

## Pictorial interlude: Caught up in a 'whirl'

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### Summary

A patient with the 'whirl sign' on computed tomography is 25.3 times as likely as a patient without the sign to have small-bowel obstruction (SBO) necessitating surgery. The 'whirl sign' therefore has an important role in the assessment of patients with clinical and radiological signs of SBO.

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### Case report

A 24-year-old man with no previous medical or surgical history presented with a history of colicky central abdominal pain, distension, nausea and vomiting. He was admitted to intensive care and was on renal support at the time the computed tomography (CT) scan was requested. The inflammatory markers and serum amylase level were raised.

The post-contrast CT scan demonstrated proximal small-bowel dilatation; the distal small bowel was of normal calibre. There was associated bowel-wall thickening and enhancement, mesenteric oedema and ascites. On axial images, a 'whirl sign' of small-bowel volvulus (SBV) was demonstrated (Figs 1 and 2). Laparotomy confirmed the diagnosis of a volvulus of the small bowel. There were no underlying adhesions or malrotation, and a diagnosis of primary small-bowel obstruction (SBO) was made.

### Discussion

SBO accounts for as many as 16% of surgical admissions for acute abdomen, and it necessitates urgent evaluation to avoid potentially severe complications. If the vascular supply to the bowel is compromised in closed-loop obstruction due to direct compression or twisting of the mesentery, ischaemia or infarction can result. However, clinical signs are not reliably predictive for the need for surgical intervention in SBO, and delay in treatment is a major prognostic factor for survival and morbidity.<sup>1</sup> The mortality rates for non-gangrenous SBV range from 5.8% to 8%, while mortality rates for gangrenous SBV are higher, ranging from 20% to 100%.<sup>2</sup>

SBV is a rare but potentially fatal surgical emergency that should be considered in every patient presenting with abdominal pain. The term refers to a loop of small bowel twisted around the axis of its own mesentery causing SBO. This can cause torsion and occlusion of the vasculature leading to ischaemia and necrosis. Primary or idiopathic volvulus occurs when there is no predisposing anatomical abnormality, as in our patient. The incidence of primary SBV is 5 to 10 times higher in Africa, Asia, the Middle East and India than in Western countries. This is believed to be caused by the ingestion of large volumes of fibre-

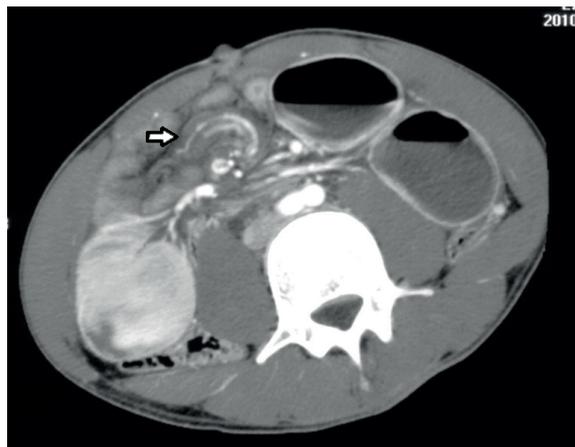


Fig. 1. Post-contrast axial CT scan, demonstrating the 'whirl sign' (arrow), as well as dilated loops of small bowel with associated enhancing, thickened walls. There is also evidence of mesenteric oedema and ascites.



Fig. 2. Post-contrast coronal reconstructed CT image, demonstrating the 'twisting' of the small bowel.

rich food after long periods of fasting,<sup>3</sup> and abnormalities in the length and height of the mesentery have also been implicated in the development of the condition.<sup>4</sup> Several studies have

suggested that increased gut motility due to parasitic infestation, beer containing 5 hydroxy-tryptamine, and diabetic autonomic neuropathy have a role in the causation.<sup>2</sup> Secondary volvulus is caused by anatomical anomalies such as postoperative adhesions or malrotation. Malrotation is much more common in children than in adults, but in adults with known malrotation, SBV is the leading cause of SBO.<sup>3</sup>

Diagnosis can be difficult because symptoms are nonspecific. Early pre-operative investigation and expedient surgical treatment are required if bowel infarction is to be prevented.<sup>5</sup> On physical examination, peritoneal irritation (an indication for surgery and a sign of possible SBO) is often absent, but no single diagnostic clinical sign consistently identifies the presence of infarcted bowel.<sup>3,2</sup> Laboratory findings are often unremarkable.<sup>3</sup> Again, no single haematological test reliably differentiates gangrenous from viable small bowel.<sup>2</sup> Plain abdominal radiographs may or may not show signs of abdominal obstruction.

As the diagnosis of SBV can be challenging, CT scan remains the imaging modality of choice.<sup>3</sup> The role of CT in the diagnosis of ischaemia in patients with suspected SBO has been analysed, with a reported 83% sensitivity, 93% specificity and 91% accuracy.<sup>5</sup> CT can reveal bowel with compromised blood flow and has been found to improve the sensitivity of initial evaluations to determine whether a patient requires surgical intervention.<sup>1</sup>

There are several specific appearances on CT that are highly suggestive of volvulus.<sup>1,3</sup> The key feature that indicates a bowel volvulus is the presence of the 'whirl sign', described as a soft-tissue mass with an internal architecture of swirling strands of soft tissue and fat attenuation. The 'whirl sign' described by Fisher (in Khurana<sup>5</sup>) was found at CT in a case of midgut volvulus, where the centre of the whirl was the superior mesenteric artery and the whirled appearance was created by the encircling loops of bowel. It was proposed that any disturbance in the 270° counter-clockwise return of the intestine into the abdominal cavity could produce a range of rotational and attachment abnormalities and that the lack

of normal peritoneal attachment predisposes to development of a volvulus, with twisting occurring around its attachment point and fulcrum, the superior mesenteric artery. Subsequent to publication of Fisher's article, many authors described various forms of volvulus.<sup>5</sup> The 'whirl sign' as seen on CT has subsequently been used to describe obstruction of the midgut and distal colon.<sup>1</sup> Patients with a 'whirl sign' on CT have a high probability of having SBO, with a positive predictive value of 80%, and those without the sign probably do not have SBO, with a negative predictive value of 86%.<sup>1</sup>

Most importantly, the 'whirl sign' may not be as apparent if the axis of rotation is not perpendicular to the transverse scanning plane. Affected mesenteric vessels are typically not seen at the same anatomical level where a closed-loop obstruction is 'pinched off' at the site of constriction. Other CT signs of SBV described in the literature are a radial distribution or a u-shaped configuration of the distended bowel loops and a triangular section or longitudinal tapering of the collapsed bowel loop at the site of torsion. Both these CT signs may be observed in a closed-loop obstruction of the small bowel and may depend on the length of the obstructed segment, and the degree of bowel distension of the closed loops in relation to the transverse scanning plane.<sup>5</sup>

In conclusion, the 'whirl sign' is highly suggestive of intestinal volvulus and should raise suspicion of complicated closed-bowel obstruction. The strong reliability of the sign for predicting the need for surgery should be especially helpful to physicians faced with equivocal clinical features.<sup>1</sup>

#### REFERENCES

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