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REVIEW ARTICLE

CME

Investigation of Small Bowel Obstruction

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ABSTRACT

Intestinal obstruction accounts for up to 20% of acute surgical hospital admissions and suspected small bowel obstruction accounts for most of these admissions. Adhesions due to previous surgery are often the underlying cause. While the clinical history may point to the likely cause in many patients, imaging is required to determine the completeness and cause of the obstruction and to determine its management. This review evaluates the role of plain film and water soluble contrast follow-through and discusses the strengths and weakness of computed tomography and its role in the diagnosis of associated ischaemia. Emerging techniques that may contribute to diagnosis are reviewed.

Key Words: *Bowel obstruction, Computed tomography*

INTRODUCTION

Intestinal obstruction accounts for up to 20% of acute surgical hospital admissions and suspected small bowel obstruction accounts for 60% to 80% of these. Adhesions due to previous surgery are the underlying cause in 60% to 80% of patients. The clinical history may point to the likely cause in many patients but imaging is required to determine the level of obstruction, whether it is partial or complete, whether there is evidence of strangulation or vascular compromise and, above all, which patients can be conservatively managed and which require urgent surgical intervention.[1]

In this review, the role of plain film and water soluble contrast follow-through (WSCFT) will be evaluated. The strengths and weakness of computed tomography (CT) and its role in the diagnosis of associated ischaemia will be discussed, together with emerging techniques that may contribute to the diagnosis.

Plain Film X-ray

The limitations of the plain abdominal X-ray in small bowel obstruction are well recognised.[2] In a study of 117 patients, a normal or non-specific appearance on the plain film was associated with surgically proven small bowel obstruction in 22% of patients, whereas signs of probable or definite obstruction on plain X-ray were confirmed at surgery in only 58% of patients.[3] However, the plain film is valuable for imaging triage and it has been recommended that where the initial X-ray suggests complete or high-grade obstruction and a trial of conservative management is contemplated, additional imaging with CT has the potential to modify the patient's management.[4] Ultrasound also contributes useful information, particularly in the context of the 'gasless abdomen', where the bowel is filled with fluid.[5]

The appropriate management for patients presenting with adhesive small bowel obstruction remains a challenge. It is critical to avoid inappropriate laparotomy in this group of patients, as further intervention may increase the number of future admissions. In the majority of patients (up to 85%) with obstruction due to adhesions, the condition will resolve with conservative management, usually within 72 hours. The recommended period of conservative management and observation ranges from 12 hours to 5 days.

Radiology can refine the selection of patients for whom conservative management is unlikely to be successful. There has been renewed interest in the prognostic role of the WSCFT. Several studies describing this technique were published in the surgical literature in the 1990s[6,7] and the prognostic and possible therapeutic value of

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this examination has recently been readdressed.[8] Patients with suspected small bowel obstruction are given gastrografin 100 ml orally and films are obtained after 30 minutes and 4 hours. Failure of contrast to reach the colon after 4 hours is indicative of high-grade obstruction, which is unlikely to resolve with conservative measures alone. In this most recent study, employment of water soluble contrast examination altered the management decision for 50% of patients. In the postoperative patient, some authors have suggested that in the investigation of patients with a diagnosis of postoperative ileus vs obstruction, the use of water soluble contrast may hasten resolution of the ileus and shorten the duration of hospital stay. In many patients, a combination of water soluble contrast study with cross sectional imaging by CT can provide further valuable information as to the level and position of adhesions which may be important if laparoscopic division of adhesions is contemplated (Figure 1).

Computed Tomography

The publication of several papers in the early 1990s highlighted the role of CT in identifying the site and level of obstruction, the characterisation of the cause, and the potential to identify closed loop obstruction and threatening signs of strangulation.[9-11] These initial reports showed a sensitivity varying from 90% to 96%, a specificity of 96%, and an accuracy of 95%. Early reports focused on patients with high-grade obstruction and subsequent studies have shown less favourable results for patients with low-grade partial obstruction (sensitivity 48%).[12] The short examination time and increased accessibility have made CT the cornerstone of assessment for patients with small bowel obstruction. Adhesions, hernias, and strictures associated with inflammatory bowel disease and tumours are easily demonstrated (Figure 2).

Patients with known malignancy presenting with small bowel obstruction are a particular challenge and these patients are often best assessed using CT as the primary diagnostic tool. There are many potential causes of obstruction in patients with malignant disease, including intra-luminal obstruction by the primary or secondary tumour and intra-mural or serosal metastatic disease, particularly in patients with ovarian cancer, 42% of whom will present with small obstruction at some stage during their illness (Figure 3). However, in 38% of patients, obstruction is due to a benign cause, which may be remediable.[13] CT is valuable for discriminating benign from malignant obstruction. A recent study has also highlighted the potential role of magnetic resonance imaging (MRI) in this context.[14]

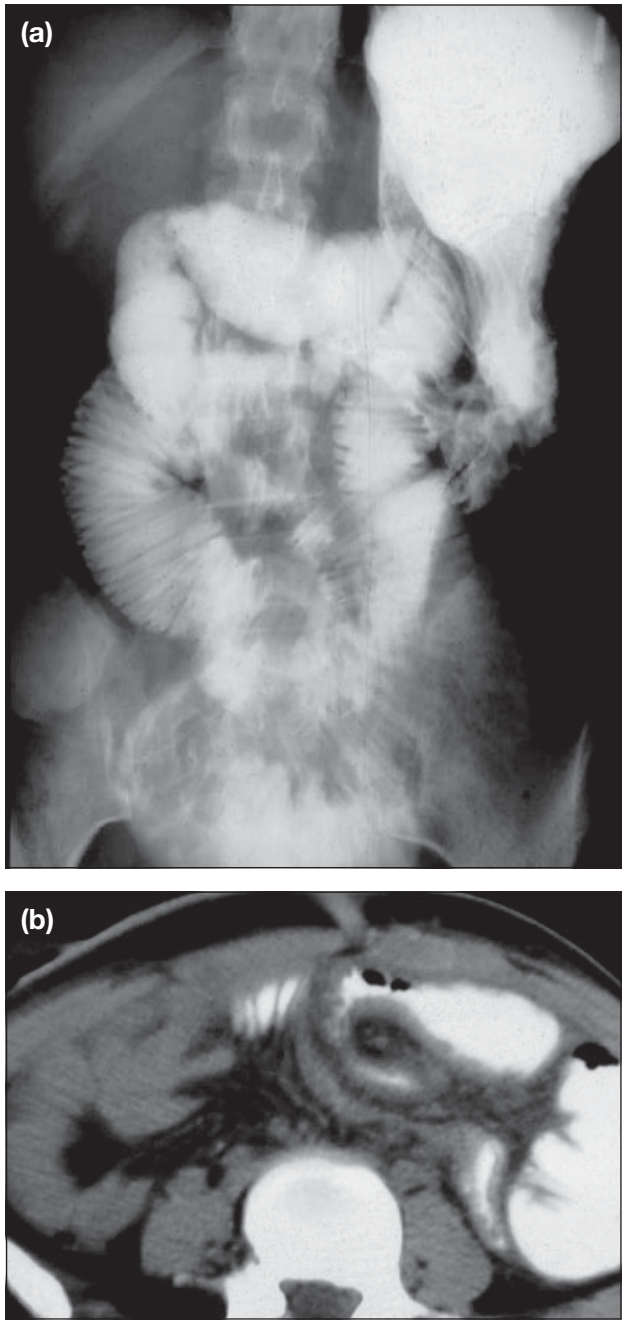

Figure 1. Small bowel obstruction in the proximal ileum demonstrated by (a) water soluble contrast study, with (b) computed tomography scan demonstrating anterior adhesions as the underlying cause.

Several specific signs have been described that are highly suggestive of 'closed loop' obstruction, including engorgement of the mesenteric vessels, the 'whirl' and 'serrated beak sign' (Figures 4 and 5).[15] Complete obstruction and particularly closed loop obstruction carries a risk of strangulation of up to 40%. CT has a high sensitivity in the diagnosis of intestinal ischaemia (90%) but its specificity is relatively low (44%) [Figure 6].[16,17] In a prospective study, CT had a negative predictive

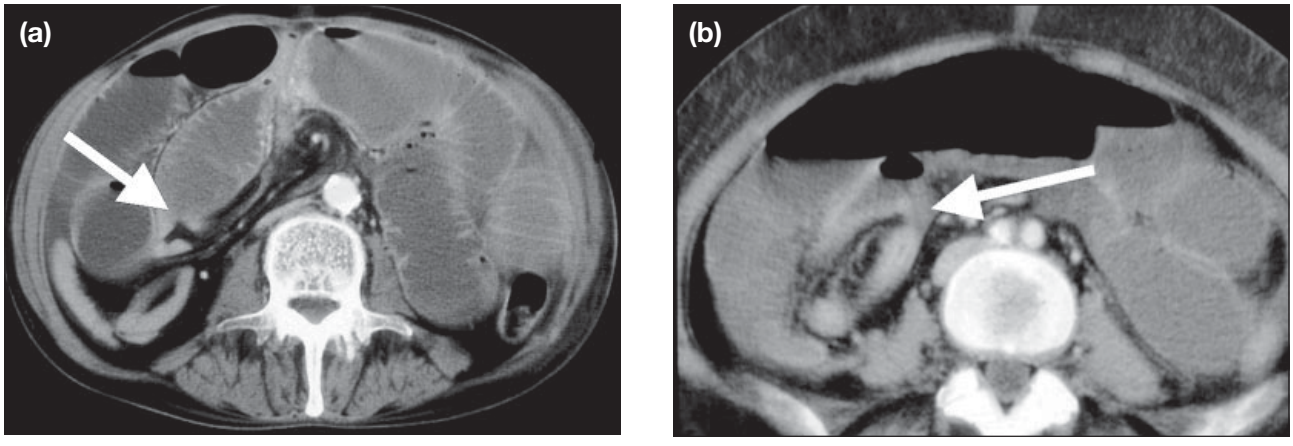

Figure 2. (a and b) High-grade small bowel obstruction with short zone of transition (arrows). The absence of an associated mass or bowel wall abnormality indicates that adhesions are the most likely cause.

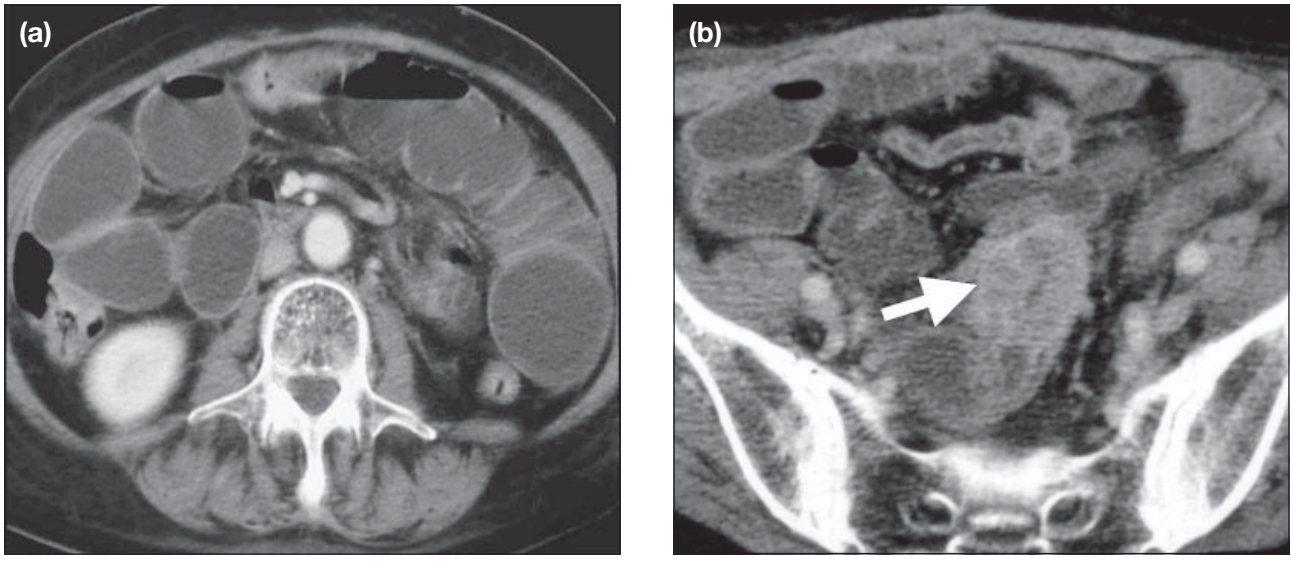

Figure 3. (a and b) High-grade small bowel obstruction caused by a serosal deposit (arrow) from ovarian carcinoma.

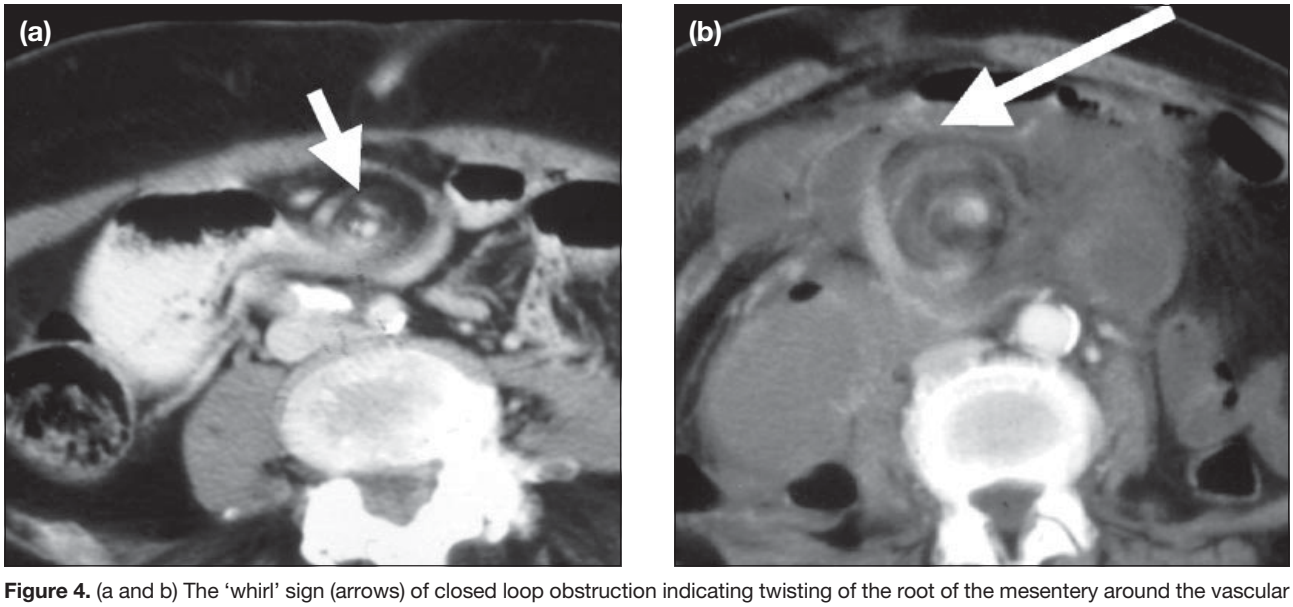

Figure 4. (a and b) The 'whirl' sign (arrows) of closed loop obstruction indicating twisting of the root of the mesentery around the vascular structures.

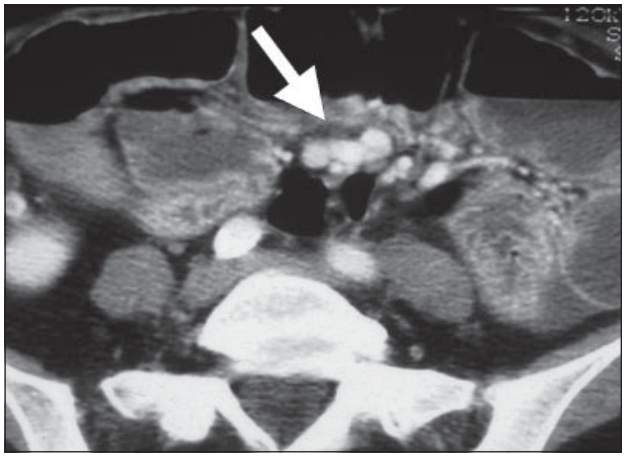

Figure 5. Congestion of vessels (arrow) in the root of the mesentery.

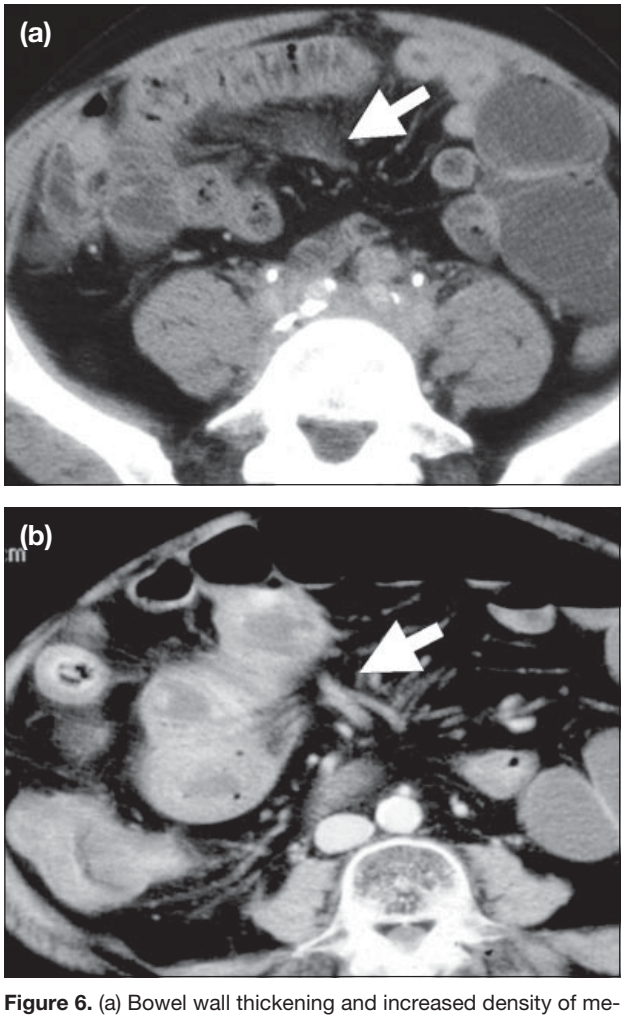

Figure 6. (a) Bowel wall thickening and increased density of mesenteric fat (arrow), suggesting early ischaemic change; and (b) 'twisting' of mesenteric vessels (arrow) with bowel wall thickening due to oedema.

value of 89% to 99% and is therefore useful for determining whether continued conservative management may be appropriate for an individual patient. Signs of advanced strangulation and infarction include high attenuation within the bowel wall precontrast, with absent contrast enhancement, bowel wall gas, mesenteric haemorrhage, and ultimately mesenteric and portal vein gas.

There are several sources of error in the evaluation of small bowel obstruction by CT, which include high small bowel obstruction and proximal decompression via the nasogastric tube. Obstruction situated at the ileocaecal valve can also be difficult to diagnose and short segment stenoses, particularly where there is post-stenotic dilatation, may be overlooked. The reduced accuracy of CT for the diagnosis of partial obstruction is recognised and, in these patients, a fluoroscopic contrast study may be appropriate.[18]

Enteroclysis — intubation infusion of barium — has been regarded as the gold standard[19] and, in a recent report, enteroclysis correctly predicted the presence of obstruction in 100% of patients, the absence of obstruction in 88%, and the level of obstruction in 89%.[3] In high-grade obstruction, excess fluid within the small bowel dilutes the intra-luminal contrast and the presence of multiple overlapping loops of dilated bowel make it difficult to evaluate the point of obstruction, particularly if it is distal. In lesser grades of obstruction, a small bowel follow-through with frequent fluoroscopic evaluation is a viable alternative, particularly if the relative fixity of segments of bowel can be evaluated with intermittent fluoroscopy and palpation.

A combination of small bowel intubation and cross-sectional imaging with CT has recently been described[20] and may be useful for the diagnosis of low-grade small bowel obstruction and for the identification of the exact position of obstructing adhesions, which may be valuable if laparoscopic adhesiolysis is considered.[21]

Magnetic Resonance Imaging

New techniques involving fast MRI sequences are emerging. Although limited access and longer examination times currently limit their use, it seems likely that for specific patient groups with suspected bowel obstruction, the role of MRI may increase.[22]

CONCLUSION

In summary, for patients with obstruction, the plain abdominal film acts as the primary triage point to determine further management (Figure 7). For patients for whom the abdominal film is non-specific, a fluoroscopic contrast examination is appropriate if the symptoms

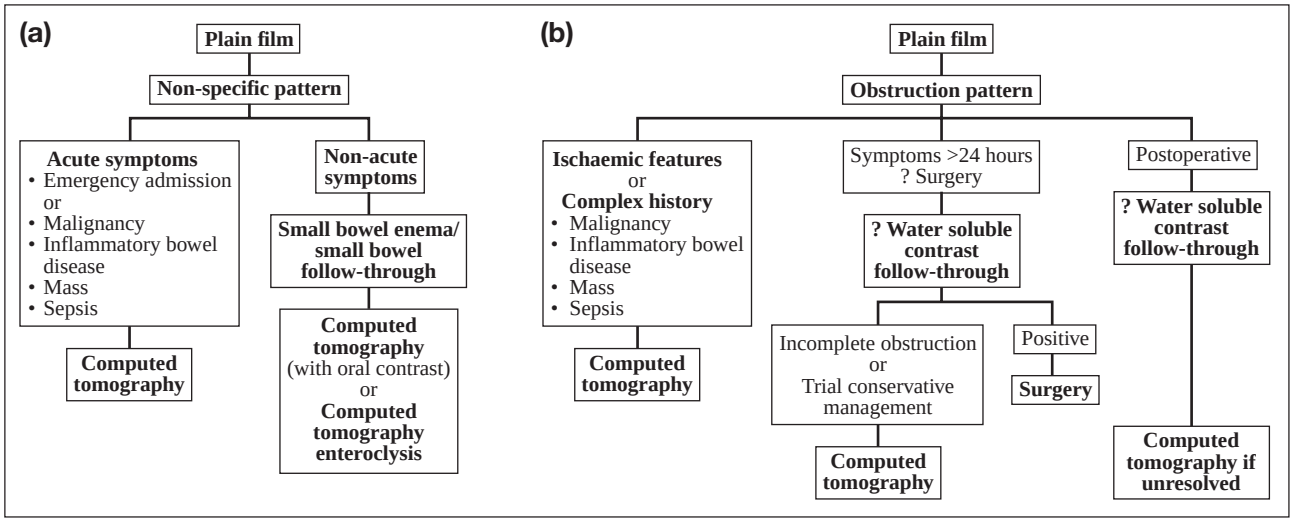

Figure 7. Suggested algorithm for the investigation of small bowel obstruction for (a) non-specific pattern; and (b) obstruction pattern.

are not acute. For patients presenting in an emergency admission, further evaluation with CT is recommended, particularly if there is a history of malignancy, inflammatory bowel disease, sepsis, or if a mass is present on abdominal examination. Where there is clear plain film evidence of small bowel obstruction, the decision to proceed to surgery may be made on clinical grounds. Where there is clinical uncertainty, WSCFT may have a valuable role and may also be useful for post-operative patients. Where there are clinical features suggesting ischaemia or where there is a complex history, a CT scan should be the investigation of choice (Figure 7).

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