death in elderly patients with dementia-related psychosis. Medicines like NUPLAZID can raise the risk of death in elderly people who have lost touch with reality (psychosis) due to confusion and memory loss (dementia). NUPLAZID is not approved for the treatment of patients with dementia-related psychosis unrelated to the hallucinations and delusions associated with Parkinson's disease psychosis.

Do not take NUPLAZID if you have had an allergic reaction to any of the ingredients in NUPLAZID. Allergic reactions have included rash, hives, throat tightness, and swelling of the tongue, mouth, lips, or face.

NUPLAZID may cause serious side effects including:

**QT Interval Prolongation:** NUPLAZID may increase the risk of changes to your heart rhythm. This risk may increase if NUPLAZID is taken with certain other medications known to prolong the QT interval. **Tell your healthcare provider about all the medicines you take or have recently taken.**

Do not take NUPLAZID if you have certain heart conditions that change your heart rhythm. It is important to talk to your healthcare provider about the possible side effect of changes to your heart rhythm. Call your healthcare provider if you feel a change in your heartbeat.

Before taking NUPLAZID, tell your healthcare provider if you have:

- Reduced kidney function. NUPLAZID is not recommended if you have severe kidney problems.
- Reduced liver function. NUPLAZID is not recommended if you have liver problems.

Other medicines may affect how NUPLAZID works. Some medicines should not be taken with NUPLAZID. Your healthcare provider can tell you if it is safe to take NUPLAZID with your other medicines. Do not start or stop any medicines while taking NUPLAZID without talking to your healthcare provider first.

The most common side effects of NUPLAZID include swelling in the legs or arms, nausea, confusion, hallucination, constipation, and changes to normal walking. These are not all the possible side effects of NUPLAZID. For more information, ask your healthcare provider about this medicine.

Tell your healthcare provider if you are pregnant or plan to become pregnant. It is not known if NUPLAZID may harm your unborn baby.

It is not known if NUPLAZID is safe and effective in people under 18 years of age.

**Dosage and Administration**
The recommended dose of NUPLAZID is 34 mg once per day, taken as two 17-mg tablets.

**Indication**
NUPLAZID is a prescription medicine used to treat hallucinations and delusions associated with Parkinson’s disease psychosis.
HIGHLIGHTS OF PRESCRIBING INFORMATION
These highlights do not include all the information needed to use NUPLAZID safely and effectively. See full prescribing information for NUPLAZID.

NUPLAZID® (pimavanserin) tablets, for oral use
Initial U.S. Approval: 2016

WARNING: INCREASED MORTALITY IN ELDERLY PATIENTS WITH DEMENTIA-RELATED PSYCHOSIS

See full prescribing information for complete boxed warning.
- Elderly patients with dementia-related psychosis treated with antipsychotic drugs are at an increased risk of death.
- NUPLAZID is not approved for the treatment of patients with dementia-related psychosis unrelated to the hallucinations and delusions associated with Parkinson’s disease psychosis. (5.1)

RECENT MAJOR CHANGES
Contraindications (4) 04/2017

INDICATIONS AND USAGE
NUPLAZID is an atypical antipsychotic indicated for the treatment of hallucinations and delusions associated with Parkinson’s disease psychosis. (1)

DOSEAGE AND ADMINISTRATION
- Recommended dose is 34 mg, taken orally as two 17 mg tablets once daily, without titration. (2)
- Can be taken with or without food. (2)

DOSEAGE FORMS AND STRENGTHS
Tablets: 17 mg (3)

FULL PRESCRIBING INFORMATION: CONTENTS

WARNING: INCREASED MORTALITY IN ELDERLY PATIENTS WITH DEMENTIA-RELATED PSYCHOSIS

1 INDICATIONS AND USAGE
2 DOSAGE AND ADMINISTRATION
2.1 General Dosing Information
2.2 Dosage Modifications for Concomitant Use with CYP3A4 Inhibitors and Inducers
3 DOSEAGE FORMS AND STRENGTHS
4 CONTRAINDICATIONS
5 WARNINGS AND PRECAUTIONS
5.1 Increased Mortality in Elderly Patients with Dementia-Related Psychosis
5.2 QT Interval Prolongation
6 ADVERSE REACTIONS
6.1 Clinical Trials Experience
6.2 Postmarketing Experience
7 DRUG INTERACTIONS
7.1 Drugs Having Clinically Important Interactions with NUPLAZID
7.2 Drugs Having No Clinically Important Interactions with NUPLAZID
8 USE IN SPECIFIC POPULATIONS
8.1 Pregnancy
8.2 Lactation
8.4 Pediatric Use
8.5 Geriatric Use
8.6 Renal Impairment
8.7 Hepatic Impairment
8.8 Other Specific Populations
9 DRUG ABUSE AND DEPENDENCE
9.1 Controlled Substance
9.2 Abuse
10 OVERDOSAGE
10.1 Human Experience
10.2 Management of Overdose
11 DESCRIPTION
12 CLINICAL PHARMACOLOGY
12.1 Mechanism of Action
12.2 Pharmacodynamics
12.3 Pharmacokinetics
13 NONCLINICAL TOXICOLOGY
13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility
13.2 Animal Toxicology and/or Pharmacology
14 CLINICAL STUDIES
16 HOW SUPPLIED/STORAGE AND HANDLING
17 PATIENT COUNSELING INFORMATION

*Sections or subsections omitted from the full prescribing information are not listed.
FULL PRESCRIBING INFORMATION

WARNING: INCREASED MORTALITY IN ELDERLY PATIENTS WITH DEMENTIA-RELATED PSYCHOSIS

Elderly patients with dementia-related psychosis treated with antipsychotic drugs are at an increased risk of death. NUPLAZID is not approved for the treatment of patients with dementia-related psychosis unrelated to the hallucinations and delusions associated with Parkinson’s disease psychosis [see Warnings and Precautions (5.1)].

1 INDICATIONS AND USAGE

NUPLAZID® is indicated for the treatment of hallucinations and delusions associated with Parkinson’s disease psychosis [see Clinical Studies (14)].

2 DOSAGE AND ADMINISTRATION

2.1 General Dosing Information

The recommended dose of NUPLAZID is 34 mg, taken orally as two 17 mg strength tablets once daily, without titration.

NUPLAZID can be taken with or without food.

2.2 Dosage Modifications for Concomitant Use with CYP3A4 Inhibitors and Inducers

- Coadministration with Strong CYP3A4 Inhibitors
  
  The recommended dose of NUPLAZID when coadministered with strong CYP3A4 inhibitors (e.g., ketoconazole) is 17 mg, taken orally as one tablet once daily [see Drug Interactions (7.1)].

- Coadministration with Strong CYP3A4 Inducers
  
  Monitor patients for reduced efficacy if NUPLAZID is used concomitantly with strong CYP3A4 inducers; an increase in NUPLAZID dosage may be needed [see Drug Interactions (7.1)].

3 DOSAGE FORMS AND STRENGTHS

NUPLAZID (pimavanserin) is available as 17 mg strength tablets. The white to off-white, round, coated tablets are debossed on one side with a “P” and “17” on the reverse side.

4 CONTRAINDICATIONS

NUPLAZID is contraindicated in patients with a history of a hypersensitivity reaction to pimavanserin or any of its components. Reactions have included rash, urticaria, tongue swelling, circumoral edema, and throat tightness.

5 WARNINGS AND PRECAUTIONS

5.1 Increased Mortality in Elderly Patients with Dementia-Related Psychosis

Antipsychotic drugs increase the all-cause risk of death in elderly patients with dementia-related psychosis. Analyses of 17 dementia-related psychosis placebo-controlled trials (modal duration of 10 weeks and largely in patients taking atypical antipsychotic drugs) revealed a risk of death in the drug-treated patients of between 1.6- to 1.7-times that in placebo-treated patients. Over the course of a typical 10-week controlled trial, the rate of death in drug-treated patients was about 4.5%, compared to a rate of about 2.6% in placebo-treated patients.
Although the causes of death were varied, most of the deaths appeared to be either cardiovascular (e.g., heart failure, sudden death) or infectious (e.g., pneumonia) in nature. NUPLAZID is not approved for the treatment of patients with dementia-related psychosis unrelated to the hallucinations and delusions associated with Parkinson’s disease psychosis [see Boxed Warning].

5.2 QT Interval Prolongation

NUPLAZID prolongs the QT interval. The use of NUPLAZID should be avoided in patients with known QT prolongation or in combination with other drugs known to prolong QT interval including Class 1A antiarrhythmics (e.g., quinidine, procainamide) or Class 3 antiarrhythmics (e.g., amiodarone, sotalol), certain antipsychotic medications (e.g., ziprasidone, chlorpromazine, thioridazine), and certain antibiotics (e.g., gatifloxacin, moxifloxacin) [see Drug Interactions (7.1)]. NUPLAZID should also be avoided in patients with a history of cardiac arrhythmias, as well as other circumstances that may increase the risk of the occurrence of torsade de pointes and/or sudden death, including symptomatic bradycardia, hypokalemia or hypomagnesemia, and the presence of congenital prolongation of the QT interval [see Clinical Pharmacology (12.2)].

6 ADVERSE REACTIONS

The following serious adverse reactions are discussed elsewhere in the labeling:

- Increased Mortality in Elderly Patients with Dementia-Related Psychosis [see Boxed Warning and Warnings and Precautions (5.1)]
- QT Interval Prolongation [see Warnings and Precautions (5.2)]

6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

The clinical trial database for NUPLAZID consists of over 1200 subjects and patients exposed to one or more doses of NUPLAZID. Of these, 616 were patients with hallucinations and delusions associated with Parkinson’s disease psychosis (PDP). In the placebo-controlled setting, the majority of experience in patients comes from studies evaluating once-daily NUPLAZID doses of 34 mg (N=202) compared to placebo (N=231) for up to 6 weeks. In the controlled trial setting, the study population was approximately 64% male and 91% Caucasian, and the mean age was about 71 years at study entry. Additional clinical trial experience in patients with hallucinations and delusions associated with PDP comes from two open-label, safety extension studies (total N=497). The majority of patients receiving long-term treatment received 34 mg once-daily (N=459). Over 300 patients have been treated for more than 6 months; over 270 have been treated for at least 12 months; and over 150 have been treated for at least 24 months.

The following adverse reactions are based on the 6-week, placebo-controlled studies in which NUPLAZID was administered once daily to patients with hallucinations and delusions associated with PDP.

Common Adverse Reactions (incidence ≥5% and at least twice the rate of placebo): peripheral edema (7% NUPLAZID 34 mg vs. 2% placebo) and confusional state (6% NUPLAZID 34 mg vs. 3% placebo).

Adverse Reactions Leading to Discontinuation of Treatment

A total of 8% (16/202) of NUPLAZID 34 mg-treated patients and 4% (10/231) of placebo-treated patients discontinued because of adverse reactions. The adverse reactions that occurred in more than one patient and with an incidence at least twice that of placebo were hallucination (2% NUPLAZID vs. <1% placebo), urinary tract infection (1% NUPLAZID vs. <1% placebo), and fatigue (1% NUPLAZID vs. 0% placebo).
Adverse reactions that occurred in 6-week, placebo-controlled studies and that were reported at an incidence of ≥2% and >placebo are presented in Table 1.

Table 1  Adverse Reactions in Placebo-Controlled Studies of 6-Week Treatment Duration and Reported in ≥2% and >Placebo

<table>
<thead>
<tr>
<th>Percentage of Patients Reporting Adverse Reaction</th>
<th>NUPLAZID 34 mg</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=202</td>
<td>N=231</td>
</tr>
<tr>
<td>Gastrointestinal disorders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td>Constipation</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>General disorders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral edema</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>Gait disturbance</td>
<td>2%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Psychiatric disorders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hallucination^a</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Confusional state</td>
<td>6%</td>
<td>3%</td>
</tr>
</tbody>
</table>

^a Hallucination includes visual, auditory, tactile, and somatic hallucinations.

Adverse Reactions in Demographic Subgroups

Examination of population subgroups in the 6-week, placebo-controlled studies did not reveal any differences in safety on the basis of age (≤75 vs. >75 years) or sex. Because the study population was predominantly Caucasian (91%; consistent with reported demographics for PD/PDP), racial or ethnic differences in the safety profile of NUPLAZID could not be assessed. In addition, in the 6-week, placebo-controlled studies, no clinically relevant differences in the incidence of adverse reactions were observed among those with a Mini-Mental State Examination (MMSE) score at entry of <25 versus those with scores ≥25.

6.2 Postmarketing Experience

The following adverse reactions have been identified during postapproval use of NUPLAZID. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure. These reactions include rash, urticaria, tongue swelling, circumoral edema, and throat tightness.
7 DRUG INTERACTIONS

7.1 Drugs Having Clinically Important Interactions with NUPLAZID

Table 2  Clinically Important Drug Interactions with NUPLAZID

<table>
<thead>
<tr>
<th>QT Interval Prolongation</th>
<th>Concomitant use of drugs that prolong the QT interval may add to the QT effects of NUPLAZID and increase the risk of cardiac arrhythmia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention:</td>
<td>Avoid the use of NUPLAZID in combination with other drugs known to prolong QT interval [see Warnings and Precautions (5.2)].</td>
</tr>
<tr>
<td>Examples:</td>
<td>Class 1A antiarrhythmics: quinidine, procainamide, disopyramide; Class 3 antiarrhythmics: amiodarone, sotalol; Antipsychotics: ziprasidone, chlorpromazine, thioridazine; Antibiotics: gatifloxacin, moxifloxacin</td>
</tr>
<tr>
<td>Strong CYP3A4 Inhibitors</td>
<td>Concomitant use of NUPLAZID with a strong CYP3A4 inhibitor increases pimavanserin exposure [see Clinical Pharmacology (12.3)].</td>
</tr>
<tr>
<td>Intervention:</td>
<td>If NUPLAZID is used with a strong CYP3A4 inhibitor, reduce the dosage of NUPLAZID [see Dosage and Administration (2.2)].</td>
</tr>
<tr>
<td>Examples:</td>
<td>Itraconazole, ketoconazole, clarithromycin, indinavir</td>
</tr>
<tr>
<td>Strong CYP3A4 Inducers</td>
<td>Concomitant use of a strong CYP3A4 inducer may reduce pimavanserin exposure resulting in a potential decrease in efficacy.</td>
</tr>
<tr>
<td>Intervention:</td>
<td>Patients should be monitored for reduced efficacy and an increase in dosage may be needed if NUPLAZID is used concomitantly with strong CYP3A4 inducers [see Dosage and Administration (2.2)].</td>
</tr>
<tr>
<td>Examples:</td>
<td>Rifampin, carbamazepine, phenytoin, St. John’s wort</td>
</tr>
</tbody>
</table>

7.2 Drugs Having No Clinically Important Interactions with NUPLAZID

Based on pharmacokinetic studies, no dosage adjustment of carbidopa/levodopa is required when administered concomitantly with NUPLAZID [see Clinical Pharmacology (12.3)].

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Risk Summary

There are no data on NUPLAZID use in pregnant women that would allow assessment of the drug-associated risk of major congenital malformations or miscarriage. In animal reproduction studies, no adverse developmental effects were seen when pimavanserin was administered orally to rats or rabbits during the period of organogenesis at doses up to 10- or 12-times the maximum recommended human dose (MRHD) of 34 mg/day, respectively. Administration of pimavanserin to pregnant rats during pregnancy and lactation resulted in maternal toxicity and lower pup survival and body weight at doses which are 2-times the MRHD of 34 mg/day [see Data].

The estimated background risk of major birth defects and miscarriage for the indicated population is unknown. In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2-4% and 15-20%, respectively.
Pimavanserin was not teratogenic in pregnant rats when administered during the period of organogenesis at oral doses of 0.9, 8.5, and 51 mg/kg/day, which are 0.2- and 10-times the maximum recommended human dose (MRHD) of 34 mg/day based on AUC at mid and high doses, respectively. Maternal toxicity included reduction in body weight and food consumption at the highest dose.

Administration of pimavanserin to pregnant rats during pregnancy and lactation at oral doses of 8.5, 26, and 51 mg/kg/day, which are 0.14- to 14-times the MRHD of 34 mg/day based on AUC, caused maternal toxicity, including mortality, clinical signs including dehydration, hunched posture, and rales, and decreases in body weight, and/or food consumption at doses ≥26 mg/kg/day (2-times the MRHD based on AUC). At these maternally toxic doses there was a decrease in pup survival, reduced litter size, and reduced pup weights, and food consumption. Pimavanserin had no effect on sexual maturation, neurobehavioral function including learning and memory, or reproductive function in the first generation pups up to 14-times the MRHD of 34 mg/day based on AUC.

Pimavanserin was not teratogenic in pregnant rabbits during the period of organogenesis at oral doses of 4.3, 43, and 85 mg/kg/day, which are 0.2- to 12-times the MRHD of 34 mg/day based on AUC. Maternal toxicity, including mortality, clinical signs of dyspnea and rales, decreases in body weight and/or food consumption, and abortions occurred at doses 12-times the MRHD of 34 mg/day based on AUC.

8.2 Lactation
Risk Summary
There is no information regarding the presence of pimavanserin in human milk, the effects on the breastfed infant, or the effects on milk production. The developmental and health benefits of breastfeeding should be considered along with the mother’s clinical need for NUPLAZID and any potential adverse effects on the breastfed infant from NUPLAZID or from the underlying maternal condition.

8.4 Pediatric Use
Safety and effectiveness of NUPLAZID have not been established in pediatric patients.

8.5 Geriatric Use
No dose adjustment is required for elderly patients.

Parkinson’s disease is a disorder occurring primarily in individuals over 55 years of age. The mean age of patients enrolled in the 6-week clinical studies with NUPLAZID [see Adverse Reactions (6.1)] was 71 years, with 49% 65-75 years old and 31% >75 years old. In the pooled population of patients enrolled in 6-week, placebo-controlled studies (N=614), 27% had MMSE scores from 21 to 24 compared to 73% with scores ≥25. No clinically meaningful differences in safety or effectiveness were noted between these two groups.

8.6 Renal Impairment
No dosage adjustment for NUPLAZID is needed in patients with mild to moderate (CrCL ≥30 mL/min, Cockcroft-Gault) renal impairment [see Clinical Pharmacology (12.3)].

Use of NUPLAZID is not recommended in patients with severe renal impairment (CrCL <30 mL/min, Cockcroft-Gault). NUPLAZID has not been evaluated in this patient population.

8.7 Hepatic Impairment
Use of NUPLAZID is not recommended in patients with hepatic impairment. NUPLAZID has not been evaluated in this patient population.
8.8 Other Specific Populations
No dosage adjustment is required based on patient’s age, sex, ethnicity, or weight. These factors do not affect the pharmacokinetics of NUPLAZID [see Clinical Pharmacology (12.3)].

9 DRUG ABUSE AND DEPENDENCE

9.1 Controlled Substance
NUPLAZID is not a controlled substance.

9.2 Abuse
NUPLAZID has not been systematically studied in humans for its potential for abuse, tolerance, or physical dependence.

While short-term, placebo-controlled and long-term, open-label clinical trials did not reveal increases in drug-seeking behavior, the limited experience from the clinical trials do not predict the extent to which a CNS-active drug will be misused, diverted, and/or abused once marketed.

10 OVERDOSAGE

10.1 Human Experience
The pre-marketing clinical trials involving NUPLAZID in approximately 1200 subjects and patients do not provide information regarding symptoms with overdose. In healthy subject studies, dose-limiting nausea and vomiting were observed.

10.2 Management of Overdose
There are no known specific antidotes for NUPLAZID. In managing overdose, cardiovascular monitoring should commence immediately and should include continuous ECG monitoring to detect possible arrhythmias [see Warnings and Precautions (5.2)]. If antiarrhythmic therapy is administered, disopyramide, procainamide, and quinidine should not be used, as they have the potential for QT-prolonging effects that might be additive to those of NUPLAZID [see Drug Interactions (7.1)]. Consider the long plasma half-life of pimavanserin (about 57 hours) and the possibility of multiple drug involvement. Consult a Certified Poison Control Center (1-800-222-1222) for up-to-date guidance and advice.

11 DESCRIPTION

NUPLAZID contains pimavanserin, an atypical antipsychotic, which is present as pimavanserin tartrate salt with the chemical name, urea, N-[(4-fluorophenyl)methyl]-N-(1-methyl-4-piperidinyl)-N’-[(4-(2-methylpropoxy)phenyl)methyl]-,(2R,3R)-2,3-dihydroxybutanedioate (2:1). Pimavanserin tartrate is freely soluble in water. Its molecular formula is (C_{25}H_{34}FN_{3}O_{2})_{2}·C_{4}H_{6}O_{6} and its molecular weight is 1005.20 (tartrate salt). The chemical structure is:

![Chemical Structure of Pimavanserin Tartrate](image)

The molecular formula of pimavanserin free base is C_{25}H_{34}FN_{3}O_{2} and its molecular weight is 427.55.

NUPLAZID tablets are intended for oral administration only. Each round, white to off-white, immediate-release, film-coated tablet contains 20 mg of pimavanserin tartrate, which is equivalent to 17 mg of
pimavanserin free base. Inactive ingredients include pregelatinized starch, magnesium stearate, and microcrystalline cellulose. Additionally, the following inactive ingredients are present as components of the film coat: hypromellose, talc, titanium dioxide, polyethylene glycol, and saccharin sodium.

12 CLINICAL PHARMACOLOGY

12.1 Mechanism of Action
The mechanism of action of pimavanserin in the treatment of hallucinations and delusions associated with Parkinson’s disease psychosis is unknown. However, the effect of pimavanserin could be mediated through a combination of inverse agonist and antagonist activity at serotonin 5-HT$_2$A receptors and to a lesser extent at serotonin 5-HT$_2$C receptors.

12.2 Pharmacodynamics
*In vitro*, pimavanserin acts as an inverse agonist and antagonist at serotonin 5-HT$_2$A receptors with high binding affinity (K$_i$ value 0.087 nM) and at serotonin 5-HT$_2$C receptors with lower binding affinity (K$_i$ value 0.44 nM). Pimavanserin shows low binding to sigma 1 receptors (K$_i$ value 120 nM) and has no appreciable affinity (K$_i$ value >300 nM), to serotonin 5-HT$_2$B, dopaminergic (including D$_2$), muscarinic, histaminergic, or adrenergic receptors, or to calcium channels.

Cardiac Electrophysiology
The effect of NUPLAZID on the QTc interval was evaluated in a randomized placebo- and positive-controlled double-blind, multiple-dose parallel thorough QTc study in 252 healthy subjects. A central tendency analysis of the QTc data at steady-state demonstrated that the maximum mean change from baseline (upper bound of the two-sided 90% CI) was 13.5 (16.6) msec at a dose of twice the therapeutic dose. A pharmacokinetic/pharmacodynamic analysis with NUPLAZID suggested a concentration-dependent QTc interval prolongation in the therapeutic range.

In the 6-week, placebo-controlled effectiveness studies, mean increases in QTc interval of ~5-8 msec were observed in patients receiving once-daily doses of NUPLAZID 34 mg. These data are consistent with the profile observed in a thorough QT study in healthy subjects. Sporadic QTcF values ≥500 msec and change from baseline values ≥60 msec were observed in subjects treated with NUPLAZID 34 mg; although the incidence was generally similar for NUPLAZID and placebo groups. There were no reports of torsade de pointes or any differences from placebo in the incidence of other adverse reactions associated with delayed ventricular repolarization in studies of NUPLAZID, including those patients with hallucinations and delusions associated with PDP [see Warnings and Precautions (5.2)].

12.3 Pharmacokinetics
Pimavanserin demonstrates dose-proportional pharmacokinetics after single oral doses from 17 to 255 mg (0.5- to 7.5-times the recommended dosage). The pharmacokinetics of pimavanserin are similar in both the study population and healthy subjects. The mean plasma half-lives for pimavanserin and the active metabolite (N-desmethylated metabolite) are approximately 57 hours and 200 hours, respectively.

Absorption
The median T$_{max}$ of pimavanserin was 6 (range 4-24) hours and was generally unaffected by dose. The bioavailability of pimavanserin oral tablet and pimavanserin solution was essentially identical. The formation of the major circulating N-desmethylated metabolite AC-279 (active) from pimavanserin occurs with a median T$_{max}$ of 6 hours.

Ingestion of a high-fat meal had no significant effect on rate (C$_{max}$) and extent (AUC) of pimavanserin exposure. C$_{max}$ decreased by about 9% while AUC increased by about 8% with a high-fat meal.
Distribution
Pimavanserin is highly protein bound (~95%) in human plasma. Protein binding appeared to be dose-independent and did not change significantly over dosing time from Day 1 to Day 14. Following administration of a single dose of NUPLAZID (34 mg), the mean (SD) apparent volume of distribution was 2173 (307) L.

Elimination

Metabolism
Pimavanserin is predominantly metabolized by CYP3A4 and CYP3A5 and to a lesser extent by CYP2J2, CYP2D6, and various other CYP and FMO enzymes. CYP3A4 is the major enzyme responsible for the formation of its major active metabolite (AC-279). Pimavanserin does not cause clinically significant CYP inhibition or induction of CYP3A4. Based on in vitro data, pimavanserin is not an irreversible inhibitor of any of the major hepatic and intestinal human CYP enzymes involved in drug metabolism (CYP1A2, 2B6, 2C8, 2C9, 2C19, 2D6, and 3A4).

Based on in vitro studies, transporters play no significant role in the disposition of pimavanserin.

AC-279 is neither a reversible or irreversible (metabolism-dependent) inhibitor of any of the major hepatic and intestinal human CYP enzymes involved in drug metabolism (CYP1A2, 2B6, 2C8, 2C9, 2C19, 2D6, and 3A4). AC-279 does not cause clinically significant CYP3A induction and is not predicted to cause induction of any other CYP enzymes involved in drug metabolism.

Excretion
Approximately 0.55% of the 34 mg oral dose of $^{14}$C-pimavanserin was eliminated as unchanged drug in urine and 1.53% was eliminated in feces after 10 days.

Less than 1% of the administered dose of pimavanserin and its active metabolite AC-279 were recovered in urine.

Specific Populations
Population PK analysis indicated that exposure of pimavanserin in patients with mild to moderate renal impairment was similar to exposure in patients with normal renal function. Age, sex, ethnicity, and weight do not have clinically relevant effect on the pharmacokinetics of pimavanserin.

Pimavanserin has not been studied in patients with severe renal impairment or mild to severe hepatic impairment [see Use in Specific Populations (8.6, 8.7)].

Drug Interaction Studies
CYP3A4 Inhibitor: ketoconazole, a strong inhibitor of CYP3A4, increased pimavanserin $C_{\text{max}}$ by 1.5-fold and AUC by 3-fold [see Dosage and Administration (2.2) and Drug Interactions (7.1)].
The effect of pimavanserin on other drugs is shown in Figure 1.

**Figure 1** The Effects of Pimavanserin on the Pharmacokinetics of Other Drugs

<table>
<thead>
<tr>
<th>Dopaminergic Agent:</th>
<th>PK</th>
<th>Fold Change and 90% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbidopa/levodopa</td>
<td>AUC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$C_{\text{max}}$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CYP3A4 Substrate:</th>
<th>PK</th>
<th>Fold Change and 90% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>midazolam (18 days on NUPLAZID)</td>
<td>AUC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$C_{\text{max}}$</td>
<td></td>
</tr>
<tr>
<td>midazolam (38 days on NUPLAZID)</td>
<td>AUC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$C_{\text{max}}$</td>
<td></td>
</tr>
</tbody>
</table>

13 **NONCLINICAL TOXICOLOGY**

13.1 **Carcinogenesis, Mutagenesis, Impairment of Fertility**

- **Carcinogenesis**
  There was no increase in the incidence of tumors following daily oral administration of pimavanserin to mice or rats for 2 years. Mice were administered pimavanserin at oral doses of 2.6, 6, and 13 (males)/8.5, 21, and 43 mg/kg/day (females) which are 0.01- to 1- (males)/0.5- to 7- (females) times the MRHD of 34 mg/day based on AUC. Rats were administered pimavanserin at oral doses of 2.6, 8.5, and 26 (males)/4.3, 13, and 43 mg/kg/day (females) which are 0.01- to 4- (males)/0.04- to 16- (females) times the MRHD of 34 mg/day based on AUC.

- **Mutagenesis**
  Pimavanserin was not mutagenic in the *in vitro* Ames reverse mutation test, or in the *in vitro* mouse lymphoma assay, and was not clastogenic in the *in vivo* mouse bone marrow micronucleus assay.

- **Impairment of Fertility**
  Pimavanserin was administered orally to male and female rats before mating, through mating, and up to Day 7 of gestation at doses of 8.5, 51, and 77 mg/kg/day, which are approximately 2-, 15-, and 22-times the maximum recommended human dose (MRHD) of 34 mg/day based on mg/m², respectively. Pimavanserin had no effect on fertility or reproductive performance in male and female rats at doses up to 22-times the MRHD of 34 mg based on mg/m². Changes in uterine parameters (decreases in the number of corpora lutea, number of implants, viable implants, and increases in pre-implantation loss, early resorptions and post-implantation loss) occurred at the highest dose which was also a maternally toxic dose. Changes in sperm parameters (decreased density and motility) and microscopic findings of cytoplasmic vacuolation in the epididymis occurred at doses approximately 15-times the MRHD of 34 mg/day based on mg/m².

13.2 **Animal Toxicology and/or Pharmacology**

Phospholipidosis (foamy macrophages and/or cytoplasmic vacuolation) was observed in multiple tissues and organs of mice, rats, and monkeys as early as 14 days following oral daily administration of pimavanserin. The most severely affected organs were the lungs and kidneys. The occurrence of phospholipidosis was both dose- and duration-dependent. Diffuse phospholipidosis with focal/multifocal chronic inflammation was
observed in the lungs of rats treated for ≥3 months at doses ≥10-times the maximum recommended human dose (MRHD) of 34 mg/day based on AUC. As a result of chronic inflammation, inflammatory lung fibrosis was observed in rats treated for 3 and 6 months at doses ≥18-times the MRHD of 34 mg/day based on AUC. The findings in the lungs correlated with increased lung weights (up to 3-times those of controls) and respiratory-related clinical signs including rales, labored breathing, and gasping. Phospholipidosis in lungs of rats caused mortality at doses ≥16-times the MRHD of 34 mg/day based on AUC. The estimated No Observed Effect Level (NOEL) for chronic lung inflammation in rats is 5-fold the MRHD of 34 mg/day based on AUC. Phospholipidosis was associated with increased kidney weights and tubular degeneration in rats at doses ≥10-times the MRHD of 34 mg/day based on AUC. The relevance of these findings to human risk is not known.

14 CLINICAL STUDIES

The efficacy of NUPLAZID 34 mg as a treatment of hallucinations and delusions associated with Parkinson’s disease psychosis was demonstrated in a 6-week, randomized, placebo-controlled, parallel-group study. In this outpatient study, 199 patients were randomized in a 1:1 ratio to NUPLAZID 34 mg or placebo once daily. Study patients (male or female and aged 40 years or older) had a diagnosis of Parkinson’s disease (PD) established at least 1 year prior to study entry and had psychotic symptoms (hallucinations and/or delusions) that started after the PD diagnosis and that were severe and frequent enough to warrant treatment with an antipsychotic. At entry, patients were required to have a Mini-Mental State Examination (MMSE) score ≥21 and to be able to self-report symptoms. The majority of patients were on PD medications at entry; these medications were required to be stable for at least 30 days prior to study start and throughout the study period.

The PD-adapted Scale for the Assessment of Positive Symptoms (SAPS-PD) was used to evaluate the efficacy of NUPLAZID 34 mg. SAPS-PD is a 9-item scale adapted for PD from the Hallucinations and Delusions domains of the SAPS. Each item is scored on a scale of 0-5, with 0 being none and 5 representing severe and frequent symptoms. Therefore, the SAPS-PD total score can range from 0 to 45 with higher scores reflecting greater severity of illness. A negative change in score indicates improvement. Primary efficacy was evaluated based on change from baseline to Week 6 in SAPS-PD total score.

As shown in Table 3, Figure 2, and Figure 3, NUPLAZID 34 mg (n=95) was statistically significantly superior to placebo (n=90) in decreasing the frequency and/or severity of hallucinations and delusions in patients with PDP as measured by central, independent, and blinded raters using the SAPS-PD scale. An effect was seen on both the hallucinations and delusions components of the SAPS-PD.

Table 3 Primary Efficacy Analysis Result Based on SAPS-PD (N=185)

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Treatment Group</th>
<th>Mean Baseline Score (SD)</th>
<th>LS Mean Change from Baseline (SE)</th>
<th>Placebo-subtracted Differencea (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAPS-PD</td>
<td>NUPLAZID</td>
<td>15.9 (6.12)</td>
<td>-5.79 (0.66)</td>
<td>-3.06* (-4.91, -1.20)</td>
</tr>
<tr>
<td></td>
<td>Placebo</td>
<td>14.7 (5.55)</td>
<td>-2.73 (0.67)</td>
<td>--</td>
</tr>
<tr>
<td>SAPS-PD Hallucinationsb</td>
<td>NUPLAZID</td>
<td>11.1 (4.58)</td>
<td>-3.81 (0.46)</td>
<td>-2.01 (-3.29, -0.72)</td>
</tr>
<tr>
<td></td>
<td>Placebo</td>
<td>10.0 (3.80)</td>
<td>-1.80 (0.46)</td>
<td>--</td>
</tr>
<tr>
<td>SAPS-PD Delusionsb</td>
<td>NUPLAZID</td>
<td>4.8 (3.59)</td>
<td>-1.95 (0.32)</td>
<td>-0.94 (-1.83, -0.04)</td>
</tr>
<tr>
<td></td>
<td>Placebo</td>
<td>4.8 (3.82)</td>
<td>-1.01 (0.32)</td>
<td>--</td>
</tr>
</tbody>
</table>

SD: standard deviation; SE: standard error; LS Mean: least-squares mean; CI: confidence interval.

a Difference (drug minus placebo) in least-squares mean change from baseline.

b Supportive analysis.

* Statistically significantly superior to placebo.
The effect of NUPLAZID on SAPS-PD improved through the six-week trial period, as shown in Figure 2.

**Figure 2**  SAPS-PD Change from Baseline through 6 Weeks Total Study Treatment

**Figure 3**  Proportion of Patients with SAPS-PD Score Improvement at the End of Week 6 (N=185)

Complete response = SAPS-PD score reduced to zero from baseline value. Patients with missing values were counted as non-responders.
Motor Function in Patients with Hallucinations and Delusions Associated with Parkinson’s Disease Psychosis

NUPLAZID 34 mg did not show an effect compared to placebo on motor function, as measured using the Unified Parkinson’s Disease Rating Scale Parts II and III (UPDRS Parts II+III) (Figure 4). A negative change in score indicates improvement. The UPDRS Parts II+III was used to assess the patient’s Parkinson’s disease state during the 6-week double-blind treatment period. The UPDRS score was calculated as the sum of the 40 items from activities of daily living and motor examination, with a range of 0 to 160.

![Motor Function Change from Baseline to Week 6 in UPDRS Parts II+III (LSM - SE)](image)

**Figure 4**  Motor Function Change from Baseline to Week 6 in UPDRS Parts II+III (LSM - SE)

LSM: least-squares mean; SE: standard error. The error bars extend one SE below the LSM.

16 HOW SUPPLIED/STORAGE AND HANDLING

NUPLAZID (pimavanserin) tablets are available as:

**17 mg Tablet:**
White to off-white, round, coated tablet debossed with “P” on one side and “17” on the reverse.
Bottle of 60: NDC 63090-170-60

**Storage**
Store at 20°C to 25°C (68°F to 77°F); excursions permitted between 15°C and 30°C (59°F and 86°F) [See USP Controlled Room Temperature].

17 PATIENT COUNSELING INFORMATION

**Concomitant Medication**
Advise patients to inform their healthcare providers if there are any changes to their current prescription or over-the-counter medications, since there is a potential for drug interactions [see Warnings and Precautions (5.2), Drug Interactions (7)].