GUIDELINES FOR THE USE OF IMAGING IN THE NHS BOWEL CANCER SCREENING PROGRAMME

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*See reference 1 and the 'Clinical Radiology' page of the Royal College of Radiologists' website (http://www.rcr.ac.uk/).

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1. INTRODUCTION

These guidelines have been developed in response to the increasing use of radiology and, in particular, computed tomographic (CT) colonography (or virtual colonoscopy) by the NHS Bowel Cancer Screening Programme (BCSP). They have been distilled by the editors from the deliberations of a multidisciplinary team (MDT) in the light of guidance set out in the international CT Colonography Standards document, which was initiated in the UK and developed in collaboration with gastrointestinal radiology groups in Canada, Australia and New Zealand.[1]

The screening algorithm for patients participating in the NHS BCSP has been widely publicised and the potential role for radiology within it clearly defined.[2] The standards detailed below have been devised for BCSP screening teams offering CT colonography to patients with positive faecal occult blood tests (FOBt) who are unable to undergo complete conventional colonoscopy. Additional information and further reading may be found in the CT Colonography Standards document.[1]

The bowel cancer screening IT system (BCSS) will be modified, where necessary, to support the new audit and reporting requirements outlined in this document.

2. PATIENT ELIGIBILITY FOR IMAGING

Patients in the screening programme who require colonoscopy but for whom the procedure would not be suitable (or has been incomplete) may instead be offered an alternative whole colon imaging examination. Where patients are unlikely to be fit enough for an imaging examination or any subsequent intervention they should not automatically be referred. Instead they should have the options explained to them (and, if appropriate, to their carer) before a decision is made on whether to continue with the screening procedure.

Patients for whom conventional colonoscopy is not indicated in the BCSP include

- patients aged up to 75 years with significant cardiovascular or respiratory comorbidity which might compromise the safety of a colonoscopy examination
- those deemed too frail to undergo standard laxative preparation but who would tolerate CT colonography using a reduced laxative faecal tagging regimen. This should be considered only in centres with sufficient experience of using CT colonography with reduced laxative faecal tagging regimens
- patients taking warfarin
- those with a history of incomplete colonoscopy.

Where imaging is indicated, CT colonography is the preferred method. Double contrast barium enema is reported to have a fourfold false negative rate: it is therefore less appropriate for screening patients with positive FOBt, who have approximately 40% likelihood of harbouring a large colonic polyp or cancer. Where high-quality CT colonography is not available locally, the patient should be referred elsewhere for examination. CT colonography should always be performed to the standards described below, and take place as close to the patient's home (or other preferred location) as possible. If the examination can be performed to a high standard at the screening centre location, but local CT colonography interpretative experience is lacking, then CT data should be transferred to a suitably experienced radiologist for double reporting.

3. PATIENT INFORMATION AND CONSENT

- A national information leaflet is being developed for patients' use. In the interim, local leaflets prepared in compliance with the international CT colonography standards should be made available[1]
- Patient referral forms should incorporate a comment on suitability of patients for bowel preparation and refer to National Patient Safety Agency (NPSA) advice on this
- A written record should be kept of when consent (verbal or written) was obtained. It should include the name and designation of the individual to whom consent was given. The specialist screening nurse practitioner will initiate the consent process at initial consultation, although it is expected that the team undertaking the examination will complete the consent procedure. Local Trust procedures for CT colonography provision should also be observed. At some stage the patient should be offered information (as above) and the opportunity to ask questions about the planned CT colonography examination, its intended benefits and possible risks
- The specialist screening practitioner (SSP) should be sufficiently informed to resolve routine queries about CT colonography and should remain the patient's main point of contact concerning the examination and the screening programme
- Contact details for an experienced CT colonography team member should be made available so patients can resolve additional questions before the day of the examination.

4. BOWEL PREPARATION

- Full laxation (using ‘dry’ purgatives) without faecal tagging is currently standard practice in the majority of centres. Faecal tagging is becoming more widely used, however, and may improve specificity. It also permits reduced laxative regimens, and these may be more appropriate for frail patients. The use of faecal tagging nevertheless requires greater interpretative experience and adds to the cost and complexity of patient preparation
- Decisions on bowel preparation should aim to ensure that the dose of laxative is consistent with the vulnerability of the patient and the nature of the target lesion. For example, a reduced laxative dose may suit a frail patient in whom the target lesion is cancer. In a relatively fit high-risk patient, however, where the detection of subtle advanced polyps assumes greater clinical significance, full laxation combined with faecal tagging may be more appropriate
- The possibility of allergic reaction should be considered when prescribing iodinated oral contrast for outpatients.

5. SCANNER PARAMETERS AND PROTOCOLS

- Multidetector CT (MDCT) should be used. When older scanners are used, pitch/table feed per rotation should be adjusted to achieve full anatomical coverage within a single breath hold and minimise movement artefact
- An initial exploratory (scout) view is essential to assess bowel distension
- The dose should be kept as low as is reasonably practicable (ALARP)

  - 120 kVp (peak kilovoltage) is generally recommended
  - milliamps (mA) should be ALARP. The dose should be reduced to the minimum (and tailored to the colon only) for at least one of the scan acquisitions. Typical values for mA for a 64 detector row scanner (when intravenous contrast is not administered) would be 80 mA for the initial acquisition (frequently supine) and 30 mA for the second (prone) scan, but parameters will vary according to patient body mass index and CT platform
  - the patient should be imaged in the craniocaudal direction

- Collimation and slice thickness should be ≤ 3 mm and ≥ 1.0 mm respectively with a reconstruction interval of 0.5 to 0.8 (× slice width) and using a softer (eg soft tissue) CT reconstruction algorithm
- Effective doses should be monitored locally and dose reference levels should be set and recorded
- Where available, dose modulation should be used. Caution should be exercised with obese patients, however, as in some instances it may inadvertently increase their dose. CT teams are advised to seek local medical physics advice on correct patient positioning when using dose modulation.

6. ON THE SCANNER TABLE

- Dual position scanning is a requirement for CT colonography
  - supine and prone positions should be routine, but in some cases, for example immobility or obesity, lateral decubitus scans should be considered as an alternative
- The SSP should check whether a patient's history includes colonic surgery. If it does, details should be recorded and made known to radiology staff
- Thin rectal catheters should be used, with or without the small inflated balloons that are designed to help reduce anal incontinence of gas
  - staff performing rectal catheterisation and colonic insufflation should have appropriate levels of anatomical knowledge and technical competence and be alert to procedural risks
  - disposable catheters and tubing to insufflation apparatus should be used once only and then discarded
- Hyoscine butylbromide improves colonic distension during CT colonography and should be actively considered unless contraindicated. Glucagon is not recommended as an alternative
  - patients should be advised to seek medical attention if they develop painful blurred vision (possible acute glaucoma) following injection
- An exploratory scout scan should be performed before the full scan acquisition, or sooner if insufflation proves difficult
- All CT images should be reviewed before the end of the examination to determine whether additional scans are needed, for example where distension is suboptimal. This initial review must be undertaken by an experienced practitioner. It could be performed by an experienced radiographer with adequate training
- Colonic distension should be undertaken with carbon dioxide, ideally using an automated insufflator
  - manual insufflation of carbon dioxide or air via thin flexible catheters is an option when insufflators are not available.

7. USE OF INTRAVENOUS CONTRAST

- Intravenous contrast should not routinely be administered to BCSP patients undergoing CT colonography unless there is a specific indication for more detailed extracolonic organ review
- Where no contrast has been administered, reports should state this explicitly and note that the ability to exclude potentially significant extracolonic pathology is thereby diminished.

8. ADDITIONAL 'ONE STOP' TESTS AFTER CT COLONOGRAPHY

- Intravenous, contrast enhanced staging CT should be performed in the majority of cases where evidence of colonic or extracolonic cancer is detected during an examination

  - staff taking this decision need the relevant knowledge, skills and experience to avoid unnecessary additional tests
  - if a cancer is identified on the initial acquisition, whether supine or prone, intravenous contrast should be administered for the second acquisition in the opposite patient position. A CT chest scan should be included

- Same-day endoscopy for cancer is usually desirable. However it may be contraindicated, inappropriate or inconvenient for some patients. Where same-day endoscopy is not performed, there should be clearly documented discussion about the CT colonography findings at the MDT meeting. This should include consensus on whether flexible sigmoidoscopy alone (eg for left-sided cancer) or full colonoscopy is needed
- Same-day CT colonography for incomplete colonoscopy is usually desirable, unless it is inappropriate for the patient or the bowel is inadequately prepared (which can be predicted by endoscopy)
- Same-day rectal magnetic resonance imaging (MRI) may be appropriate in some cases. It is unlikely to be implemented routinely, however, as capacity is limited in many centres.

9. PATIENT EXPERIENCE AND SAFETY

- All members of the CT colonography team must be trained to recognise complications arising before, during and after procedures
- The CT colonography team must follow clearly documented and recognised protocols for managing complications such as

  - cardiovascular complications (including angina, hypotension and bradycardia). These frequently combine in vasovagal attacks and may result from using Buscopan®
  - anaphylaxis
  - contrast extravasation or haematoma at the cannula site
  - severe abdominal pain
  - colonic perforation

- Resources must also be available to manage immediate complications, including resuscitation, monitoring equipment and appropriately qualified medical and nursing staff
- There must be a local protocol in place for managing diabetic patients (including those taking metformin if intravenous contrast is to be administered)
- Radiographers who administer intravenous (IV) contrast (for staging when a cancer is found) or Buscopan® must do so in accordance with a locally written Patient Group Directive
- Patients should remain in the CT department for at least 15 minutes after injection with IV contrast and for 30 minutes if they are at increased risk of anaphylaxis. If a cannula has been inserted and an adverse event is anticipated the cannula should remain in place until the patient is ready to leave the department
- Colonic perforation is a recognised complication of CT colonography and occurs in 1 in 3000 examinations.[4] A radiologist or appropriately trained radiographer should review the two-dimensional (2D) scan images before the patient leaves the scanning suite. If a perforation is detected the reviewer should contact the appropriate surgical team to request a timely clinical assessment. While most perforations caused by CT colonography are asymptomatic, further management should be at the discretion of the local surgical team
- Patients should have easy access to lavatory and changing facilities
- A comfortable quiet area should be available for patients to relax and recuperate after a procedure
- Consideration should be given to offering patients light refreshments (such as tea and biscuits) once the initial observation period of 15 minutes has elapsed following administration of IV contrast. It may be appropriate to restrict this to water, however, until a decision is taken on whether to proceed to same-day endoscopy
- After examination, patients should be provided with information which describes common minor symptoms following the procedure and offers advice on what to do if the symptoms are more severe or persist for more than a few hours
- Following CT colonography some patients may need further imaging for staging, onward referral or same-day endoscopy. Staff undertaking this imaging or organising referral will need additional skills and competencies (including interpretation and communication skills, such as breaking bad news) and should work within local protocols and procedures. A suitable private area should be available for communicating scan results to patients.

10. INTERPRETATION METHODS AND COMPUTER AIDED DETECTION

- CT colonography interpretation requires access to software with 2D displays, multiplanar reformats and a three-dimensional (3D) endoluminal reconstruction. Either primary 2D or primary 3D reading methods are acceptable, providing access to both 2D and 3D displays is available. Computer aided detection (CAD) software is incorporated into several reading platforms and may benefit accuracy of interpretation by approximately 10%, particularly for less experienced radiologists. Use of CAD, however, is not specifically recommended at this time as further evidence of efficacy is awaited.
- Readers should be competent in both 2D and 3D reading techniques. The choice of reading method may vary within and between CT colonography datasets, depending on technical quality and the target lesion
- CT colonography interpretation should be undertaken only by a consultant radiologist
- For the BCSP, in which there is a particularly high prevalence of early neoplasia, radiologists interpreting CT colonography should be able to produce audit data of performance (see below) for more than 100 NHS (symptomatic or BCSP) CT colonography examinations per year.

11. PATIENT MANAGEMENT AND INTERVAL SURVEILLANCE

- Reporting radiologists must have a good knowledge of the BCSP pathways and its strategies for managing polyps and masses of different sizes and morphologies
- Radiologists should report the probable biological significance of colonic findings to the director of the screening programme and the patient's GP
- Radiologists should indicate their degree of confidence (eg as a percentage) that a reported abnormality is likely to be a true positive finding. This will help to ensure that the patient is managed appropriately and to quantify the likelihood of a positive finding at endoscopic review.

Surgery without endoscopy/histopathological confirmation is an option where the patient is deemed unfit for endoscopy (eg full laxation) or where colonoscopy has failed but multiple and/or large polyps/masses are seen on the CT colonography examination. However it should be considered only if a suitably experienced radiologist (see above) is confident about the findings, if the patient is fit enough for surgery and if he or she is thought to be at high risk of colorectal cancer (ie the risk–benefit ratio is deemed low).

Patients who are unfit for intervention but may improve should be reviewed after six months by the SSP and colonoscopist; further decisions about patient management may be taken at that point. Where large or multiple small polyps (maximal diameter 6–9 mm) are found in such patients, these may be subject to surveillance every one to three years, with the actual surveillance interval being determined locally.

Where the patient is unfit for surgical intervention and unlikely to improve over time, current guidance is that the management of a suspected cancer or advanced adenoma should be discussed by the screening MDT.

12. PLANNING CT COLONOGRAPHY TEAMS AND LISTS

- A radiologist with the necessary CT colonography expertise should provide leadership and take primary responsibility for the CT colonography service. This may be the lead radiologist for the BCSP or an appointed deputy
- A team approach is critical to the success of CT colonography. The local organisation of a team will depend on the skills mix and competencies of its members. The skills and competencies needed should be clearly defined in the screening centre's protocols

  – governance and risk management strategies should be robust, fully documented and well understood by all team members. This will help to ensure that responsibilities can be delegated, where necessary, with confidence.

13. MEASURING AND MONITORING CT COLONOGRAPHY ACTIVITY AND OUTCOMES

- All departments offering a CT colonography service to the BCSP must measure and monitor their BCSP activity and achievements in relation to patient safety, patient outcomes and patient experience. All radiologists must collect their individual audit data for at least 100 examinations per year, to include all BCSP activity. Data from NHS examinations should be used to make up any shortfall if BCSP activity comprises fewer than 100 cases.
- Patient safety audits should include
  - clearly displayed protocols for managing complications and adverse reactions
  - documented monitoring of complications and adverse reactions
  - demonstrable compliance with standard acquisition and radiation protection protocols
  - quality control of CT colonography equipment, including the workstation and insufflators
- Patient outcome measures should include
  - description of reporting methods used for examinations, indicating whether they are double reported and, if so, by whom
  - time interval between CT colonography examination and when the report is received by the referrer
  - assessment of examination quality, including the proportion of inadequate examinations
  - positive predictive value (PPV, compared with endoscopy and/or pathology)
  - negative predictive value (by referral to regional and MDT cancer registries on a biannual basis)
  - large adenoma and cancer detection rate
  - extracolonic lesions
    - percentage of examinations with extracolonic finding(s) requiring additional work-up (including the number of examinations and method/s used, eg the imaging modality).
    - PPV of reported extracolonic findings for those undergoing additional investigation
- Patient experience measures should include
  - examination time
  - results of the annual patient satisfaction survey
  - monitoring of complaints.

The BCSS will be modified to facilitate these audits.

14. TRAINING AND ASSESSMENT

- All radiologists interpreting CT colonography examinations for the BCSP should be consultants on the UK General Medical Council's specialist register. Only practitioners with a national board certificate in radiology (FRCR or equivalent) should report CT colonography; this applies to both colonic and extracolonic findings
- All interpreting radiologists must have undergone

  - individual practical training involving at least 50 endoscopically validated CT colonography cases
  - training via lectures or presentations on: colonic anatomy, pitfalls of CT colonography and interpretation (including how to accurately estimate polyp diameter), managing complications and the pathogenesis/epidemiology of colorectal cancer
  - bespoke BCSP workshops to meet these needs are in development. In the interim, relevant training is available in the form of two-day practical CT colonography workshops currently being offered in several countries. In neither case can training alone guarantee competence

- All radiologists and radiographers who conduct examinations require specific training in examination technique covering options for bowel preparation, how to provide patient information, gaining patient consent, colonic insufflation, CT scan parameters and radiation safety
- Radiologists who are responsible for interpretation must take part in national BCSP audits when required to do so, and also participate in colorectal MDT activities in their hospital
- A list of competencies must be drawn up for all CT colonography team members and this must be consistent with national recommendations, locally agreed, clearly displayed and easily reviewed by team members
- Every member of the CT colonography team, including radiology assistants, must undergo training appropriate to their role and responsibilities. Opportunities for role extension should be supported where appropriate.

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