

Diagnostic Imaging Pathways - Contrast Agents: Ultrasound Contrast Media

Ultrasound Contrast Media

US contrast agents (UCA) consist of microscopic bubbles of gas enclosed in thin flexible shell. The types of gas and shell material used differ depending on the brand of contrast agent. The microbubbles are generally 1-4 micrometers in size (smaller than a red blood cell) making them small enough to flow easily through the circulation, but large enough so they remain inside the blood vessels. Depending on their composition, injection method and dose, microbubbles can be detected in circulation from several minutes up to 60 minutes, after which their gas core diffuses out of the shell and the components are cleared by the reticuloendothelial system. [8](#) When high frequency sound waves from an ultrasound probe hit them, they oscillate and reflect a non-characteristic echo. The ultrasound probe is directed to send a special pulse inversion signal which enhances the echoes from the UCA, while reducing the echoes from the surround tissue. This results in an enhanced image of the tissue vasculature. [1](#)

The UCA may continue to oscillate for a short time before it bursts. The gas diffuses into the bloodstream, and the shell material is metabolised. Generally the UCA is given as an injection and only lasts a short time in the body. If longer times are required, UCA may be given through a drip to maintain a steady infusion of contrast. [1](#)

Safety

Ultrasound contrast agents are generally tolerated very well and have a very good safety record. They are among the safest contrast agents used in radiology. [1,2](#) The main serious adverse reaction is an anaphylactoid hypersensitivity reaction, which may occur in 1 in 7000 patients. This reaction is non-IgE mediated and may occur even if the patient has not been previously exposed to UCA. [2](#) However the overall rate of fatal events is quite low (approximately 1 in 500000). Less serious adverse reactions may include itching, moderate hypotension, headache, erythema, sensation of warmth and nausea & vomiting. [3](#) UCAs do not cause any renal impairment, and can be used in patients with any level of renal function.

A retrospective review of over 23000 injections of UCA in Italian centres found only 2 serious adverse reactions and no deaths (< 1 in 10000 serious adverse reactions). [3](#) There were 27 minor adverse reactions recorded (1 in 850). Another retrospective review compared the mortality & morbidity of 42000 patients who had UCA during rest & stress echocardiograms and compared with a matched cohort of 16000 patients who did not have UCA. [4](#) They found that there were no significant differences in the rates of death of AMI. A smaller retrospective study looked for differences in adverse reaction rates in patients undergoing dobutamine stress echocardiography with & without UCA. [5](#) Two different types of UCA were used in a total of 1486 patients. The control group contained 1012 patients. They did not find any significant differences in the incidence of adverse events among the three groups.

It is recommended that any UCA administration should take place in the presence of an experienced clinician who is experienced in managing severe hypersensitivity reactions. Additionally, patients with pulmonary hypertension or unstable cardiopulmonary conditions should have continuous monitoring of their ECG & vital signs for at least 30 minutes.

Indications

Contrast-enhanced US has multiple and increasing uses [8](#), including

- Cardiac US [8](#)
- Characterisation of focal liver lesions [6,8](#)
- Monitoring of percutaneous and transcatheter tumour ablation [6](#)
- Vascular US [8,9](#)
- Assessing vascularity of focal lesions (especially when CT and MR contrast agents are contra-indicated) [7,8](#)

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References - Ultrasound Contrast Media

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