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CoRIPS Research Grant 185

£4,780.39 awarded

Title: Enhanced Preparation In Colonic Ultrasound: A study investigating the accuracy of Ultrasound compared with CT in the assessment of colon when combined with bowel preparation.

Principle Aim

The primary aim of this trial will be to compare the accuracy of TAUS with CTC when diagnosing bowel pathology proximal to the sigmoid, in a prepared colon.

Primary research question

Is the accuracy of TAUS comparible with CTC when diagnosing bowel pathology proximal to the sigmoid, in a prepared colon?

Secondary research questions: Is the visualisation rate of the appendix improved using TAUS in the prepared colon?

Outcomes

There is limited research data of the effect giving patients having TAUS bowel preparation has on diagnostic findings. The outcomes of this quantitative study will be addressing the research question and aim, providing new knowledge of the accuracy of TAUS in diagnosing bowel pathology proximal to the sigmoid in a prepared bowel.

These findings will identify if it is feasible in the future to develop specific TAUS protocols using bowel preparation in screening for bowel pathology proximal to the sigmoid.

Review of literature and identification of current gap in knowledge

The comparative accuracy of TAUS against imaging modalities such as magnetic resonance colonography (MRC) and computed tomography colonography (CTC), in combination with colonoscopy (CS), in assessing large bowel pathology (LBP) and influencing patient pathways has not been well documented. Accuracy of TAUS in a prepared bowel is an area particularly lacking in clinical research.

TAUS is very often the first line imaging test used, without bowel preparation, to assess patients with abdominal pain. It is a widely available, inexpensive and non-invasive examination, and with development of technical experience by clinicians and sonographers, and integration of a clinical focus at patient evaluation, it can be a powerful tool for bowel assessment.

The focus of this background literature review is to investigate, using previous research, the accuracy of TAUS in the detection of bowel pathology, with emphasis on colonic polyps, cancers and appendicitis. A comparison of TAUS with other imaging modalities will also be made. It is the aim to establish, with the proposed research, if TAUS of the colon has the potential to be improved with the use of bowel preparation prior to scanning.

Polyps and Cancer: Studies indicate that most colorectal cancers arise from adenomatous polyps (Bond, 2000). Wang et al (2018) state that although the detection and removal of pre-cancerous polyps using colonoscopy is the accepted gold standard, the detection rate of adenomatous polyps can vary significantly among endoscopists. The implementation of colonoscopy has also been limited by its invasiveness and poor patient acceptance.

According to Public Health England (2019), CTC is the only alternative diagnostic test available in the bowel cancer screening pathway when colonoscopy is incomplete, or the patient is considered medically unfit for that procedure. However, the use of ionizing radiation is a significant drawback for screening in average risk patients. MRC does not require ionizing radiation, but appears to be less suitable for bowel cancer screening than CTC, predominantly because of decreased spatial resolution, availability and financial implications (Thornton et al. 2010). Many patients also have contra-indications, preventing them from having MRI. Few studies have reported the diagnostic value of MRC versus CTC. Graser et al (2013) found MRC detected colorectal neoplasia with lower levels of sensitivity than colonoscopy. Recently, Shuangyan et al compared the diagnostic value of MRC versus CTC for colorectal cancer, and found CTC to have a higher overall diagnostic value (2018).

TAUS, although not a widely accepted imaging modality in the detection of colonic polyps and lesions, has been advocated within several studies as being capable of LBP detection. It has been shown to present high sensitivity and specificity in the diagnosis of tumours located above the rectosigmoid junction (Martínez-Ares. Et al, 2005). Recent research carried out by Liu et al also highlights that bowel preparation before TAUS optimises imaging results (2017). Siripongsakun et al also stated that excellent colonic cleansing was mandatory to detect small polyps in colonic studies, as adherent stool can mimic small polyps (2013).

Loftus et al (2014) demonstrated that TAUS performed without bowel preparation on 50 patients with symptoms suggestive of colon cancer detected a higher percentage of cancers than colonoscopy. TAUS was also shown to have a sensitivity and specificity of 100% in this small study.

According to research carried out by Kuzmich, Harvey, Kuzmich and Tan (2012), sonographic examination of the accessible colon without bowel preparation can reveal large colonic polyps, which appear as spherical or ovoid, well-defined hypo-echoic lesions within colonic lumen. They found that, with careful technique, they did not encounter false-positive results, and reported very high specificity of up to 99.4% for colonic polyp detection. Hosokawa et al (2019) found the accuracy for detecting colorectal polyps in paediatric and young adult patients using TAUS without bowel preparation to be 89% in their cohort. Limberg's study (1992) involving 300 patients, showed using hydrocolonic ultrasound (HUS) for detecting colonic polyps greater than or equal to 7 mm in size and colonic cancer with a sensitivity of 91–97% and 100%, respectively (1992). Siripongsakun et al (2013) reiterated this in a smaller study, with radiologists performing HUS with a sensitivity of 89% for large polyps of greater than or equal to 1 cm. However, their sensitivity for small polyps of 6-9 mm was only 25%. With increasing operator experience and technical advances in ultrasound equipment to date, sensitivity of small polyps and lesion detection should increase.

Following the correct preparation for subsequent CTC, as within the proposed study, should eliminate most residual stool, without the need for a hydro-colonic techniques discussed in other studies. Although there is limited literature concerning the use of colonic preparation prior to TAUS, the diagnosis of intestinal lesions has been shown to be improved by adding a bowel preparation or using water as a contrast agent in the rectum, providing supplementary data on the intestinal layers affected and distances from lesions to the anal border (Chamié et al, 2010).

The Appendix: TAUS is currently often the first line imaging modality for patients with possible appendicitis. Kim et al (2018) compared TAUS with CT and MRI in detecting the normal appendix using a validated systematic review and meta-analysis. They found the appendix detection rate was 71% for TAUS, CT was 84%, and MRI 69% overall, comparing data from 1987 to 2017.

TAUS has also been shown to compare favourably to CT on straightforward cases of appendicitis. Atema et al found TAUS and CT to have a false positive rates of 10% and 8% respectively (2014).

The sensitivity and specificity of TAUS can approach that of CT when diagnosing AA, without the use of ionizing radiation. This has been researched more

extensively within the paediatric population, however, the first-line use of TAUS for diagnosing AA is indicated in adult patients, with complementary imaging following if necessary, for example, if there was non-visualisation of the appendix on TAUS (Mostbeck et al, 2015).

Further study, as proposed, is warranted to assess the accuracy of TAUS in the detection of both the appendix, and colonic lesions in a prepared colon. The limited data available concerning the accuracy of TAUS of the bowel has shown that it can be comparable to that of CT and superior to MRI. It is also non-invasive, which is a major drawback of the gold standard colonoscopy. With improved operator expertise and continuing technical advances, this modality may have the potential to be used as a screening tool for evaluating bowel pathology.

Methodology

The sampling strategy will involve patients being approached to participate within the study who have CTC referral requests, to rule out/investigate the presence of large bowel pathology.

Patients will be approached to consider participation (and be given the patient information leaflet) in the trial in the following ways:

- In the outpatient clinic appointment, when their CTC is initially instigated. This will require the requesting physician and specialist nurses' participation.
- In the outpatient clinic by one of the Radiology research team members.
- An invitation, together with the patient information leaflet, will be sent along with the appointment for the patient's CTC scan. A follow-up phone call will accompany this method, with appropriate ethical approval confirmed.
- Cold calling will not be carried out

<u>Patient and Public Involvement</u>

We have a Patient Research Ambassador (PRA) group who are volunteers and come from different professional backgrounds. They will be able to give advice on the design of our study as well as review patient facing documents to ensure this is patient-friendly. There has been disruption to the regularity of these meetings due to the COVID- 19 pandemic; however, a meeting with this group will be arranged as soon as possible.

It is estimated that 208 patients will be enrolled between the periods of January and December, 2021.

The following examination technique will be required for each participant:

Preparation: Oral contrast preparation and diet as per CTC protocol

Nil by mouth- 4 hours

Technical requirements: Use of both curve-linear and high resolution ultrasound probe (min 5 Mhz frequency)

Procedure: Systematic review of colon and small bowel with both ultrasound probes

Systematic review of abdominal solid viscera

Application of colour Doppler

Data collection during each scan will include the following to include in participant's CRF:

Pathology, Location, ?Identified on TAUS, ?Size, ?Identified on CTC, ?Size

Data regarding the identification of the appendix will also be documented.A detailed statistical analysis plan will be produced and finalised prior to data collection completion and transfer to the trial statistician within the Portsmouth Hospital's NHS Trust. Analysis will be based on all patients in the study.

Data analysis

As a technology trials unit (https://portsmouthtechnologiestrialsunit.org.uk/) we work in collaboration with the University of Portsmouth. We have a University statistician who provides statistical support for studies sponsored by PHT. We also have a dedicated data management team who can create and manage CRFs. The data management team will support with the development of a data management plan to ensure high quality data is collected.

Potential impact

On completion of this study, the results could be used to change or add to current practice in the patient pathways directed by clinicians such as specialist consultant surgeons, gastroenterologists and general practitioners. If the TAUS in a prepared bowel examination is not used as an alternative to CT, it may be used as an additional test to enhance findings. Patients following specific lower gastrointestinal pathology pathways would benefit from the potential findings, as

it may eliminate or reduce their exposure to ionising radiation. The research may also create an opportunity to extend the practice of gastrointestinal sonographers.

Dissemination Strategy

Participants, such as patients and clinicians, will be given feedback on the study findings, and may wish to participate in the dissemination of the research.

The intention is to share results of the study by presenting at the annual Trust's lower gastrointestinal MDT, where clinicians from surrounding trusts attend, ensuring clinicians within the area are aware of the findings. Results will be shared nationally at conferences such as UK Radiology Conference and international conferences such as the European Society of Gastro Abdominal Radiology. In addition to regional dissemination, reports and presentations will be submitted to suitable professional outlets such as professional journals, conference posters and presentations. Social media will also be used as a medium to share findings from this study. This enables both professional and general public viewing. Any presentation, publication and event where the study will be discussed will be advertised through sites such as Twitter, university, hospital and professional body/organisational social sites.

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