Outcome predictors in median arcuate ligament syndrome

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ABSTRACT

Background: Median arcuate ligament syndrome (MALS) is a condition characterized by chronic abdominal symptoms associated with median arcuate ligament compression of the celiac artery. The selection of patients is difficult in the management of MALS. This study aimed to identify factors that predict outcomes of surgical and nonoperative treatment in these patients.

Methods: Patients referred with a possible diagnosis of MALS between 1998 and 2013 were identified retrospectively. Only patients with chronic symptoms and radiologically confirmed celiac artery compression were included. The clinical features, investigations, and management were documented. Outcome was assessed using the Visick score, Gastrointestinal Symptom Rating Scale, and 12-Item Short Form Health Survey by telephone interview and review of medical records.

Results: There were 67 patients, 43 (64%) treated surgically and 24 (36%) managed without surgery, with a median follow-up of 25 months and 24 months, respectively. After surgical treatment, 16 (37%) were asymptomatic, 24 (56%) were partially improved, 3 (7%) had no changes in symptoms, and none had worsening of symptoms. Postexertional pain predicted improvement after surgery ($P = .022$). Vomiting ($P = .046$) and unprovoked pain ($P = .006$) were predictors of poor surgical outcome. After nonoperative management, 1 (4%) was asymptomatic, 7 (29%) were partially improved, 12 (50%) had no changes in symptoms, and 4 (17%) had worsening of symptoms. No outcome predictors of nonoperative treatment were identified.

Conclusions: MALS was more likely to respond to decompression if patients had postexertional pain. Patients who presented with vomiting and unprovoked pain were unlikely to respond to surgery. In contrast with previous studies, postprandial pain was not found to be predictive of outcome. (J Vasc Surg 2017;■:1-8.)

Median arcuate ligament syndrome (MALS), or celiac artery compression syndrome, is an uncommon condition that has been defined as chronic abdominal symptoms, such as abdominal pain, weight loss, and anorexia, associated with compression of the celiac artery by the median arcuate ligament of the diaphragm.[1-3]

The treatment of MALS has been a controversial issue since the condition was first described in 1963.[4] Surgical decompression of the celiac artery is currently the mainstay of treatment for MALS.[5] However, some clinicians consider the association between celiac artery compression and chronic abdominal symptoms to be coincidental and therefore advocate nonoperative management.[6] Hence, the management of MALS can be divided into surgical and nonoperative treatment.

Surgical management has evolved during the past five decades, but long-term outcomes remain variable, with symptom relief occurring in 65% to 87% of treated patients.[7-9] In clinical practice, selection of appropriate patients for surgical treatment remains difficult because both clinical and radiographic features of MALS are nonspecific.[6,10] As well, there is insufficient understanding of the clinical predictors of treatment outcomes. After investigations negative for other pathologic processes, the patient and referring clinician may fixate on the radiologic finding of median arcuate ligament compression as the cause and have a strong desire for surgical intervention. Thus, there is a need to improve the selection criteria for surgery and the outcomes overall.

Outcomes in patients with proven median arcuate ligament compression of the celiac trunk who have not undergone surgical decompression (ie, nonoperative management) have been reported in three small studies with widely variable results, such as symptom relief being achieved in between 0% and 75% of this group.[11-13] Thus, this is another group worthy of assessment in more detail. The current study identified a contemporary

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This study was funded by the participating authors and hospital departments.

Author conflict of interest: none.

Presented at the Royal Australasian College of Surgeons Annual Scientific Congress and the Australia and New Zealand Society for Vascular Surgery Annual Scientific Meeting, Canberra, Australia, October 11-13, 2014.

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The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

0741-5214

http://dx.doi.org/10.1016/j.jvs.2016.11.040

cohort of symptomatic patients with compression of the celiac artery by the median arcuate ligament and then retrospectively assessed the outcome predictors for those selected to undergo surgical treatment. In addition, the outcomes from those who did not have surgery (ie, nonoperative management) were similarly assessed.

METHODS

MALS was defined as the presence of both unexplained chronic abdominal symptoms and celiac artery compression. Celiac artery compression was defined as celiac artery peak systolic velocity (PSV) >200 cm/s on duplex ultrasound or >50% diameter reduction of the proximal celiac artery on angiography, which may be digital subtraction angiography, computed tomography angiography, or magnetic resonance angiography. Radiologic findings were collected from the radiologists' reports instead of original scan images because the imaging laboratories did not regularly preserve the original images. All patients included in this study fulfilled this definition of MALS.

Study design. After approval from the Metro South Health Research Ethics Committee and the University of Queensland School of Medicine Ethical Review Committee, patients referred for assessment and management of suspected MALS between 1998 and 2013 were identified by the treating clinicians (four general and three vascular surgeons) from the clinical records from two Brisbane tertiary teaching hospitals (Princess Alexandra Hospital and the Royal Brisbane and Women's Hospital) and from patients referred to a vascular imaging laboratory (Queensland Vascular Diagnostics).

A retrospective review of all patient records was conducted. Information including demographics, clinical features at the time of presentation, investigations performed and the results, and treatment provided to the patients was recorded and maintained using Microsoft Excel (Microsoft, Redmond, Wash). An attempt was made to contact all patients through mailed invitation letters with a follow-up telephone survey assessing the outcomes of their treatment. Informed consent was obtained for all patients who were contacted for the survey.

The survey included three outcome measures:

1. Visick score, a subjective comparison of pretreatment and post-treatment symptom severity whereby patients describe their symptomatic outcome with four options (asymptomatic, improved, unchanged, and worsened). This scoring system has been previously used to evaluate the outcomes of surgical treatment of MALS.[10]
2. Gastrointestinal Symptom Rating Scale (GSRS), a 15-item survey assessing the degree of "bother" from 15 gastrointestinal symptoms on a scale of 1 (none) to 7 (very severe).
3. 12-Item Short Form Health Survey (SF-12), a 12-item survey that assessed the health-related quality of life. Results from this survey were converted into two scores, the physical composite score and the mental composite score, using the standardized SF-12 formula available online. Adjusted composite scores were then calculated from the difference between each patient's composite scales and the published Australian norms of the corresponding gender and age groups.[14] A positive adjusted score can be interpreted as a higher quality of life of the patient compared with the Australian norm. A negative adjusted score can be interpreted as a lower quality of life of the patient compared with the Australian norm.

For those patients who could not be contacted, a Visick score was developed from the clinical notes at the time of the last follow-up assessment. In the event that a patient who had treatment for MALS had an additional abdominal operation for an unrelated condition, the Visick score was assessed using the clinical notes from the last follow-up appointment before the second procedure. Where there were insufficient clinical notes for the Visick score to be assessed, the patient was excluded from the study.

A favorable outcome was suggested by subjective improvement of symptoms as indicated by the Visick score, lower GSRS scores, or higher adjusted SF-12 composite scores. Cure was defined as being asymptomatic at the time of follow-up as reported by the patient.

Surgical approach. Both laparoscopic and open surgical approaches were used. The supraceliac abdominal aorta was approached through dissection of the gastrohepatic ligament and the parietal peritoneum over the right crus of the diaphragm. Typically, the approach was lateral to the right crus through the diaphragm. The dissection was continued caudally on the anterior wall of the abdominal aorta. Distally, the celiac trunk was identified by following the left gastric artery proximally. With an approach from above and below, the compressive band across the proximal celiac artery was identified. The compressive band was divided (Fig), and further dissection was performed to divide any other compressive tissues surrounding the celiac artery until the proximal celiac artery was exposed completely. Postoperatively, imaging studies were not routinely performed.

Data analysis. Data collected from medical records and telephone surveys were collated and analyzed using IBM SPSS Statistics (IBM Corp, Armonk, NY). In identifying outcome predictors, associations between nominal factors and Visick scores were analyzed using linear-by-linear associations. One-way analysis of variance was used to compare scale variables between patients with different Visick scores. Because of the relatively small sample size in this study, the Visick scores were stratified into two groups: those who were asymptomatic at the