

Doppler Ultrasound in the Diagnosis of Intestinal Ischemia

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Abstract. Conventional ultrasound is unreliable in detecting narrowing of the visceral arteries. Two cases are reported in which duplex Doppler ultrasound correctly identified severe narrowing of the celiac artery. Doppler ultrasound promises to be more accurate than conventional ultrasound in the diagnosis of visceral ischemia and may help to identify those patients who may require angiography.

Key words: Doppler ultrasound – Mesenteric arteries – Visceral ischemia – Mesenteric vascular occlusion – Angiography.

Ultrasound is widely used to image the intraabdominal blood vessels but, until recently, Doppler ultrasound has been used infrequently to assess abdominal blood flow. Doppler is now being used increasingly in the operative evaluation of ischemic bowel [1], the demonstration of portal vein patency [2], the assessment of porta caval shunts [3, 4], and the assessment of portal hypertension [5]. In the investigation of visceral arterial blood flow, the normal Doppler signals from various abdominal arteries have been well-documented in normal subjects [6]. Because it is often difficult to detect reliably narrowing of a visceral artery using real-time ultrasound, the possible use of Doppler scanning to demonstrate such narrowings, in a similar manner to that used to assess arterial stenoses elsewhere in the body, would be of considerable use

in the investigation of patients with possible intestinal ischemia.

We report our experience of Doppler scanning correctly indicating the presence of significant narrowing of visceral arteries.

Patients and Methods

Patients were examined in the supine position using a duplex scanner (Diasonics CV 400), which consists of a real-time 2-dimensional sector scanner with an integrated 3.5 MHz pulsed Doppler flow meter. Doppler signals were recorded from the celiac artery, its proximal branches, and from the proximal superior mesenteric artery. Real-time imaging was used to place the Doppler sample volume within the lumen of the vessel. Intraarterial digital subtraction aortography was performed to confirm the Doppler findings.

Case Reports

Case 1

A 59-year-old man presented with an 8-month history of severe postprandial abdominal pain, 23 kg weight loss, and symptoms of steatorrhea. He had had recurrent duodenal ulceration for the previous 3 years but, apart from a long history of smoking, had no other relevant history. Physical examination showed a thin man with no abdominal masses or bruits. Findings on esophagogastroduodenoscopy, small bowel enema, endoscopic pancreatography, and abdominal radiography were normal.

Abdominal ultrasound appeared to show a narrowed proximal celiac artery (Fig. 1A) but an apparently normal superior mesenteric artery (SMA) (Fig. 1B). However, Doppler scanning showed that there was no flow in the SMA (Fig. 2A) and very turbulent blood flow in the celiac artery (Fig. 2B), extending up into the splenic artery. This was interpreted as indicating a severe proximal celiac artery stenosis and complete occlusion of the SMA. This was confirmed by angiography (Fig. 3).

Case 2

A 65-year-old man was admitted with a 14-day history of intermittent severe central abdominal pain. He also complained of intermittent nausea and 5 kg weight loss. He had had an aorto-

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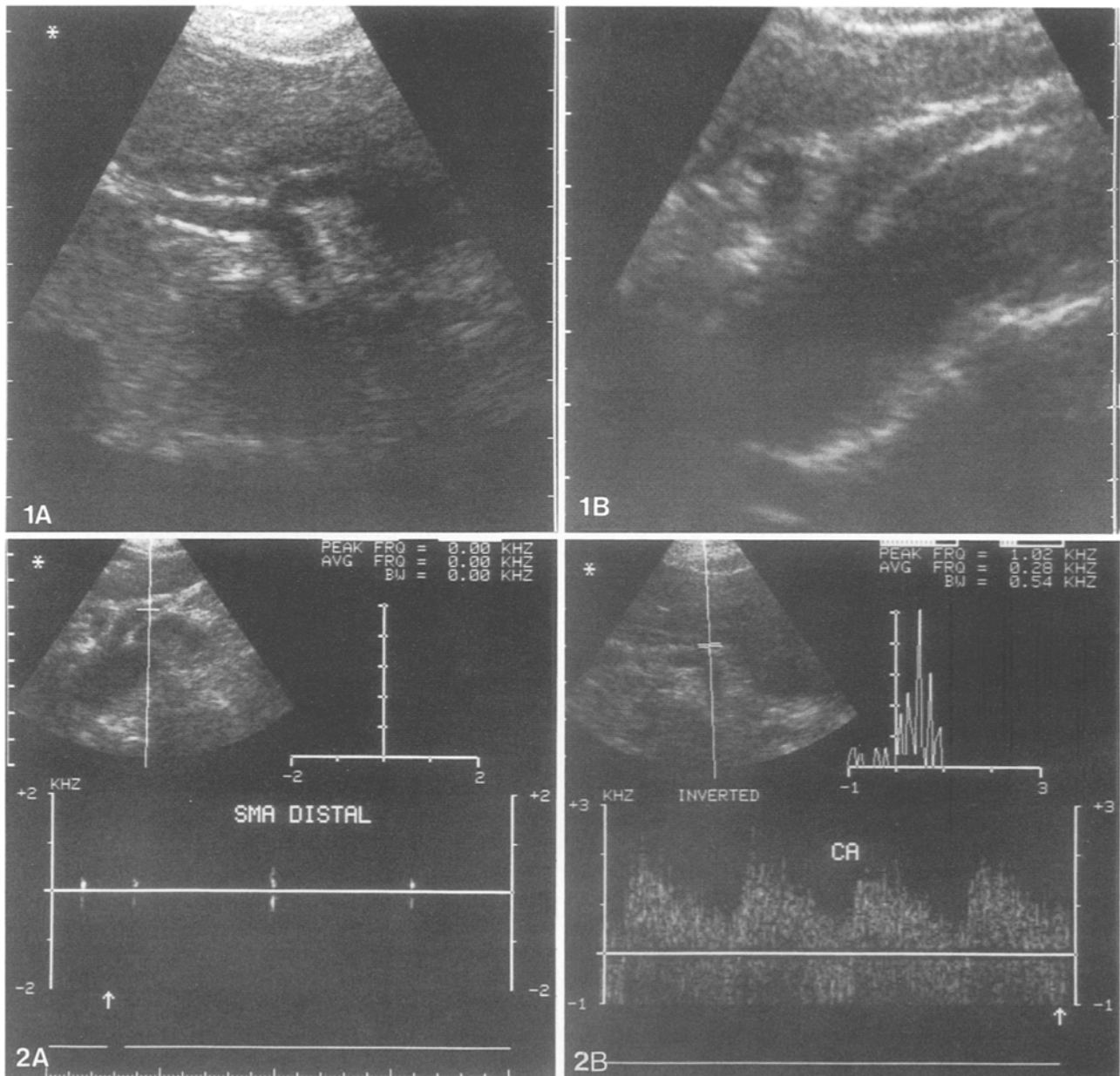


Fig. 1. Case 1. **A** Transverse section ultrasound scan of stenosed origin of celiac artery. **B** Sagittal section ultrasound scan of apparently normal origin of SMA.

Fig. 2. Case 1. **A** Doppler trace from superior mesenteric artery shows no flow. **B** Doppler trace from celiac artery shows very turbulent flow throughout the cardiac cycle.

bifemoral graft for an abdominal aortic aneurysm 8 months previously. Physical examination showed that he was very thin and dehydrated. Blood pressure was 150/110 mm/Hg with no other abnormal signs outside the abdomen. The abdomen was soft with no palpable masses but there was a loud bruit audible over the abdominal aorta, iliac, and femoral arteries. The abdomen was not tender.

Abdominal ultrasound showed a normal upper aorta, clot below the origin of the SMA in the aortic graft, a normal origin of the SMA, and a narrowed proximal celiac artery origin (Fig. 4A). The SMA Doppler signal was normal. The Doppler signal recorded from the celiac axis showed marked systolic spectral broadening (Fig. 4B), an increased peak Doppler shift

(up to 5 kHz), and reversed flow in systole. This was interpreted as indicating a severe proximal celiac artery stenosis with a normal SMA. This was confirmed by intraarterial digital subtraction angiography (Fig. 4C), which also showed a leak from the proximal graft anastomosis.

Discussion

Both of our patients with celiac artery narrowing had abnormal Doppler signals, recorded from these arteries, which were similar in nature to the Doppler abnormalities found in carotid artery

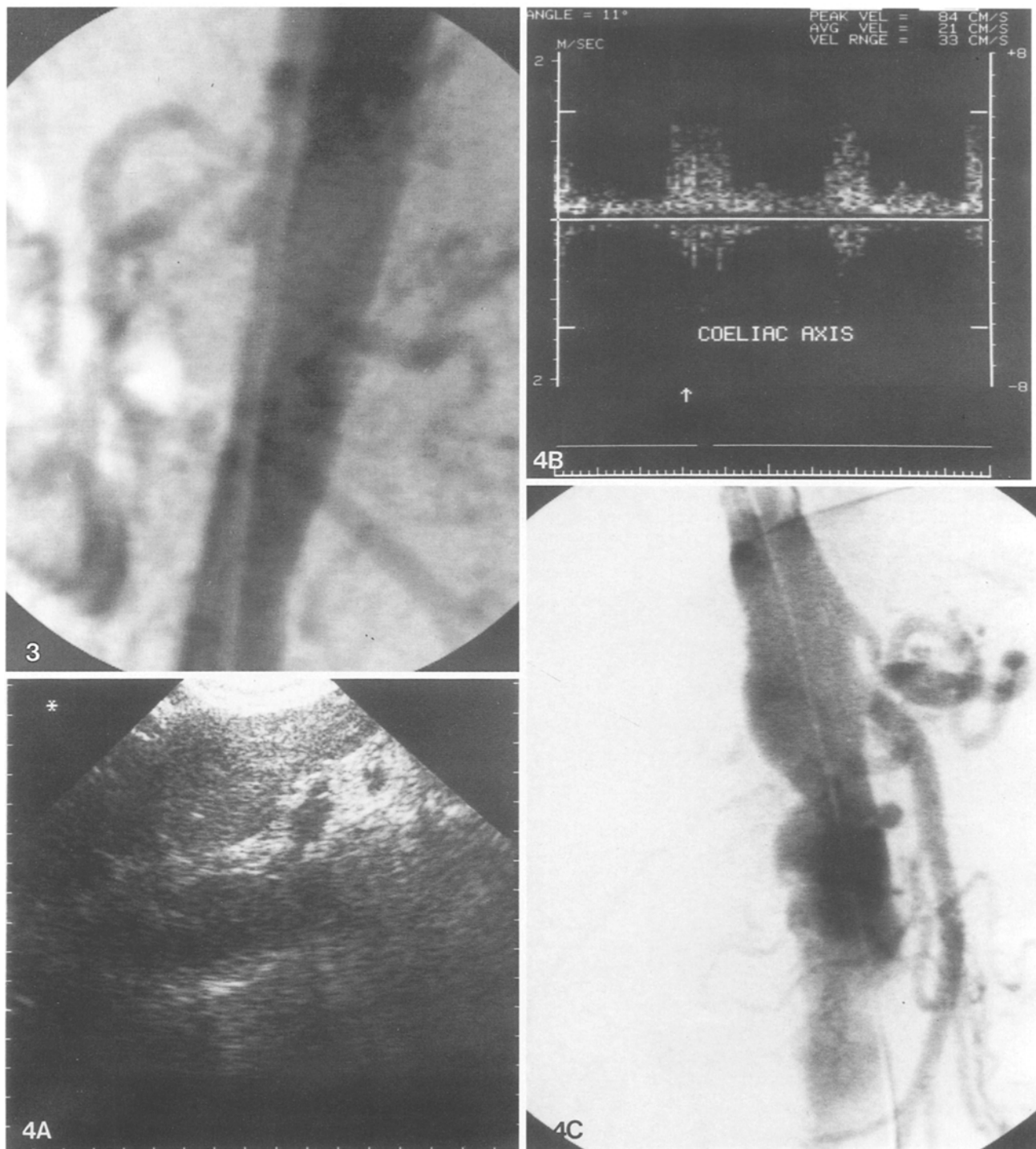


Fig. 3. Case 1. Digital subtraction lateral aortogram shows stump of occluded SMA and stenosed origin of celiac artery.

Fig. 4. Case 2. **A** Sagittal section ultrasound scan of narrowed origin of celiac artery. **B** Doppler trace from celiac artery shows systolic spectral broadening, increased Doppler shift, and reversal of flow. **C** Digital subtraction lateral aortogram shows normal origin of SMA and narrowed origin of the celiac artery.

stenosis [8]. As far as we know this has only been reported on one previous occasion [7]. Since the celiac and carotid arteries are of a similar diameter it is not surprising that stenoses of these arteries can produce similar Doppler spectrum abnormali-

ties. While real-time ultrasound cannot accurately diagnose narrowing of the visceral arteries, Doppler scanning could prove to be a reliable method for detecting significant stenosis of these arteries.

The diagnosis of intestinal ischemia is often difficult to make without resorting to angiography. In this group of patients, coexisting aortoiliac atheroma can make angiography difficult and hazardous. Doppler ultrasound may identify those patients who should be investigated by angiography. If the Doppler signal from both the celiac artery and SMA is normal (peak Doppler shift 3.5 kHz, narrow spectrum), significant mesenteric ischemia is unlikely. In equivocal cases the administration of a test meal may demonstrate an abnormal blood flow response on Doppler examination to support the presence of mesenteric ischemia [9, 10].

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