RESEARCH LETTERS

Assessing Aberrant Subclavian Artery on High-Resolution Esophageal Manometry

Dysphagia lusoria is defined as dysphagia related to vascular compression of the esophagus most commonly from an aberrant subclavian artery (ASA), a rare embryologic abnormality of the aortic arch.[1–3] Although persons with ASA are often asymptomatic with the variant identified incidentally, up to 20%–40% of adults develop symptoms most often solid food dysphagia.[3,4] Evaluation to exclude secondary causes of dysphagia is recommended including esophagogastroduodenoscopy, barium esophagram, and high-resolution esophageal manometry (HRM), especially given the morbidity and lack of symptom improvement with surgery for ASA in some patients.[5] Findings related to ASA on HRM are not well investigated and the aim of this study was to describe HRM characteristics of patients with ASA. [5,6]

Adult patients with confirmed ASA on computed tomography (CT) imaging of the chest who underwent HRM between February 2013 and December 2022 at Mayo Clinic Florida were included. The study was deemed exempt by the Mayo Clinic institutional review board. HRM was performed using a catheter placed transnasally followed by a 30-second baseline period and then 10 5-mL liquid swallows (Medtronic, Shoreview, MN). As most HRM studies were performed before development of the Chicago Classification version 4.0, studies were classified according to version 3.0 (CCv3.0).[7]

To assess the findings of ASA on HRM, studies were manually reviewed for vascular impression in the first or second esophageal segments on HRM during the 30-second baseline recording. Forty control patients who underwent HRM without ASA on CT imaging of the chest were identified to match controls: cases in at least a 3:1 ratio. Vascular impression was defined as present if visually there was a continuous band of artifact in a pulsatile pattern along the length of the baseline recording (Figure A1). Measurements of the vascular impression included distance from the nares (cm), impression width (cm), maximum pressure (mmHg), and minimum pressure for a contiguous isobaric contour along the vascular impression (mmHg, Figure A1). To assess pressure along the vascular impression during deglutition, we measured the vascular impression relaxation pressure (VIRP), the mean of the 4 seconds of maximal relaxation along the vascular impression in the 10 seconds after swallow initiation. Groups were compared with Fisher's exact test for categorical variables and Mann-Whitney U for continuous variables (Jamovi, version 2.5)

Twelve patients were identified with ASA who underwent HRM. The median age was 57.5 years, 7 (58.3%) patients were female, and the median body mass index was 24.0 kg/m^2. Ten patients had right ASA and 2 patients left ASA. External compression related to ASA was seen in 1 of 11 patients during esophagogastroduodenoscopy and 4 of 10 who underwent barium esophagram. Indications for HRM and CT chest are listed in Table A1. According to the CCv3.0, 4 (33.3%) patients had normal classification, 5 (41.7%) ineffective esophageal motility, 1(8.3%) distal esophageal spasm, and 2 (16.7%) esophagogastric junction outflow obstruction. Of the control patients, 36 of 40 (90%) had normal HRM, 2 ineffective esophageal motility, 1 distal esophageal spasm, and 1 hypercontractile esophagus.

All 12 patients with ASA had evidence of vascular impression on HRM versus 20 of 40 (50%) control patients ($P = .002$). Among patients with vascular impression on HRM, there were no differences between the study patients and controls including distance from the nares (median 26.5 vs 29 cm, $P = .092$), impression width (median 1.5 vs 1.5 cm, $P = .83$), maximum pressure (median 31.5 vs 39.8 mmHg, $P = .45$), and minimum pressure for contiguous isobaric contour (9 vs 5.5 mmHg, $P = .37$, Table). Patients with ASA had a higher VIRP compared to controls (0.8 vs −5.5 mmHg, $P = .038$, Figure). When assessing impedance bolus clearance above the vascular impression in the study patients, none had incomplete clearance.

Of the 12 patients with ASA, 10 were seen in follow-up. The most

Table. Characteristics of Vascular Impression in the First or Second Portion of the Esophageal Body During the 30-s Baseline Period on High-Resolution Esophageal Manometry Between Patients With and Without ASA.

Vascular impression on HRM, # (%)	Patients with ASA (n = 12)	Controls (n = 40)	*P* value
Present	12, 100	20, 50	.002
Absent	0, 0	20, 50	
Metrics of vascular impression on HRM, median (IQR)			
Distance from the nares, cm	26.5 (24.0–28.3)	29 (26.0–31.0)	.092
Impression width, cm	1.5 (1.5–1.6)	1.5 (1.4–1.7)	.83
Maximum pressure, mmHg	31.5 (29.8–42.9)	39.8 (27.5–74.5)	.45
Pressure for a contiguous isobaric contour, mmHg	9 (4.75–11.3)	5.5 (3.0–10.5)	.37
Vascular impression relaxation pressure (VIRP)	0.8 (−3.7 to 4.7)	−5.5 (−15 to 4.7)	.038

IQR, inter-quartile range.

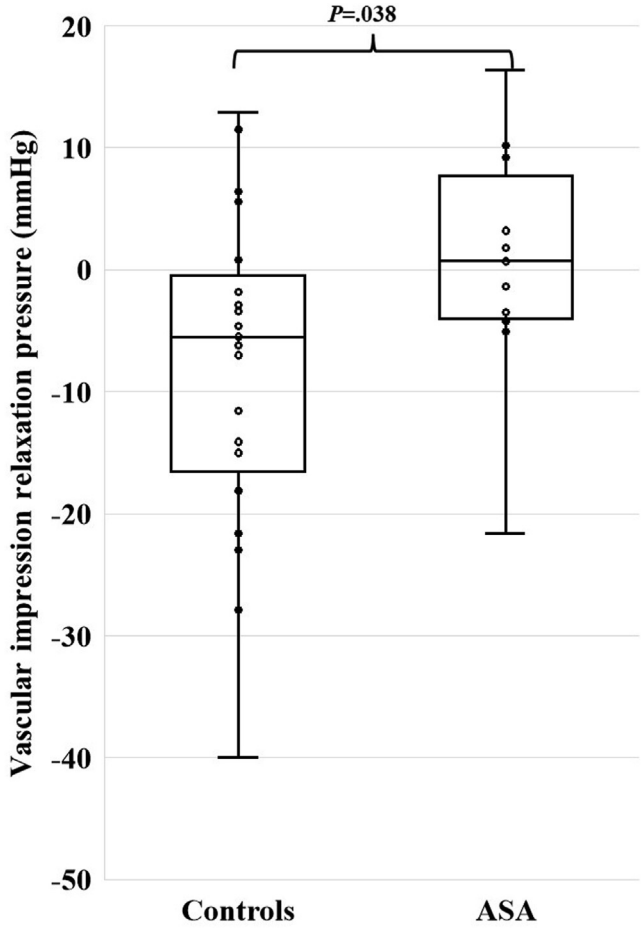

Figure. Box plot demonstrating differences in the VIRP measured on high-resolution esophageal manometry between patients with aberrant subclavian artery and controls. The VIRP was calculated as the mean of the 4 seconds of maximal relaxation along the vascular impression in the 10 seconds after swallow initiation.

common diagnosis attributed to esophageal symptoms was gastroesophageal reflux disease in 8 (80%) patients with eosinophilic esophagitis and functional dysphagia in 1 patient each. All patients were treated conservatively with acid suppression or lifestyle measures (ie diet modification, smaller bites, chewing well). No patients were referred for vascular surgery for treatment of ASA.

The main findings of this study assessing HRM in patients with ASA are that vascular impression was present in all patients with ASA and more common compared to controls, but no different in location and intensity than control patients. This study assessed a novel metric, the VIRP, which assessed the reduction in pressure along the vascular impression following deglutition. The VIRP was higher in patients with ASA suggesting higher esophageal pressure and reduced lumen diameter related to ASA compression, although esophageal symptoms were not attributed to ASA in this cohort.

This study supports findings that vascular impression is often incidental and does not impact swallowing.[8,9] Prior studies using esophageal manometry in patients with ASA have demonstrated mixed findings. In a study of 6 patients with ASA who underwent conventional esophageal manometry, 2 patients had reduced esophageal contraction amplitudes, 2 a high-pressure zone at the level of aberrant artery, and 1 a hypocontractile zone in the proximal esophagus.[5] Although patients with ASA are generally asymptomatic or have mild symptoms, it remains unclear why patients develop symptoms later in life or might develop severe symptoms necessitating surgery.[1] Potential etiologies include anatomic and physiologic changes including decreased compliance of the esophagus or aneurysm formation (Kommerell's diverticulum).[3] Dynamic obstruction to bolus flow by the vascular impression may lead to a compensatory, increased contraction and dysphagia in some patients and may be evaluated in the future with distension contraction plots.[10] A high proportion of control patients were evaluated with CT chest for lung transplant evaluation, and it is possible these patients had respiratory disease that might impact HRM findings between controls and patients.

In conclusion, in this study of patients with ASA who underwent HRM, vascular impression was common and associated with higher esophageal pressures across the vascular impression during deglutition. Although the clinical relevance of this finding requires further investigation, HRM may be considered in the evaluation of symptomatic patients with ASA.

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Supplementary Materials

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Abbreviations used in this paper: **ASA, aberrant subclavian artery; HRM, high-resolution esophageal manometry; CT, computed tomography; (CCv3.0), Chicago Classification version 3.0; VIRP, vascular impression relaxation pressure**

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