



**Australian Government**  
**Department of Health and Ageing**



Australia and New Zealand Horizon Scanning Network

**ANZHSN**

AN INITIATIVE OF THE NATIONAL, STATE AND  
TERRITORY GOVERNMENTS OF AUSTRALIA  
AND THE GOVERNMENT OF NEW ZEALAND

# **Horizon Scanning Technology Prioritising Summary**

## **Computed tomography in the assessment of suspected large bowel obstruction**

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**Australian  
Safety  
and Efficacy  
Register  
of New  
Interventional  
Procedures -  
Surgical**



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# PRIORITISING SUMMARY

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**REGISTER ID** S000053

**NAME OF TECHNOLOGY:** COMPUTED TOMOGRAPHY ASSESSMENT FOR SUSPECTED LARGE BOWEL OBSTRUCTION

**PURPOSE AND TARGET GROUP:** PATIENTS SUFFERING FROM SUSPECTED LARGE BOWEL OBSTRUCTION

## STAGE OF DEVELOPMENT (IN AUSTRALIA)

- |   |   |
|---|---|
| <input type="checkbox"/> Yet to emerge      | <input type="checkbox"/> Established  |
| <input type="checkbox"/> Experimental       | <input checked="" type="checkbox"/> Established <i>but</i> changed (additional) indication or modification of technique |
| <input type="checkbox"/> Investigational    | <input type="checkbox"/> Should be taken out of use   |
| <input type="checkbox"/> Nearly established |   |

## AUSTRALIAN THERAPEUTIC GOODS ADMINISTRATION APPROVAL

- |  |             |    |
|--|-------------|----|
| <input type="checkbox"/> Yes                       | ARTG number | NA |
| <input type="checkbox"/> No                        |             |    |
| <input checked="" type="checkbox"/> Not applicable |             |    |

## INTERNATIONAL UTILISATION

COUNTRY	LEVEL OF USE		
	Trials Underway or Completed	Limited Use	Widely Diffused
Australia		✓	
Belgium	✓		
Canada	✓		
Denmark	✓		
France	✓		
Germany	✓		
Greece	✓		
India	✓		
Italy	✓		
Japan	✓		
Korea	✓		
Poland	✓		
Singapore	✓		

Switzerland	✓		
Turkey	✓		
United Kingdom	✓		
United States		✓	

## IMPACT SUMMARY

Computed tomography is a widely available diagnostic imaging procedure. An additional emerging application for this technology is in the diagnosis of suspected large bowel obstruction.

## BACKGROUND

Large bowel obstruction (LBO) is often the result of a mechanical blockage which prevents the normal transit of the products of digestion. Pseudo-obstruction is a condition that presents with symptoms of LBO, but without any evidence of mechanical obstruction. The main causes of LBO, which may be intraluminal, intrinsic or extrinsic, are carcinoma (approximately 60% of cases), volvulus (abnormal twisting of the bowel; around 10% of cases), and diverticulitis (approximately 10% of cases) (Taourel et al. 2003). Treatment for mechanical LBO frequently requires surgery to relieve the obstruction, while pseudo-obstruction is usually managed conservatively and by pharmacologic methods.

Acute LBO is often an emergency condition (Sinha and Verma 2005). The clinical symptoms of LBO include abdominal pain and distension, constipation or obstipation (severe constipation) and vomiting, with clinical findings varying with the degree and level of bowel obstruction (Taourel et al. 2003). Rapid and accurate diagnosis of mechanical LBO is necessary because its progression can result in caecal perforation and faecal peritonitis, a condition associated with mortality rates of around 20% (Sinha and Verma 2005; Pavlidis et al. 2006). A technique for accurately differentiating between mechanical obstruction and pseudo-obstruction could help avoid unnecessary surgery such as laparotomy in this frail patient group, which is typically elderly with multiple comorbidities (Beattie et al. 2007).

To aid the clinical diagnosis of mechanical LBO, plain abdominal X-rays are traditionally used. However, it is often difficult to differentiate between mechanical obstruction and pseudo-obstruction using this technique. In one study, approximately one-third of patients with clinical signs and abdominal X-ray results suggesting mechanical LBO had no mechanical obstruction, while approximately 20% of patients suspected of having pseudo-obstruction had mechanical LBO (Koruth et al. 1985). To confirm a mechanical obstruction diagnosis, single-contrast water-soluble enema is used. The sensitivity and specificity of using clinical signs and abdominal X-ray results to diagnose LBO are 84% and 72%, respectively, whereas contrast enema has a sensitivity and specificity of 96%

and 98% (Chapman et al. 1992). However, contrast enema is often poorly tolerated by patients with suspected LBO, and failure to retain the enema is common (Beattie et al. 2007).

Computed tomography (CT) is emerging as a possible alternative to contrast enema for assessing suspected LBO. CT is already an established procedure for diagnosing small bowel obstruction. A recent systematic review of the literature reported that CT for complete small bowel obstruction has a sensitivity of 92% (range 81% to 100%), specificity of 93% (range 68% to 100%), positive predictive value of 91% (range 84% to 100%), and negative predictive value of 93% (range 76% to 100%) (Mallo et al. 2005).

A modern CT scanner allows rapid acquisition of large bowel images during one breath-hold by the patient. The CT diagnosis of mechanical LBO is based on the presence of a dilated proximal colon with an abrupt transition zone and a collapsed distal colon. After the intravenous administration of a contrast agent, the CT scans are performed with the patient lying face up to confirm a transition point, with additional scans in other positions being conducted where necessary (Beattie et al. 2007). CT may be used for confirming a diagnosis of mechanical LBO, as well as providing detail on the site and cause of the obstruction (Taourel et al. 2003).

Several additional studies examine the effectiveness of CT in samples that included both small and large bowel obstructions. Suri et al. (1999) found CT to have a sensitivity, specificity, and accuracy of 93%, 100% and 94% respectively in diagnosing bowel obstruction in 32 patients. CT correctly identified the level of obstruction in 100% of patients with obstruction, and the aetiology of the obstruction in 87% of these cases (Suri et al. 1999). Megibow et al. 1991 had similar findings in a sample of 84 patients, with CT found to have a sensitivity, specificity, and accuracy of 94%, 96% and 95% respectively in diagnosing bowel obstruction, and an ability to diagnose the cause of the obstruction in 73% of cases. Beall et al. 2002 found the sensitivity, specificity, and accuracy of CT in diagnosing small and large bowel obstruction in 21 patients all to be 71%, which is lower than the other studies.

## **CLINICAL NEED AND BURDEN OF DISEASE**

The incidence of intestinal obstruction (including small and large bowel obstructions) in 2003 was 29,804, or 1.5 per 1000 Australians (AIHW 2007). LBO accounts for between 2% and 4% of surgical admissions for acute abdominal conditions, and 485 Australians died from intestinal obstruction in 2003 (Taourel et al. 2003; AIHW 2007).

## **DIFFUSION**

Although CT is widely available throughout the world, its use for assessing suspected LBO is limited. One comparative study has been performed in the United States (Frager et al. 1998), and a case series study was recently performed in Australia (Beattie et al.

2007). The use of CT for diagnosing LBO has also been reported in individual case reports from several other countries, including Belgium, Canada, Denmark, France, Germany, Greece, India, Italy, Japan, Korea, Poland, Singapore, Switzerland, Turkey and the United Kingdom.

## **COMPARATORS**

The comparators to diagnosing LBO by CT are plain abdominal X-rays, single-contrast water-soluble enema, and surgery or endoscopy.

## **SAFETY AND EFFECTIVENESS ISSUES**

Two studies on the use of CT for diagnosing LBO were identified by the literature searches: one non-randomised comparative study and one cross-sectional analytic study.

In the comparative study by Frager et al. (1998), 75 patients (32 men and 43 women; age range 39 to 91 years) with suspected LBO from clinical signs and/or dilation observed on abdominal X-rays were examined. CT scans were performed on all patients. Diagnosis was confirmed by surgery and/or endoscopy in 65 patients, contrast enema in one patient and clinical course in nine patients. Of the 75 patients, 26 had both CT and contrast enema investigations, allowing for comparison between the two procedures.

Beattie et al. (2007) performed CT scans on 44 patients (22 men and 22 women; age range 39 to 94 years) with possible LBO. Diagnosis was confirmed by surgery, further clinical imaging and/or clinical course. No comparator investigation was undertaken.

Both studies performed the CT scans with patients lying face up. When necessary, additional scans were conducted while the patient was reclining or lying face down. Frager et al. (1998) used oral contrast and intravenous contrast in 56 patients, while Beattie et al. (2007) routinely used only intravenous contrast. In both studies, a LBO based on CT scan was defined as proximal colon dilation followed by an abrupt transition to collapsed colon at the site of a recognisable abnormality (Frager et al. 1998; Beattie et al. 2007).

For both studies, positive and negative likelihood ratios were reported where possible. A positive LR is the ratio of the true-positive rate to the false-positive rate (sensitivity/(1 - specificity)). A negative LR is the ratio of the false-negative rate to the true-negative rate ((1 - sensitivity)/specificity). A positive LR > 10 and negative LR < 0.1 suggest convincing or definitive diagnostic evidence.

### **a) Safety**

In the study by Frager et al. (1998), safety is only mentioned through the observation that the CT examination was faster and simpler to perform, and gentler on the patient, than

contrast enema. CT was performed on all 75 patients with no adverse incidents (Frager et al. 1998).

Beattie et al. (2007) identified several difficulties associated with contrast enema including the potential for the hyperosmolar water-soluble contrast agent to exacerbate fluid and electrolyte imbalances and dehydrate patients; and the small risk of rectal or colonic perforation. In contrast, CT did not require insertion of instruments or contrast medium into the rectum and was therefore better tolerated. CT was performed on all 44 patients in this study, with no adverse incidents reported (Beattie et al. 2007).

#### **b) Effectiveness**

Of the 75 patients with suspected LBO studied by Frager et al. (1998), 47 patients had mechanical LBO on final diagnosis, while 28 did not. CT was performed in all patients, while in five out of 25 patients, contrast enema could not be completed because the patient was unable to hold the contrast in the bowel or tolerate insertion of the rectal tube, with one patient expelling the barium immediately due to the obstruction itself. CT correctly distinguished between obstruction and pseudo-obstruction in 71 of 75 patients. Obstruction was diagnosed correctly by CT in 45 of 47 patients, with two false-negative results, giving a sensitivity of 96%. Pseudo-obstruction was diagnosed correctly by CT in 26 of 28 patients, with two false-positives, giving a specificity of 93%. The positive and negative predictive values of CT were 96% and 93%. The positive and negative likelihood ratios were 13.7 and 0.043, which indicates that CT provides definitive diagnostic evidence for detecting LBO. Using CT, the correct pathological diagnosis was made in 81% of patients with obstruction (38/47), and the point of obstruction was correctly localised in 94% (44/47). Contrast enema was incorrect, incomplete or non-diagnostic of obstruction in 20% of the patients who had surgically proven obstruction, and had a sensitivity of 80% and specificity of 100%. CT was more sensitive ( $P = 0.045$ ), more accurate ( $P = 0.047$ ) and had better negative predictive value ( $P = 0.0004$ ) than contrast enema when compared using the Fisher exact test (Frager et al. 1998).

Beattie et al. (2007), in their study of 44 patients with suspected LBO, found that 22 patients had proven mechanical LBO on final diagnosis, while the remaining 22 had no mechanical obstruction. CT identified obstruction correctly in 20 of 22 patients, with two false-negatives, giving a sensitivity of 91%. Pseudo-obstruction was also correctly ascertained by CT in 20 of 22 patients, with two false-positives, giving a specificity of 91%. The positive and negative predictive values were both 91%. The positive and negative likelihood ratios were 10.1 and 0.099, which as in the study by Frager et al. (1998) indicates that CT provides convincing diagnostic evidence for diagnosing the presence of LBO. CT provided the correct diagnosis of the cause of obstruction in 64% of cases (14/22) (Beattie et al. 2007).

In both studies there was a lack of consistency in the method used to verify the diagnosis, with surgery, further clinical imaging and/or clinical course all being used on occasion to provide a final diagnosis. Neither study appeared to use a consecutive or all inclusive sample. This introduces a significant selection bias that may affect the results.

## **COST IMPACT**

There were no cost-effectiveness studies on the use of CT for suspected LBO, although Frager et al. (1998) mentioned that contrast enema is much cheaper than CT.

## **ETHICAL, CULTURAL OR RELIGIOUS CONSIDERATIONS**

No issues were identified from the retrieved material.

## **OTHER ISSUES**

Both of the included studies (Frager et al. 1998; Beattie et al. 2007) noted that experience is necessary for the accurate interpretation of CT results, with Frager et al. (1998) stating that the few false-negative and false-positive diagnoses resulted from misinterpretation of the CT scans.

Although non-invasive, CT is considered a moderate to high radiation diagnostic procedure (ARPANSA 2007). A CT of the abdomen delivers an effective dose of >5 Millisieverts, which is equivalent to over 250 chest X-rays (Rehani and Berry 2000). However the radiation dose from a CT scan is similar to its comparative procedure of contrast enema. The contrast agent used during CT scans of patients with suspected LBO is associated with a low risk of allergic reaction and kidney damage, and is contraindicated in patients with moderate kidney failure (Verrelli 2006).

## **SUMMARY OF FINDINGS**

One non-randomised comparative study and one cross-sectional analytic study were available on the safety and efficacy of using CT to assess suspected LBO. CT appeared to have high specificity and sensitivity for diagnosing LBO, was comparable to the most routinely used procedure of contrast enema, and was better tolerated by patients. No adverse effects of using CT on patients with LBO were reported, and all patients were able to complete the necessary scans. The main safety issue is the moderate to high radiation dose delivered by a CT scan, but no studies have investigated the effects of this in patients with LBO. However the radiation dose from a CT scan is similar to its comparative procedure of contrast enema. More comparative studies in patients with suspected LBO are required to confirm these findings and examine the cost-effectiveness of using CT for this indication. Further research is also required to assess the clinical impact of using CT on the management, treatment, and outcomes of patients with suspected LBO.

## HEALTHPACT ACTION

Based on the high detection rates achieved with CT and the established use of CT in the diagnosis of small bowel obstruction, CT in the assessment of suspected large bowel obstruction will be archived.

## NUMBER OF STUDIES INCLUDED

Total number of studies	2
Level III-1 diagnostic evidence	1
Level IV diagnostic evidence	1

## REFERENCES

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#### **SEARCH CRITERIA TO BE USED**

Computed tomography  
CT  
Large bowel obstruction  
Colon\$ obstruction  
Intestin\$ obstruction