^{51}Cr erythrocytes

1. Indications

^{51}Cr erythrocytes or labelled red blood cells are prepared using a registered radiopharmaceutical precursor Sodium chromate (^{51}Cr) Solution. ^{51}Cr erythrocytes can be used in the determination of red blood cell volume, the study of red blood cell survival time and evaluation of blood loss.

When using ^{51}Cr erythrocytes for red blood cell volume studies, the method can be combined with a plasma volume study using ^{125}I albumin.This so called dual-isotope technique provides very accurate results, but requires a complex procedure. ^{125}I albumin or ^{125}I HSA is in some countries registered as Seralb®.

2. Preparation

The preparation of ^{51}Cr erythrocytes is described in the SmPC and in the guidelines of the International Committee for Standardization in Haematology (ICSH). The preparation can be summarized in the following steps:

a. Fill a syringe with anticoagulant (ACD-A).
b. Collect blood using a needle with an inner diameter of 19 G. Needles with a smaller inner diameter will damage the cells. Make sure that the blood is well mixed with the anticoagulant.
c. Add the ^{51}Cr Sodium Chromate solution to the blood.
d. Incubate for 15-30 min at room temperature.
e. Add 50 mg ascorbic acid (as sterile solution for injection) to the mixture and allow to stand for 5 min.
f. Wash and re-suspend the cells with a sterile isotonic sodium chloride (0,9%) solution.
g. Draw the needed activity of ^{51}Cr erythrocytes for the patient dose and measure precisely.
h. When required for the method set aside an aliquot for the preparation of standards.

Special considerations:

- Working with blood can introduce risks to both the operator and the patient. The department labelling the cells should comply with all regulations. Adequate facilities, equipment, procedures and training for operators should be present. Additional the risks for blood contamination should be recognised and precautionary measures should be implemented to minimise those risks.
- Ascorbic acid is added to reduce untagged Cr^{6+} to Cr^{3+} and to stop the reaction.
- The patient should be at rest, in a recumbent position, for 15 min before administration of the labelled ^{51}Cr erythrocytes to avoid transient fluctuations in packed cell volume due to muscular exercise and changes in posture. The injection should be entirely

intravenous, avoiding extravasation.
- When the method is combined with ^{125}I albumin, an exact amount of ^{125}I albumin can be added to the labelled red cell suspension.

3. Quality control
- Before the blood cell labelling is started and throughout the procedure a check on the absence of blood clots needs to be performed.
- The labelling efficiency of the ^{51}Cr labelled erythrocytes should be determined after labelling. The labelling efficiency is defined as the total radioactivity measured in the cells as a percentage of the total radioactivity measured in both the cells and the plasma. The method is described in the literature. Under optimal circumstances a labelling efficiency from approximately 90% might be expected. The labelling efficiency depends on several aspects such as: pH, temperature, hematocrit, cell damage, operator inter-variability and drugs (see 'interactions').
- When the method is combined with ^{125}I albumin it is possible to measure the radioactivity of the ^{51}Cr and ^{125}I separately. This is because of the fact that these isotopes produce γ-rays of different energies. Correction for 'cross-talk' should be carried out.

Although no other quality control tests have been described, measurement of cell efflux of ^{51}Cr could be performed periodically or for validation purposes.

4. Interactions, contraindications & adverse reactions

Interactions

It has been reported that high in-vivo concentrations of ascorbic acid (vitamin C) affect the labelling of red cells with ^{51}Cr. The results indicate that a higher labelling efficiency may be obtained if oral or parenteral ascorbic acid therapy is discontinued before withdrawing blood to be used for labelling with ^{51}Cr. Because of the short half-life of ascorbic acid of 30 min, a discontinuation 12 h before the study should be sufficient.

Contraindications

Hypersensitivity to the active substance or to any of the excipients.

Adverse reactions

No adverse reactions to ^{51}Cr erythrocytes have been reported.

5. Biodistribution & pharmacokinetics

^{51}Cr is tightly bound to the beta-chain of haemoglobin. After intravenous injection of the ^{51}Cr labelled erythrocytes, ^{51}Cr slowly elutes from the cells in circulation at a rate of 1% per day. The labelled cells remain in circulation until sequestration in the spleen. At that time the chromium is released to the plasma. The chromium released by the cells is eliminated predominantly by the kidneys (96%) and is not taken up by other cells. Normal labelled red blood cells have a survival half-time of 25-35 days.

6. Stability

It has been reported that the loss of label for ^{51}Cr chromate is not significant during the first 43 h. Slight haemolysis was seen at the end of this 43 h. The SmPC does not state a specific maximum shelf life. In practice, longer periods of time between blood being taken from a

patient and the cells being re-injected have provided no evidence of problems. However it is recommended to re-inject as soon as possible, preferably within 1-2 h after labelling.

7. Literature

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