

Summary of product characteristics

1. NAME OF THE MEDICINAL PRODUCT

SonoVue 8 microlitres/mL powder and solvent for dispersion for injection

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Each mL of the dispersion contains 8 µL sulphur hexafluoride microbubbles, equivalent to 45 micrograms.

For the full list of excipients, see section 6.1.

3. PHARMACEUTICAL FORM

Powder and solvent for dispersion for injection.

White powder.

Clear, colourless solvent.

4. CLINICAL PARTICULARS

4.1 Therapeutic indications

This medicinal product is for diagnostic use only.

SonoVue is for use with ultrasound imaging to enhance the echogenicity of the blood, or of fluids in the urinary tract which results in an improved signal to noise ratio.

SonoVue should only be used in patients where study without contrast enhancement is inconclusive.

Echocardiography

SonoVue is a transpulmonary echocardiographic contrast agent for use in adult patients with suspected or established cardiovascular disease to provide opacification of cardiac chambers and enhance left ventricular endocardial border delineation.

Doppler of macrovasculature

SonoVue increases the accuracy in detection or exclusion of abnormalities in cerebral arteries and extracranial carotid or peripheral arteries in adult patients by improving the Doppler signal to noise ratio.

SonoVue increases the quality of the Doppler flow image and the duration of clinically-useful signal enhancement in portal vein assessment in adult patients.

Doppler of microvasculature

SonoVue improves display of the vascularity of liver and breast lesions during Doppler sonography in adult patients leading to more specific lesion characterisation.

Ultrasonography of excretory urinary tract

SonoVue is indicated for use in ultrasonography of the excretory tract in paediatric patients from newborn to 18 years to detect vesicoureteral reflux. For the limitation in the interpretation of a negative urosonography, see section 4.4 and 5.1.

4.2 Posology and method of administration

This product should only be used by physicians experienced in diagnostic ultrasound imaging.

Emergency equipment and personnel trained in its use must be readily available.

Posology

Intravenous use

The recommended doses of SonoVue in adults are:

- B-mode imaging of cardiac chambers, at rest or with stress: 2 mL.
- Vascular Doppler imaging: 2.4 mL.

During a single examination, a second injection of the recommended dose can be made when deemed necessary by the physician.

Elderly Patients

The dose recommendations for intravenous administration also apply to elderly patients.

Paediatric Patients

The safety and efficacy of SonoVue in patients under 18 years of age has not been established for intravenous administration and use in echocardiography and vascular Doppler imaging.

Intravesical use

- In paediatric patients the recommended dose of SonoVue is 1 mL.

Method of administration

For instructions on reconstitution of the medicinal product before administration see section 6.6.

Intravenous use

SonoVue should be administered immediately after drawing into the syringe by injection into a peripheral vein. Every injection should be followed by a flush with 5 mL of sodium chloride 9 mg/mL (0.9%) solution for injection.

Intravesical use

After introduction of a sterile 6F-8F urinary catheter into the bladder under sterile conditions, the bladder is emptied of urine and then filled with saline (normal sterile 0.9% sodium chloride solution) to approximately one third or half of its predicted total volume [(age in years + 2) x 30] mL. SonoVue is then administered through the urinary catheter. Administration of SonoVue is followed by completion of bladder filling with saline until patient has the urge to micturate or there is the first slight sign of back pressure to the infusion. Ultrasound imaging of the bladder and kidneys is performed during filling and voiding of the bladder. Immediately following the first voiding, the bladder may be refilled with saline for a second cycle of voiding and imaging, without the need of a second SonoVue administration. A low mechanical index (≤ 0.4) is recommended for imaging the bladder, ureters, and kidney during ultrasonography of the urinary tract with contrast.

4.3 Contraindications

Hypersensitivity to the active substance(s) or to any of the excipients listed in section 6.1.

Intravenous use of SonoVue is contraindicated in patients known to have right-to-left shunts, severe pulmonary hypertension (pulmonary artery pressure > 90 mmHg), uncontrolled systemic hypertension, and in patients with adult respiratory distress syndrome.

SonoVue must not be used in combination with dobutamine in patients with conditions suggesting cardiovascular instability where dobutamine is contraindicated.

4.4 Special warnings and precautions for use

Hypersensitivity reactions

In the event of an anaphylactic reaction, beta blockers (including eye drop preparations) may aggravate the reaction. Patients may be unresponsive to the usual doses of adrenaline used to treat the allergic reactions.

Intravenous use

Patients with unstable cardiopulmonary status

ECG monitoring should be performed in high-risk patients as clinically indicated. It is recommended to keep the patient under close medical supervision during and for at least 30 minutes following the administration of SonoVue.

Use extreme caution when considering the administration of SonoVue in patients with recent acute coronary syndrome or clinically unstable ischaemic cardiac disease, including: evolving or ongoing myocardial infarction, typical angina at rest within last 7 days, significant worsening of cardiac symptoms within last 7 days, recent coronary artery intervention or other factors suggesting clinical instability (for example, recent deterioration of ECG, laboratory or clinical findings), acute cardiac failure, Class III/IV cardiac failure, or severe rhythm disorders because in these patients allergic like and/or vasodilatory reactions may lead to life threatening conditions. SonoVue should only be administered to such patients after careful risk/benefit assessment and a closely monitoring of vital signs should be performed during and after administration.

It should be emphasised that stress echocardiography, which can mimic an ischaemic episode, could potentially increase the risk of SonoVue utilisation. Therefore, if SonoVue is to be used in conjunction with stress echocardiography patients must have a stable condition verified by absence of chest pain or ECG modification during the two preceding days. Moreover, ECG and blood pressure monitoring should be performed during SonoVue-enhanced echocardiography with a pharmacological stress (e.g. with dobutamine).

Chronic obstructive pulmonary disease

Caution is advised when SonoVue is administered to patients with clinically significant pulmonary disease, including severe chronic obstructive pulmonary disease.

Other concomitant diseases

Caution is advisable when administering the product to patients with: acute endocarditis, prosthetic valves, acute systemic inflammation and/or sepsis, hyperactive coagulation states and/or recent thromboembolism, and end-stage renal or hepatic disease, as the numbers of patients with those conditions who were exposed to SonoVue in the clinical trials were limited.

Patients on mechanical ventilation or with unstable neurological diseases

SonoVue is not suitable for use in ventilated patients, and those with unstable neurological diseases.

Interpretation of voiding urosonography with SonoVue and limitations of use

False negative cases can occur with voiding ultrasonography with SonoVue and have not been clarified (see section 5.1).

Technical recommendation

In animal studies, the application of echo-contrast agents revealed biological adverse reactions (e.g. endothelial cell injury, capillary rupture) by interaction with the ultrasound beam. Although these biological side effects have not been reported in humans, the use of a low mechanical index is recommended.

Excipients

This medicinal product contains less than 1 mmol sodium (23 mg) per dose, i.e. essentially 'sodium-free'.

4.5 Interaction with other medicinal products and other forms of interaction

No interaction studies have been performed.

4.6 Pregnancy, lactation, and fertility

Pregnancy

No clinical data on exposed pregnancies are available. Animal studies do not indicate harmful effects with respect to pregnancy, embryonal/foetal development, parturition or postnatal development (see section 5.3 Preclinical safety data). As a precautionary measure, it is preferable to avoid the use of SonoVue during pregnancy.

Breastfeeding

It is not known if sulphur hexafluoride is excreted in human milk. However, based on its rapid elimination from the body via the expired air, it is considered that the breastfeeding can be resumed two to three hours after administration of SonoVue.

Fertility

No clinical data are available. Animal studies do not indicate harmful effects on fertility.

4.7 Effects on ability to drive and use machines

SonoVue has no or negligible influence on the ability to drive and use machines.

4.8 Undesirable effects

Adult population-Intravenous use

The safety of SonoVue after intravenous administration was evaluated in 4653 adult patients who participated in 58 clinical trials. The undesirable effects reported with SonoVue after intravenous administration were, in general, non-serious, transient and resolved spontaneously without residual effects. In clinical trials, the most commonly reported adverse reactions after intravenous administration are: headache, injection site reaction, and nausea.

The adverse reactions are classified by System Organ Class and frequency, using the following convention: Very common ($\geq 1/10$), Common ($\geq 1/100$ to $< 1/10$), Uncommon ($\geq 1/1,000$ to $< 1/100$), Rare ($\geq 1/10,000$ to $< 1/1,000$), Very rare ($< 1/10,000$), not known (cannot be estimated from the available data).



System Organ Class	Adverse Drug Reactions		
	Frequency Category		
	Uncommon (≥1/1,000 to <1/100)	Rare (≥1/10,000 to <1/1,000)	Not known Cannot be estimated from available data
Immune system disorders		Hypersensitivity*	
Psychiatric disorders		Insomnia	
Nervous system disorders	Headache, paraesthesia, dizziness, dysgeusia	Sinus headache	Vasovagal reaction
Eye disorders		Vision blurred	
Cardiac disorders			Myocardial infarction** Myocardial ischemia**
Vascular disorders	Flushing	Hypotension	
Respiratory, thoracic and mediastinal disorders	Pharyngitis		
Gastrointestinal disorders	Nausea, Abdominal pain		
Skin and subcutaneous tissue disorders	Pruritus, rash		
Musculoskeletal, connective tissue and bone disorders	Back pain		
General disorders and administration site conditions	Chest discomfort, injection site reaction, feeling hot	Chest pain, pain, fatigue	
Investigations	Blood glucose increased		

*Cases suggestive of hypersensitivity may include: skin erythema, bradycardia, hypotension, dyspnoea, loss of consciousness, cardiac/respiratory arrest, anaphylactic reaction, anaphylactoid reaction or anaphylactic shock. **In some of the cases of hypersensitivity, in patients with underlying coronary artery disease, myocardial ischemia and/or myocardial infarctions were also reported.

In very rare cases, fatal outcomes have been reported in temporal association with the use of SonoVue. In all these patients there was a high underlying risk for major cardiac complications, which could have led to the fatal outcome.

Paediatric population - Intravesical use

The safety of SonoVue after intravesical administration was based on evaluation of published literature involving use of SonoVue in over 6000 paediatric patients (age range 2 days to 18 years). No adverse reactions were reported.

Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via the national reporting system listed in Appendix V.

4.9 Overdose

Since there have been no cases of overdose reported to date, neither signs nor symptoms of overdose have been identified. In a Phase I study doses up to 56 mL of SonoVue were administered to normal volunteers without serious adverse events being reported. In the event of overdose occurring, the patient should be observed and treated symptomatically.

5. PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Ultrasound contrast media. ATC code: V08DA05.

Sulphur hexafluoride is an inert, innocuous gas, poorly soluble in aqueous solutions. There are literature reports of the use of the gas in the study of respiratory physiology and in pneumatic retinopathy. The addition of sodium chloride 9 mg/mL (0.9%) solution for injection to the lyophilised powder followed by vigorous shaking results in the production of the microbubbles of sulphur hexafluoride. The microbubbles have a mean diameter of about 2.5 µm, with 90% having a diameter less than 6 µm and 99% having a diameter less than 11 µm. Each millilitre of SonoVue contains 8 µL of the microbubbles. The intensity of the reflected signal is dependent on concentration of the microbubbles and frequency of the ultrasound beam. The interface between the sulphur hexafluoride bubble and the aqueous medium acts as a reflector of the ultrasound beam thus enhancing blood echogenicity and increasing contrast between the blood and the surrounding tissues.

Intravenous use

At the proposed clinical doses for intravenous administration, SonoVue has been shown to provide marked increase in signal intensity of more than 2 minutes for B-mode imaging in echocardiography and of 3 to 8 minutes for Doppler imaging of the macrovasculature and microvasculature.

Intravesical use

For ultrasonography of the excretory urinary tract in paediatric patients, after intravesical administration, SonoVue increases the signal intensity of fluids within the urethra, bladder, ureters, and renal pelvis, and facilitates the detection of reflux of fluid from the bladder into the ureters.

The efficacy of SonoVue for detection/exclusion of vesicoureteral reflux was studied in two published open label single centre studies. The presence or absence of vesicoureteral reflux with SonoVue ultrasound was compared to the radiographic reference standard. In one study including 183 patients (366 kidney-ureter units), SonoVue ultrasound was correctly positive in 89 out of 103 units with reflux and correctly negative in 226 out of 263 units without reflux. In the second study including 228 patients (463 kidney-ureter units), SonoVue ultrasound was correctly positive in 57 out of 71 units with reflux and correctly negative in 302 out of 392 units without reflux.

5.2 Pharmacokinetic properties

The total amount of sulphur hexafluoride administered in a clinical dose is extremely small, (in a 2 mL dose the microbubbles contain 16 µL of gas). The sulphur hexafluoride dissolves in the blood and is subsequently exhaled. After a single intravenous injection of 0.03 or 0.3 mL of SonoVue/kg (approximately 1 and 10 times the maximum clinical dose) to human volunteers, the sulphur hexafluoride was cleared rapidly. The mean terminal half-life was 12 minutes (range 2 to 33 minutes). More than 80% of the administered sulphur hexafluoride was recovered in exhaled air within 2 minutes after injection and almost 100% after 15 minutes. In patients with diffuse interstitial pulmonary fibrosis, the percent of dose recovered in expired air averaged 100% and the terminal half-life was similar to that measured in healthy volunteers.

5.3 Preclinical safety data

Non-clinical data reveal no special hazard for humans based on conventional studies of safety pharmacology, genotoxicity and toxicity to reproduction. Caecal lesions observed in some repeat-dose studies with rats, but not in monkeys, are not relevant for humans under normal conditions of administration.

Intravesical local tolerance for SonoVue was also assessed. A single-dose study and a repeat-dose study, both followed by a treatment-free period, were performed in female rats with local toxicity evaluated through macroscopic and histopathological examination of both kidneys, ureters, the urinary bladder and urethra. It did not reveal any test item-related lesions in any of the examined organs, in particular in the urinary bladder, in both the single-dose and the repeat-dose studies. It was therefore concluded that SonoVue is well tolerated in the urinary tract in the rat.

6. PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Powder:

Macrogol 4000
Distearoylphosphatidylcholine
Dipalmitoylphosphatidylglycerol Sodium
Palmitic acid

Solvent:

Sodium chloride 9 mg/mL (0.9%) solution for injection.

6.2 Incompatibilities

This medicinal product must not be mixed with other medicinal products except those mentioned in section 6.6.

6.3 Shelf life

2 years. Once reconstituted, chemical and physical stability has been demonstrated for 6 hours. From a microbiological point of view, the medicinal product should be used immediately. If not used immediately, in use storage times and conditions prior to use are the responsibility of the user.

6.4 Special precautions for storage

The medicinal product does not require any special storage conditions. For storage conditions after reconstitution of the medicinal product, see section 6.3.

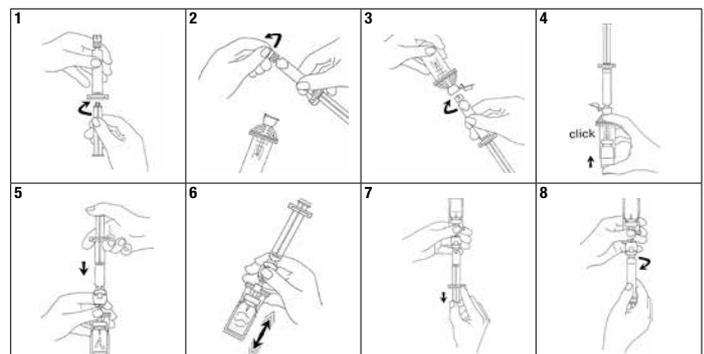
6.5 Nature and contents of container

Type I colourless glass vial containing 25 mg of dry, lyophilised powder in an atmosphere of sulphur hexafluoride closed with a grey butyl rubber stopper and sealed with an aluminium crimp seal with a flip-off disc. A transfer system (MiniSpike).

Type I clear glass pre-filled syringe containing 5 mL sodium chloride 9 mg/mL (0.9%) solution for injection.

6.6 Special precautions for disposal

Before use examine the product to ensure that the container and closure have not been damaged. SonoVue must be prepared before use by injecting through the septum 5 mL of sodium chloride 9 mg/mL (0.9%) solution for injection to the contents of the vial. The vial is then shaken vigorously for twenty seconds after which the desired volume of the dispersion can be drawn into a syringe as follows:



1. Connect the plunger rod by screwing it clockwise into the syringe.
2. Open the MiniSpike transfer system blister and remove syringe tip cap.
3. Open the transfer system cap and connect the syringe to the transfer system by screwing it in clockwise.
4. Remove the protective disk from the vial. Slide the vial into the transparent sleeve of the transfer system and press firmly to lock the vial in place.
5. Empty the contents of the syringe into the vial by pushing on the plunger rod.
6. Shake vigorously for 20 seconds to mix all the contents in the vial to obtain a white milky homogeneous liquid.
7. Invert the system and carefully withdraw SonoVue into the syringe.
8. Unscrew the syringe from the transfer system.

Do not use if the liquid obtained is clear and/or if solid parts of the lyophilisate are seen in the suspension. SonoVue should be administered immediately by injection into a peripheral vein for use in echocardiography and in vascular Doppler imaging in adults or by intravesical administration for use in ultrasonography of the excretory urinary tract in paediatric patients.

If SonoVue is not used immediately after reconstitution the microbubble dispersion should be shaken again before being drawn up into a syringe. Chemical and physical stability of the microbubble dispersion has been demonstrated for 6 hours.

The vial is for a single use only.

Any unused medicinal product or waste material should be disposed of in accordance with local requirements.

7. MARKETING AUTHORISATION HOLDER

Bracco International B.V.
Strawinskylaan 3051
NL - 1077 ZX Amsterdam
The Netherlands

8. MARKETING AUTHORISATION NUMBERS

EU/1/01/177/002

9. DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

Date of first authorisation: 26 March 2001

Date of latest renewal: 24 April 2006

10. DATE OF REVISION OF THE TEXT

24/08/2017