Detection of Gastrointestinal Protein Loss using ^{99m}Tc-HSA

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Warning: The radiopharmaceutical ^{99m}Tc Human Serum Albumin has not been registered for use as described in this protocol.

1. Introduction

Normal catabolism of serum protein takes place partly in the gastrointestinal tract. A wide range of gastrointestinal disorders can cause a pathological increase in this type of protein loss. ^{99m}Tc human serum albumin (HSA) is a labelled globular protein which remains in the bloodstream when vessel/intestinal wall permeability is normal. If this permeability is increased, intravenously administered ^{99m}Tc HSA is excreted from the bloodstream into the gastrointestinal tract, a process that can be recorded using sequential gamma camera imaging. This method of determining protein loss is easier to carry out than tests using ^{51}Cr chloride and can also provide information about the location of the protein leak. ^{99m}Tc is excreted partly by the kidneys (<15% after 30 min).

2. Methodology

This guideline is based on available scientific literature on the subject, the previous guideline (Aanbevelingen Nucleaire Geneeskunde 2007), international guidelines from EANM and/or SNMMI if available and applicable to the Dutch situation.

3. Indications

Hypoproteinaemia caused by protein losing enteropathy which can occur in: Crohn's disease, ulcerative colitis, enteritis, Whipple's disease, sprue, Menetrier's disease (damage to the gastric mucosa), constrictive pericarditis, congestive heart failure, intestinal lymphangiectasis or SLE.

4. Relation to other diagnostic procedures

Leakage of plasma proteins into the gastrointestinal tract can also be demonstrated and quantified by measuring the faecal presence of intravenously administered ^{51}Cr chloride.

5. Medical information necessary for planning

a. History of presenting complaint especially duration of symptoms.
b. Past medical history including known or suspected abnormalities.
c. Endoscopy results.
d. Blood results: serum protein, ESR and/or CRP, enumeration and differentiation of leucocytes.

6. Radiopharmaceutical

Product:	^{99m}Tc Human Serum Albumin
Nuclide:	Technetium-99m
Dosage:	500-740 MBq
Administration:	Intravenous

7. Radiation safety

a. Pregnancy

The external radiation dose received by the foetus after intravenous administration of the radiopharmaceuticle to the mother is approximately 1,4 mGy (0,0019 mGy/MBq). Foetal risk is therefore low for this investigation. Nevertheless, the investigation should be postponed till after parturition whenever possible.

b. Lactation

According to ICRP 106 there is no need to interrupt breastfeeding, but due to possible free ^{99m}Tc pertechnetate it is advisable to interrupt the feeding for 4 h.

c. Effective dose (mSv/MBq)

0,0061 for an adult patient with a normal biological functioning.

8. Patient preparation/essentials for the procedure

Patient preparation

Endoscopy and studies of the intestine with radiopaque contrast must be avoided during the 3 days prior to this investigation. The patient may not eat or drink for 3 h before the start of the investigation. During the investigation only light food is allowed. Prokinetic agents (domperidone, cisapride, metoclopramide) should not be used within the two days prior to the investigation.

Essentials for the procedure

No specific requirements

9. Acquisition and processing

a. Following intravenous injection of freshly prepared ^{99m}Tc HSA the patient is placed in supine position under the gamma camera. Dynamic images of the abdomen are obtained for the first 30 min after which static images are obtained at 1, 2, 4 and 24 h.

b. If the patient has a stoma, the contents of the stoma bag should be checked regularly for activity by placing the bag on the camera and acquiring a static image. Faeces should be collected and checked if leakage is suspected.

c. Camera setting and processing:

Energy:	^{99m}Tc setting, 140 keV
Window:	15-20%
Collimator:	LEAP
Counting time:	Dynamic: 1 min per image; static: 5-15 min per image
Computer:	Dynamic: 64x64; static: 128x128

10. Interpretation

a. Normally there is no activity in the bowel. Thus, ^{99m}Tc HSA scintigraphy is reported

as positive for gastrointestinal protein loss if activity is visible in the bowel which increases in intensity over time.

b. Physiological activity is visible in the liver, spleen, kidneys, bladder and major blood vessels.
c. The use of freshly prepared ^{99m}Tc HSA is recommended. Interference from free pertechnetate can be assessed on the basis of uptake in the gastric mucosa and the thyroid.
d. Hypoproteinaemia due to decreased protein synthesis cannot be demonstrated reliably using radionuclide techniques.

11. Report

The presence of activity in the bowel which increases over time and indicates gastrointestinal protein loss should be described. A record of the pattern of activity over time can be useful in localizing the source of leakage.

12. Literature

- Chiu NT, Lee BF, Hwang SJ, et al. Protein-losing enteropathy: diagnosis with 99mTc-labeled human serum albumin scintigraphy. Radiology 2001:219;86-90.
- Halaby H, Bakheet SM, Shabib S, et al. 99m-Tc-human serum albumin scans in children with protein-loosing enteropathy. J Nucl Med 2000;41:215-19.
- Wang SJ, Tsai SC, Lan JL. Tc-99m albumin scintigraphy to monitor the effect of treatment in protein-loosing gastroenteropathy. Clin Nucl Med 2000:25;197-9.