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Diagnosing colorectal polyps and masses

The use of CT colonography

Background
Colorectal cancer is common, over 13 000 cases were diagnosed in Australia in 2005. The pathogenesis of colorectal cancer has been well investigated and usually occurs in a predictable sequence progressing from dysplasia, to carcinoma in situ before becoming an invasive malignancy. The symptoms and signs of colorectal polyps and masses are often nonspecific, however, given that polyps are easily cured with polypectomy, it is vital to have an accurate and acceptable diagnostic test. Traditional tests include conventional (optical) colonoscopy and double contrast barium enema. Computed tomographic (CT) colonography is a newer, minimally invasive method for examining the colon for colorectal polyps.

Objective
To inform general practitioners about CT colonography, its evidence, indications, controversies and extracolonic ancillary findings.

Discussion
The evidence supporting CT colonography is discussed along with how it is performed, as well as a discussion of the factors unique to it, such as extracolonic findings and polyp management.

Keywords: colonography, computed tomographic; colorectal neoplasms; colonic polyps; screening

How is CT colonography performed?

Computed tomographic (CT) colonography is a low radiation dose CT scan performed in supine and prone positions following a full colonic preparation, and then followed by colonic insufflation with carbon dioxide via a rectal catheter with no need for sedation. Supine and prone positions are required to move any residual colonic fluid that may obscure polyps and ensure that each colonic segment is adequately distended. Faecal tagging can be used. This involves patients drinking 150 mL of barium liquid with meals starting 48 hours before the examination and allows easy differentiation of residual faecal material from polyps. Faecal tagging is omitted in patients with an incomplete optical colonoscopy as it allows a same day study to be performed and avoids patients having to repeat bowel preparation. The images can be reviewed in any plane or reconstructed into a 'virtual colonoscopy' allowing a colonic 'fly through' simulation of optical colonoscopy (OC). Researchers are actively exploring computer bowel cleansing so that CT colonography can be performed without requiring a bowel preparation, however, this has not yet eventuated.

CT colonography vs. optical colonoscopy

The sentinel study[1] on CT colonography was published in 2003. It was cleverly designed with 1233 asymptomatic adults and compared CT colonography and OC. Patients had standard bowel preparation and had a CT colonography, which was immediately reported as the patient proceeded to OC. Following OC examination of each colonic segment, the CT colonography report for that segment was then revealed to the endoscopist who had a second look to see if the CT colonography and OC findings contradicted one another. This enabled the sensitivity and specificities for OC and CT colonography to be calculated using combined CT colonography/OC result as the gold standard. The sensitivity for CT colonography detection of polyps over 6 mm was 89%, for polyps over 8 mm was 94%, and for

polyps over 10 mm detection was 96%, and was equal to OC with a specificity of 96% for polyps measuring over 10 mm. Of note, a meta-analysis of CT colonography studies found a significantly lower sensitivity of 59% for polyps 6–9 mm and 76% for polyps over 9 mm,[2] however, many of the studies included in this analysis had thick slice reconstruction of up to 5 mm while current practice demands slice thickness of less than 2 mm with most centres using 1.5 mm or less. Using these thick slices it is not surprising that they found a low sensitivity. The original study results showing a high sensitivity have been confirmed by subsequent studies.[3,4] It is important to remember that OC is not a true gold standard. Studies have shown that OC will miss up to 12% of polyps that measure over 10 mm and 12–13% of polyps over 6 mm.[5,6] Critics of CT colonography argue that these high sensitivities are due to the studies being performed in academic centres of excellence and that in other centres the sensitivity will be less. While this may be true, the same can be said for OC, which in these studies is also being performed in a centre of excellence. It has been shown that there can be disparate sensitivities between endoscopists within a single practice.[7]

The significance of polyps is related to polyp size. Advanced histology, which is often defined as an adenoma with villous or serrated histology, high grade dysplasia or an invasive cancer, occurs in 1.7% of polyps 1–5 mm, 6.6% of polyps 6–9 mm and 30.6% of polyps measuring over 10 mm.[8] Most polyps under 5 mm are hyperplastic with no malignant potential,[9,10] so most radiologists only report polyps greater than 5 mm in diameter unless multiple diminutive polyps are present.

In a study with over 3000 patients in each arm[11] patients were enrolled for OC or CT colonography for polyp detection. Of these patients, 7.9% of were referred to OC for polypectomy following CT colonography with 561 polyps removed from the CT colonography group and 2434 polyps removed from the OC group. There was no statistically significant difference in the number of polyps with advanced histology between the two groups despite over four times as many polypectomies being performed in the OC cohort. This implies that the polyps remaining in situ following CT colonography are unlikely to harbour advanced histology. Seven colonic perforations occurred in the OC group and none in the CT colonography arm. The morbidity of OC should be remembered with a perforation rate of approximately 1:1000 and a mortality rate of between 1:10 000 and 1:17 000[12,13] which may be secondary to complications from sedation or following perforation.

While flat and carpet lesions are relatively common in Asia,[14] the prevalence and significance of flat lesions in Western settings is debatable. A study found that while flat and depressed lesions are considerably less common than their polypoid counterparts, they have an increased incidence of advanced histology regardless of size and occur at a higher than expected rate than previously thought.[15] The findings of this study have been challenged[16] as the vast majority of lesions in this study were relatively flat but did protrude above the adjacent normal mucosa, with completely flat and depressed lesions being rare. The histological classification has also been criticised for categorising carcinoma in situ along with invasive cancers, rather than as high grade dysplasia, which is how it is classed in other studies. Other studies contradict these results and find that flat lesions are less likely to harbour advanced histology than both pedunculated and sessile adenomas.[17,18] Early studies using 16 slice CT found a sensitivity of CT colonography for detecting flat lesions of less than 50%,[19] while more modern studies utilising advances in scanning technologies show a sensitivity of 90% for detecting flat adenocarcinomas and 67% for detecting nonpolypoid adenomatous lesions (this includes adenomas and adenocarcinomas).[20]

Currently CT colonography is a complementary test to OC, and is performed in patients who are unsafe for OC or who have an incomplete OC. Up to 10% of OC are incomplete which may relate to adhesions, redundant bowel loops, herniae or diverticular disease. An expanded role for CT colonography in the future is yet to be established.

Managing polyps detected at CT colonography

One undoubted advantage of OC is the ability to remove polyps at the time of detection. All authors agree that polyps measuring 10 mm or above should be referred for endoscopic polypectomy. The management of polyps measuring 5–9 mm is being debated as CT colonography use increases. Some authors feel CT colonography surveillance at 12 months should be performed and if the polyp has grown it should be removed.[21] They argue that 90% of polyps will regress or be stable. Others feel that all polyps should be removed.[22–24] With the current body of evidence, all polyps measuring over 6 mm should be referred to OC for polypectomy.[25] The current National Health and Medical Research Council (NHMRC) guidelines state that all polyps should be sampled or removed.[26] These guidelines make practical sense because when they were devised polyps were being diagnosed at OC and therefore were amenable to sampling. We feel the evidence supporting these guidelines is debatable and now that an accurate noninvasive method of polyp detection exists, the evidence needs to be re-examined and further studies performed.

What are extracolonic findings?

As the entire abdomen and pelvis is scanned during a CT colonography, intra-abdominal viscera, lung bases, vertebra and pelvic bones are also examined. Abnormal 'extracolonic findings' (ECF) are incidentally diagnosed pathologies beyond the colon. These are unique to CT colonography as OC only examines the colonic mucosa. Extracolonic findings are common and occur in up to 85% of patients,[27] however, only around 10–15% are considered clinically significant,[28] with the majority of the others representing simple cysts, vascular calcification and degenerative disease of the lumbar spine. Extracolonic findings are more frequently encountered with increasing age, in symptomatic patients and in females.[29,30] Up to 10% of ECFs are potentially the cause of the symptoms that lead to the initial colonic investigation.[31] Almost 4% of ECF represent NOMO malignancy (ie. malignancy with no nodal or distant metastases) or abdominal aortic aneurysm.[28] While the additional diagnosis of ECF sounds appealing, these benefits must be weighed against the additional costs, anxiety and potential complications of further

investigation. It is difficult to determine the cost that ECFs cause by prompting further investigation. These costs vary depending on how they are calculated and increase if surgical procedures are initiated.[32–34] However, as the vast majority are benign, only a minority should be further investigated.[35]

How much radiation?

The population burden of medically acquired radiation should be considered with all investigations. As there is intrinsically high contrast resolution between the gas filled colonic lumen and polyps, a low radiation dose CT scan is performed. Despite both prone and supine images being acquired the total radiation dose of a typical CT colonography is 2.17 mSv (millisieverts).[36] To put this figure in context, it is almost half the radiation dose of a double contrast barium enema and is less than 1 year of normal background radiation. The biological risks of radiation are estimated from following populations exposed to wartime and accidental radiation exposure. There is a certain degree of guess work involved with these estimations, although at low dose it is felt that the risk is negligible.[37] However, currently there is no standard method for performing CT colonography and doses can vary significantly between different radiology practices.[38] While the radiation risk of a single study may be small, the accumulative effects of radiation if CT colonography was used as a regular screening examination must be weighed against the benefit of the technique.

Who can have CT colonography?

In Australia CT colonography has a Medicare rebate in patients who have a suspected perforation or obstructing lesions or who have had a prior incomplete colonoscopy. Colonoscopy can be incomplete due to diverticular disease, redundant bowel loops, poor colonic preparation, herniae, adhesions or strictures. In the public hospital setting, CT colonography is often used for patients who are deemed medically unfit for optical colonoscopy (although this does not attract a Medicare rebate). Reasons for being unfit for colonoscopy include anticoagulation, problems with sedation or multiple comorbidities. Computed tomographic colonography is an appropriate test in these settings. However, until the issues relating to extracolonic findings and standardised radiation doses are resolved, CT colonography will struggle to prove a viable primary alternative to OC in Australia where patients have readily available access to endoscopy. In the United States of America (USA), CT colonography has been recognised as a primary diagnostic tool for colorectal polyp diagnosis by the American Cancer Society,[39] however, other agents in the USA such as Medicare do not recognise it.[40] There is ongoing debate about the cost effectiveness of CT colonography screening in patients over 65 years of age, some models prove cost effective[41] while others are contradictory.[42] These cost issues need to be examined in the Australian setting.

Computed tomographic colonography is contraindicated in patients with active colonic inflammation and recent polypectomy (usually can be performed 1 month postpolypectomy).

In studies that involved over 20 000 patients, the rate of colonic perforation for CT colonography was 0.009% with a major complication rate of 0.02%, half of these being acute renal failure exacerbated by the bowel preparation.[43] This compares favourably with OC complication rates.[12,13]

What do patients prefer?

Patients who have had both OC and CT colonography have been studied to examine patient preference. These studies have found that both procedures are well tolerated by patients with respect to pain, embarrassment and overall expectations and most patients state that the colonic preparation is the worst component of both examinations.[44,45]

Future challenges

Before CT colonography can be widely accepted in Australia, a number of issues will need to be addressed. Currently there are no guidelines stipulating minimum training required to report these often complex studies, although the Royal Australian New Zealand College of Radiologists (RANZCR) is currently devising accredited training courses that must be undertaken by radiologists before reporting CT colonography, similar to the approach taken with cardiac CT. This will ensure maximum accuracy and reproducibility between centres. Scan parameters must also be formalised to ensure only minimal radiation dose techniques are employed. The costs of ECF and their subsequent management needs to be explored and applied to both asymptomatic screening populations and symptomatic patients to ensure CT colonography is cost effective.

Conclusion

Computed tomographic colonography is a safe and well tolerated tool for the diagnosis of colonic polyps and masses, and when performed well, it is as accurate as OC. Cost and training issues however, will need to be addressed before it will be widely accepted beyond the current indications of incomplete OC or patients unsafe for OC.

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