

CT ENTEROGRAPHY/CT ABDOMEN AND PELVIS USING NEUTRAL ORAL CONTRAST. A NEW COMBINATION OF NATURAL PRODUCTS.

Muhammad Ovais Aslam¹, Sabtain Raza², Madihia Batool³, Nizar Al-Nakshabandi⁴

ABSTRACT:

Our purpose was to assess the performance of a new combination of neutral oral contrast for CT abdomen and CT Enterography in comparison with commercially available neutral oral contrast VoLumen . Seventy three consecutive patients were given sorbitol/CMC (Carboxy Methyl Cellulose) solution or VoLumen as oral contrast agent for abdominal computed tomography (CT) scan. 23 patients were male and 37 females. Age range was between 16 and 67 years.

Since the use of CT scan for abdominal pathologies, there was need to separate bowel loops to localize the pathology. Three types of oral contrast can be used in CT-Scan abdomen; Positive, Neutral and negative. The above used contrasts are "Neutral contrast" these refers to agents that have an attenuation value similar to that of water (0-30 H).

Aslam MO¹

Professor of Radiology
KEMU, Lahore

Raza S²

Radiologist

Batool M³

Radiologist

Nakshabandi N A⁴

Professor of Radiology
Kingsaud University,
Riyadh, Saudia Arabia.

Our results show this new combination of CMC and Sorbitol to be equally good as VoLumen, for luminal distension and mural details, in duodenum and jejunum. While better than VoLumen for Ileal distension.

KEYWORDS:

CT-Scan Abdomen, CT Enterography, Oral contrast, Neutral oral contrast.

INTRODUCTION:

Since the use of CT scan for abdominal pathologies, there was need to separate bowel loops specially the small bowel loops to localize the pathology. For this purpose positive oral contrast was used for decade. This provides very little information regarding bowel related pathologies. It obscured the mucosa and inner bowel wall. The positive oral contrast used is containing barium or iodine-containing products. (Milk 1-5) With the advancement in CT technology and advent of multi detector helical CT scanners (MDCT) lead to new techniques like CT angiography, CT urography, and CT cholangiopancreatography, the high-attenuation contrast material in the bowel loops has been found to interfere with two- and three-dimensional multiplanar reformation with maximum and minimum intensity projections (6-9).

Neutral contrast" refers to agents that have an attenuation value similar to that of water (0-30 H). For neutral contrast agents to be effective they need be used with IV contrast material and the small-bowel distention must be optimal.

The availability of MDCT along with advancements in 3D CT imaging systems has greatly expanded the role of CT in evaluation of

suspected small bowel pathology. CT is now considered a first line for the evaluation of a wide variety of bowel diseases in combination with neutral oral contrast. It can also evaluate other abdominal pathologies related to solid organs and provide valuable information of the abdominal vessels using MIP images.

PURPOSE:

Our purpose was to assess the performance of a new combination of neutral oral contrast for CT abdomen and CT Enterography.

It has been established that CT scan is an excellent modality for the evaluation of bowel related abnormalities. Its ability to evaluate the intraluminal pathologies and demonstration of mural and extra luminal details make it the best available tool for the assessment of this rather inaccessible part of the body.

Many different types of orally administered contrasts have been used to distend the bowel lumen, which is essential for making an accurate diagnosis. Neutral contrasts, which are probably the most widely used agents, have long been investigated for this purpose. Water (10) and water-methylcellulose solution, water and sorbitol / manitol solution, lactulose (11) polyethylene glycol (PEG) electrolyte solution or low-concentration barium (Volumen; E-Z-EM, Westbury, NY) 0.1% w/v ultra-low-dose barium with sorbitol. VoLumen is one such commercially available agent, shown to be good for distension and visualization of bowel wall, by different investigators.(12)

Our experience, although, showed some problems with its use. Its thick consistency that is often not acceptable to the patient. Its inability to properly distend the lumen of bowel, particularly ileum. Its rather high density of 20 HU can at instances make the detection of intraluminal abnormalities difficult. And last but not the least its high cost.

We decided to use the long known ability of carboxy-methyl-cellulose (CMC) to distend the bowel lumen and to combine it with the water retaining ability of a very easily available sugar alcohol, Sorbitol, for use as a neutral contrast agent in CT abdomen. We intended to compare the performance of our new contrast combination to that of VoLumen, in terms of bowel lumen distension, bowel wall visibility, patient acceptance and cost. Our hypothesis was that

CMC and Sorbitol combination is better than VoLumen in terms of the above.

METHODS AND MATERIALS:

This study is part of the ongoing study which we are conducting on a larger group of patients, conducted at our medical group (AlRayan and Olaya centers Riyadh).

73 patients included in the study, presented with a variety of abdominal symptoms.

The patients were randomly allocated to two groups. Group A received, contrast A, 1200-1500 ml of a solution comprising a mixture of Sorbitol and carboxy-methyl-cellulose (CMC). The two solutions were prepared separately and then mixed, freshly for every patient. Group B received an equal amount of VoLumen.

Patients were asked to drink the initial 1000 ml in 30-45 minutes. Another 250 ml, given 15 minutes before and the rest when the patient was on the examination table.

The patients who could not drink at least 1200 ml of either of the contrast, were excluded from the study. In addition, patients allergic to contrast were also excluded. 80 - 120 ml non ionic iodinated contrast material was injected, of 300mg I/ml, at a rate of 2.5-3cc/sec, followed by a 20 ml saline flush. Imaging was performed on 6 and 64 channel CT scanners (GE Healthcare). Scanning was performed at 65-70 sec delay. We chose the venous phase for scanning because we wanted to generalize this protocol for all CTs of the abdomen and not just for enterography. None of the patients received Glucagon or Buscopan. Eight scans were done on a six detector row scanner and the rest on 64 row MDCT.

Image interpretation was done by two radiologists, having three to fifteen year experience in reading abdominal CTs. Both the readers were blinded to the type of contrast agent consumed.

Degree of bowel distension was qualitatively evaluated on a three point scale 1-3 (1= luminal distension of 0-1cm, 2= 1-2cm, 3=2-3cm). The visualization of bowel wall enhancement was also noted for all the patients. We also calculated the cost of each type of oral contrast for each patient. Patient feed back was also recorded for acceptance of contrast and any untoward symptoms following consumption.

STATISTICAL ANALYSIS:

The mean values of qualitative assessment of bowel lumen in the two groups, were assessed using a Student t test with p significance value set at less than 0.05. Chi square test was applied to assess the difference in each bowel segment. Paired t test was used to evaluate the difference in distension of jejunum and ileum within the same group.

RESULTS:

Non specific abdominal pain	18
Crohn's disease	11
Lymphoma	9
GI malignancies	9
GI bleeding	5
Post operative	4
Hernia	3
Foreign body	1

DISTRIBUTION OF INDICATIONS FOR CT:

23 patients were male and 37 females.
 Age range was between 16 and 67 years in group A and 19 and 58 years in group B.
 Five patients reported nausea during and after the consumption of oral contrast (n=2 for Contrast A and n=3 for Contrast Volumen), most likely related to the volume of contrast.

	CMC + Sorbitol	VoLumen
Pleasant	13% (4)	6% (2)
Easily drinkable	73% (22)	60% (18)
Difficult to drink	13% (4)	33% (10)

PATIENT FEEDBACK FOR CONTRAST ACCEPTANCE:

There was no significant difference observed in the visibility of bowel wall in the two groups but some what higher densities were seen in distal small bowel in few cases . The effect of this high density could not be established probably due to the small number of patients.

There was no significant difference in the Mean values of distension in duodenum and jejunum in both groups. The difference in luminal distension

was significant in ileum according to the 2nd observer (p=0.046) but borderline according to the 1st (p= 0.055).

The difference in distension of jejunum and ileum within the groups was not significant.

Between the two observers a very good agreement was observed for the distension of duodenum and ileum but was not as good for jejunum (kappa= 0.5).

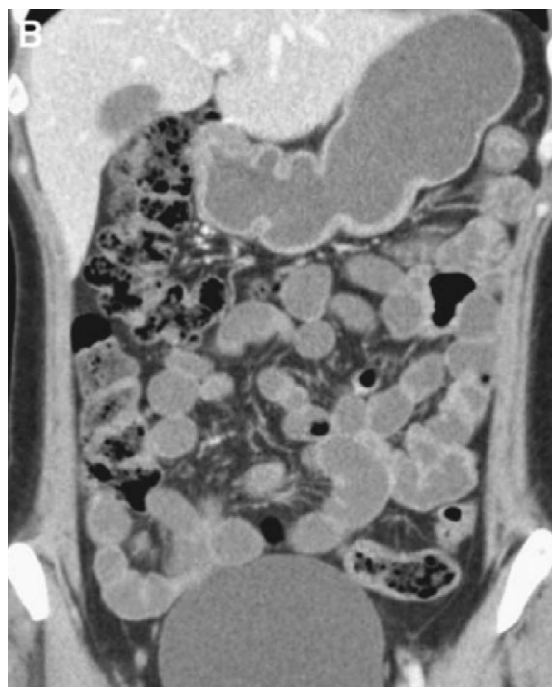
Total cost incurred for Contrast A preparation was 04 Saudi riyals (1.06 USD) and 90 Saudi riyals for VoLumen (24 USD).

CONCLUSION:

Our results show this new combination of CMC and Sorbitol to be equally good as VoLumen, for luminal distension and mural details, in duodenum and jejunum. While better than VoLumen for Ileal distension.

In addition, the better patient acceptance and much lower costs of this new combination, proves it to be a better agent than VoLumen for use in routine CT abdomen and CT enterography procedures.

Its universal availability and simplicity of preparation makes it our preferred choice, which is better both for the patient and the department.



VoLumen oral contrast



Sorbitol/CMC oral contrast



Positive oral contrast

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