Lumason (sulfur hexafluoride lipid-type A microspheres) for injection is an ultrasound contrast agent indicated for intravenous use or intravesical use.

**INDICATIONS AND USAGE**

- **Adults**
  - Ultrasonography of the liver for characterization of focal lesions.
  - Echocardiography to opacify the left ventricular endocardial border in adult patients.

- **Pediatric Patients**
  - The recommended dose of Lumason after reconstitution in pediatric patients is 0.03 mL per kg administered, if needed. Follow Lumason injection with an intravenous flush using 5 mL of 0.9% Sodium Chloride Injection.

**DOSAGE FORMS AND STRENGTHS**

- For injectable suspension, for intravenous use or intravesical use (sulfur hexafluoride lipid-type A microspheres)

**ADMINISTRATION**

For intravenous injection:

- Avoid intra-arterial injection. Intra-arterial injection may lead to ischemia and infarction.
- Follow each injection with an intravenous flush using 5 mL of 0.9% Sodium Chloride Injection.

**PRECAUTIONS**

- **Serious Cardiopulmonary Reactions**
  - Patients should be monitored closely for serious cardiopulmonary reactions, including those that may follow the administration of ultrasound contrast agents, including sulfur hexafluoride lipid microspheres.

**ADVERSE REACTIONS**

- The reported reactions that may follow the administration of ultrasound contrast agents include: fatal cardiac or lactic shock have uncommonly been observed following the injection of Lumason. These reactions may occur minutes of administration. The risk for these reactions may be increased among patients with unstable cardiopulmonary disease.

**CONTRAINdications**

- Patients with a known allergy to any of the inactive ingredients in Lumason.
In a study of healthy subjects, the mean values for the apparent steady-state volume of distribution of SF$_6$ fol-
lowing intravenous injection of a tracer dose were 11.7 L/kg (range 4.0 to 27.9 L/kg). In patients with pulmonary impairment, blood concentrations of SF$_6$ peaked at 1 to 4 minutes follow-
ing injection and were lower than those observed in healthy subjects. In a study that examined SF$_6$ elimination twenty minutes following Lumason injection, the mean cumulative recovery in expired air was 102 ± 18% (mean ± standard deviation).

PHARMACOKINETICS

SF$_6$ gas distributes rapidly and homogeneously throughout the non-aqueous tissue. Therefore, an ultrasound beam is reflected from the interface between the microspheres and the surrounding tissues. The effective ultrasound signal provides a real-time image that shows a contrast between the non-aqueous tissue and the surrounding fluid. Lumason has a high acoustic impedance and high attenuation coefficient, which results in good contrast enhancement.

CLINICAL PHARMACOLOGY

12.1 Mechanisms of Action

Although Lumason does not contain SF$_6$ gas, the gas component of Lumason provides dynamic patterns of differential signal intensity enhancement above the baseline signal, allowing visualization and characterization of focal liver lesions. There are no data on the presence of Lumason in human milk, the effects on the breastfed infant, or the effects on the mother’s milk supply. 

12.2 Pharmacokinetics

Each kit is packaged in a clear plastic container.

In an open-label study, 416 patients were treated with Lumason for ultrasound imaging of the liver. The median duration of useful contrast effect was 3.1 minutes (range 1.7 to 3.1 minutes). The mean volume of distribution was 11.7 L/kg (range 4.0 to 27.9 L/kg). The cumulative recovery of SF$_6$ gas in expired air was 102 ± 18% (mean ± standard deviation).

Table 1: Reduction in Percentage of Patients with Inadequate Border Delineation

<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>Inadequate Border Delineation (%)</th>
<th>Difference</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study A</td>
<td>76</td>
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<td>0%</td>
<td>0.66</td>
</tr>
<tr>
<td>Study B</td>
<td>62</td>
<td>56%</td>
<td>-20%</td>
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</tr>
<tr>
<td>Study C</td>
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<td>82%</td>
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The improvement in endocardial border delineation following Lumason administration as a reduction in percent-age manifested as visualization of at least two additional endocardial border segments. Table 1 demonstrates that the use of Lumason was associated with a significant improvement in endocardial border delineation compared to non-contrast images.

Table 2: Pharmacokinetic Parameters of SF$_6$ in Lumason

<table>
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<td>Time to peak</td>
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<tr>
<td>Mean ± SD</td>
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The pharmacokinetic of the SF$_6$ gas component of Lumason was evaluated in 12 healthy adult subjects. After intravenous injection of a tracer dose, the mean time to peak concentration was 3.1 minutes (range 1.7 to 3.1 minutes). The mean volume of distribution was 11.7 L/kg (range 4.0 to 27.9 L/kg). The cumulative recovery of SF$_6$ gas in expired air was 102 ± 18% (mean ± standard deviation).

13. CLINICAL STUDIES

13.1 Ultrastructure of the Liver

In patients who received Lumason for ultrasound imaging of the liver, the mean improvement in endocardial border delineation was 44% (p = 0.02). The improvement in endocardial border delineation was significant compared to non-contrast images. The cumulative recovery of SF$_6$ gas in expired air was 102 ± 18% (mean ± standard deviation). 

13.2 Comparison of Lumason and Non-contrast Ultrasound Imaging

The study design included a randomized, controlled, parallel-group study comparing Lumason to non-contrast ultrasound imaging. In this study, the mean improvement in endocardial border delineation was 44% (p = 0.02). The improvement in endocardial border delineation was significant compared to non-contrast images.

14. ADVERSE REACTIONS

In a study involving 103 patients, the incidence of adverse events was low. The most common adverse events were mild to moderate in severity and included rash, wheezing, or shortness of breath. These events occurred in approximately 0.8% of patients and resolved spontaneously.

Table 3: Clinical Studies of Lumason

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