Endoscopic, Radiographic, and Manometric Findings Associated with Cardiovascular Dysphagia

MITCHELL S. CAPPELL, MD, PhD

The roentgenographic, echocardiographic, endoscopic, and manometric findings were studied in five consecutive patients with cardiovascular dysphagia, including four with a dilated left atrium and one with an anomalous left subclavian artery. Common and different manometric findings were found in the two types of cardiovascular dysphagia. The major manometric abnormality in all cases was an elevated baseline pressure, with superimposed large rhythmic pressure waves occurring at the same frequency as the electrocardiogram in the mid-esophagus. This manometric abnormality, produced by pulsatile cardiovascular compression, provides direct evidence that cardiovascular dysphagia is caused by esophageal luminal obstruction from cardiovascular compression. Indirect evidence supporting this mechanism includes smooth extrinsic compression and hang-up of ingested barium in the mid-esophagus on esophagogram and transmitted mural pulsations and a compressed lumen in the mid-esophagus at panendoscopy. Two of the five patients had deranged esophageal peristalsis within the high-pressure zone, which also contributed to the dysphagia. Autopsy in one patient with deranged peristalsis revealed a band of ischemic esophageal mucosa in the zone compressed by the dilated left atrium. A novel manometric maneuver might distinguish dysphagia due to an anomalous left subclavian artery from dysphagia due to a dilated left atrium. Left arm elevation during manometry in the single patient with the anomalous artery significantly increased the mean mid-esophageal baseline pressure by 92% (N = 10 trials), and mean pressure wave amplitude by 93% (N = 10 trials, P < 0.002 for each, nonparametric signed rank test). Left arm elevation in this patient also increased the observed luminal obstruction during endoscopy. These manometric and endoscopic findings may be explained by increased arterial compression of the esophagus produced by arterial stretch and anterior displacement with arm elevation.

KEY WORDS: left atrial dilatation; cardiomegaly; mitral regurgitation; mitral stenosis; mitral valve; aberrant left subclavian artery; subclavian steal syndrome; dysphagia, manometry; esophageal motility.

Delayed esophageal transit from cardiovascular abnormalities is important to appreciate because this phenomenon may be more common than clinically recognized (1–3), and because these abnormalities can produce severe dysphagia and serious complications (4–9). Cardiovascular causes of dysphagia include left atrial dilatation (4), thoracic aortic aneurysm (10), tortuous atherosclerotic aorta (11–13), aberrant right subclavian artery (14), and aberrant left subclavian artery (15). We prospectively analyzed the roentgenographic, echocardiographic, endoscopic, and manometric findings in five consecu-
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tive patients with dysphagia associated with cardiovascular abnormalities presenting to the Robert Wood Johnson University Hospital Motility Unit in the past three years. This work extends previous reports of manometric findings in cardiovascular dysphagia (4, 13, 14), reports manometric findings common to all the patients with dysphagia from cardiovascular structures, describes a novel manometric maneuver in one patient that might distinguish dysphagia due to an anomalous left subclavian artery from dysphagia due to a dilated left atrium, and describes a possible pathophysiologic explanation of the reported manometric findings.

MATERIALS AND METHODS

All patients had the following studies: complete blood count, routine serum electrolytes, serum biochemical parameters of liver function, serum cholesterol level, prothrombin time and partial thromboplastin time determinations, posteroanterior and lateral chest roentgenograms, air-contrast upper gastrointestinal series, panendoscopy, noninvasive radiologic studies to confirm the cardiovascular abnormality (echocardiography in patients with a dilated left atrium and chest computerized tomography in the patient with an aberrant subclavian artery), and esophageal manometry with simultaneous electrocardiography. Manometry and electrocardiography were recorded simultaneously on different chart recorders using precisely the same recording speeds. The recordings were then photographically combined. This study was approved by the Institutional Review Board. All procedures were performed after consultation with a cardiologist regarding patient safety. One patient did not undergo panendoscopy because the benefits of panendoscopy were not felt to justify the increased risks in this patient from cardiac disease. The esophageal mucosa was analyzed in this patient by postmortem examination.

Cardiac medications that might affect esophageal motility were discontinued 24 hr prior to manometry. Standard manometric measurements were made using a soft plastic catheter containing three fused capillary tubes with apertures spaced 5 cm apart (Esopha-cath manometric tube, Sensor Medics Corp., Anaheim, California), a low-compliance Armador pneumatic capillary infusion system (Armador Medical Specialties, Greendale, Wisconsin), and a Beckman Dynograph R611 four-channel external pressure transducer and chart recorder. Sphincter pressures were determined using stepwise "stationary" recordings.

RESULTS

Case 1: Anomalous Left Subclavian Artery. A 31-year-old right-handed white male complained of progressive dysphagia to solids during the prior two years and of left arm dysesthesia and paresthesia with left arm elevation. The patient did not use his left hand to hold utensils while eating because left arm elevation exacerbated the dysphagia and caused left arm dysesthesia. Physical examination revealed a stocky male with normal vital signs. Cardiac and abdominal examination were within normal limits. The left radial pulse was weak with the left arm extended (in the anatomic position), and disappeared with left arm elevation. The right radial pulse was of normal strength, and unaffected by right arm elevation. Left arm skin appearance, sensory perception, motor strength, and deep tendon reflexes were normal. The stool did not contain occult blood.

The hematocrit was 43.6. Serum levels of electrolytes and of biochemical parameters of liver function were within normal limits. Chest roentgenogram and computerized tomography revealed a right-sided aortic arch and anomalous left subclavian artery (Figure 1A). A barium esophagram demonstrated on oblique extrinsic esophageal impression from the anomalous subclavian artery and transient hang-up of barium at this level (Figure 1B and C). Panendoscopy revealed transmitted mural pulsations occurring at the frequency of the peripheral pulse and a compressed lumen in the midesoph-