Use of a saline chaser in abdominal computed tomography: a systematic review
Takao H, Nojo T, Ohtomo K

CRD summary
This review assessed the usefulness of saline chaser to improve contrast enhancement in abdominal computed tomography (liver, portal vein and abdominal aorta) and concluded that contrast enhancement of the liver was improved in time-density analysis, but not clinical images. Due to limitations of the data set and weaknesses in the review, these conclusions should be viewed cautiously.

Authors' objectives
To assess the usefulness of a saline chaser for improving contrast enhancement in abdominal computed tomography (CT).

Searching
MEDLINE was searched from inception to March 2007. Search terms were reported. Bibliographies of retrieved articles were screened for additional studies. Searches were not restricted by language or publication status.

Study selection
Studies that compared CT contrast enhancement with and without a saline chaser and reported contrast enhancement values for the liver, portal vein or abdominal aorta were eligible for inclusion.

Included studies used 4, 8 or 16 detectors (multidetector row CT (MDCT)). Where reported, between 50mL and 100mL of contrast material at 300mgI/mL or 350mgI/mL was used and the volume of saline flush was between 20mL and 50mL.

Two radiologists independently screened studies for inclusion; disagreements were resolved by consensus.

Assessment of study quality
Two radiologists independently extracted data on study design, method of randomisation, allocation concealment and blinding. Any disagreements were resolved by consensus.

Data extraction
Data were extracted on the mean and standard deviation of contrast enhancement in Hounsfield units (HU) with and without saline flush for each included study. Separate data were extracted for the liver, portal vein and abdominal aorta, as available.

Two radiologists independently extracted data. Disagreements were resolved by consensus.

Methods of synthesis
Pooled mean differences in the magnitude of contrast enhancement, with 95% confidence intervals (CIs), were estimated for randomised controlled trials (RCTs) that compared the same dose of contrast material with and without a saline chaser. Separate pooled estimates were calculated for each anatomical area, and for the use of clinical images and time-density analysis. A fixed-effects model was used for all analyses. Between-study heterogeneity was assessed using the $\chi^2$ test.

Results of the review
A total of 17 studies were included in the analyses: nine RCTs (only one described the randomization method used); five controlled trials; and three self-controlled studies. No study reported allocation concealment, patient blinding or investigator blinding. Seven studies (five RCTs and two self-controlled studies) reported blinding of outcome assessors.

For clinical images there was no significant difference in mean contrast enhancement, with or without saline flush, for
the liver (mean difference -0.4, 95% CI -2.4 to 1.7; two studies) or the abdominal aorta (mean difference 11, 95% CI -5.3 to 27; two studies). Saline flush significantly improved contrast enhancement for the portal vein (mean difference 7.4, 95% CI 1.3 to 14; three studies).

For time-density analysis, saline flush significantly improved contrast enhancement in all anatomical areas studies: liver (mean difference 8.2, 95% CI 4.2 to 12; two studies); portal vein (mean difference 28, 95% CI 16 to 40; two studies) and abdominal aorta (mean difference 15, 95% CI 0.3 to 30; three studies).

The results of between-study heterogeneity assessment were not reported.

**Authors' conclusions**

In clinical images, a saline chaser did not improve contrast enhancement of the liver. In time-density analysis a saline chaser improved peak contrast enhancement of the liver, portal vein and abdominal aorta.

**CRD commentary**

This review addressed a clearly stated research question on the usefulness of saline chaser to improve contrast enhancement in abdominal CT. Appropriate inclusion criteria were defined. Searches were limited to a single bibliographic database, with reference screening, so it was possible that relevant data were omitted. There were no restrictions by language or publication status, which minimising the potential for language and publication biases. Measures to minimise error and/or bias in the review process were reported. An assessment of the methodological quality of included studies was made and study quality was incorporated in the interpretation of the results. Study quality was generally poor and study size small. Although non-randomised controlled studies were included in the review, conclusions appeared to be based solely on meta-analyses of RCTs. The analytical methods used were broadly appropriate, although the validity of the use of a fixed-effect model was unclear since the results of heterogeneity testing were not reported. The authors concluded that saline chaser improved CT contrast enhancement of the liver in time-density analysis, but not in clinical images. Due to the limitations of the data set (acknowledged by the authors) and some weaknesses in the review, these conclusions should be viewed with caution.

**Implications of the review for practice and research**

**Practice:** The authors did not state any recommendations for practice.

**Research:** The authors did not state any recommendations for future research.

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