**REVIEW**
243  Endoscopic ultrasound in oncology: An update of clinical applications in the gastrointestinal tract  
Valero M, Robles-Medranda C

**MINIREVIEWS**
255  Endoscopic recommendations for colorectal cancer screening and surveillance in patients with inflammatory bowel disease: Review of general recommendations  
Huguet JM, Suárez P, Ferrer-Barceló L, Ruiz L, Monzó A, Durá AB, Sempere J

**ORIGINAL ARTICLE**
**Retrospective cohort study**
263  Endoscopic resolution and recurrence of gastric antral vascular ectasia after serial treatment with argon plasma coagulation  
Garg S, Aslam B, Nickl N

**Observational Study**
267  Utility of the balloon-overtube-assisted modified over-the-wire stenting technique to treat post-sleeve gastrectomy complications  
Ponte A, Pinho R, Proença L, Silva J, Rodrigues J, Sousa M, Silva JC, Carvalho J

**Randomized Controlled Trial**
273  Multicenter randomised controlled trial comparing the high definition white light endoscopy and the bright narrow band imaging for colon polyps  
Singh R, Cheong KL, Zorron Cheng Tao Pu L, Mangira D, Koay DSC, Kee C, Ng SC, Rerknimitr R, Aniwan S, Ang TL, Goh LK, Ho SH, Lau JYW

**CASE REPORT**
282  Bladder urothelial carcinoma extending to rectal mucosa and presenting with rectal bleeding  
Aneese AM, Manuballa V, Amin M, Cappell MS
**AIM AND SCOPE**

*World Journal of Gastrointestinal Endoscopy* (World J Gastrointest Endosc, WJGE, online ISSN 1948-5190, DOI: 10.4253) is a peer-reviewed open access (OA) academic journal that aims to guide clinical practice and improve diagnostic and therapeutic skills of clinicians. 

*WJGE* covers topics concerning gastroscopy, intestinal endoscopy, colonoscopy, capsule endoscopy, laparoscopy, interventional diagnosis and therapy, as well as advances in technology. Emphasis is placed on the clinical practice of treating gastrointestinal diseases with or under endoscopy.

We encourage authors to submit their manuscripts to *WJGE*. We will give priority to manuscripts that are supported by major national and international foundations and those that are of great clinical significance.

**INDEXING/ABSTRACTING**

*World Journal of Gastrointestinal Endoscopy* is now indexed in Emerging Sources Citation Index (Web of Science), PubMed, and PubMed Central.

**FLYLEAF**

I-III  Editorial Board

**EDITORS FOR THIS ISSUE**

- **NAME OF JOURNAL**
  World Journal of Gastrointestinal Endoscopy
- **ISSN**
  ISSN 1948-5190 (online)
- **LAUNCH DATE**
  October 15, 2009
- **FREQUENCY**
  Monthly
- **EDITORS-IN-CHIEF**
  Atsushi Imagawa, PhD, Director, Department of Gastroenterology, Mitoyo General Hospital, Kan-onji, Kagawa 769-1695, Japan
  Juan Manuel Herrera Gutierrez, PhD, Academic Fellow, Chief Doctor, Professor, Unidad de Gestión Clínica de Aparato Digestivo, Hospital Universitario Virgen Macarena, Sevilla 41009, Sevilla, Spain
- **EDITORIAL BOARD MEMBERS**
  All editorial board members resources online at http://www.wjgnet.com/1948-5190/editorialboard.htm
- **EDITORIAL OFFICE**
  Xiu-Xia Song, Director
  World Journal of Gastrointestinal Endoscopy
  Baishideng Publishing Group Inc
  7901 Stoneridge Drive, Suite 501, Pleasanton, CA 94588, USA
  Telephone: +1-925-2238242
  Fax: +1-925-2238243
  E-mail: editorialoffice@wjgnet.com
  Help Desk: http://www.f6publishing.com/helpdesk
  http://www.wjgnet.com
- **PUBLISHER**
  Baishideng Publishing Group Inc
  7901 Stoneridge Drive, Suite 501, Pleasanton, CA 94588, USA
  Telephone: +1-925-2238242
  Fax: +1-925-2238243
  E-mail: bpgoffice@wjgnet.com
  Help Desk: http://www.f6publishing.com/helpdesk
  http://www.wjgnet.com
- **RESORT/ASSISTANT EDITOR**
  Xiang Li
- **RESORT/SCIENCE EDITOR**
  Jin-Xin Kong
- **RESPONSIBLE ELECTRONIC EDITOR**
  Huan-Liang Wu
- **PROOFING EDITOR-IN-CHIEF**
  Lian-Sheng Ma
- **PROOFING EDITORIAL OFFICE DIRECTOR**
  Jin-Lei Wang
- **PUBLICATION DATE**
  June 16, 2017
- **COPYRIGHT**
  © 2017 Baishideng Publishing Group Inc. Articles published by this Open-Access journal are distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits use, distribution, and reproduction in any medium, provided the original work is properly cited, the use is non-commercial and is otherwise in compliance with the license.
- **SPECIAL STATEMENT**
  All articles published in journals owned by the Baishideng Publishing Group (BPG) represent the views and opinions of their authors, and not the views, opinions or policies of the BPG, except where otherwise explicitly indicated.
- **INSTRUCTIONS TO AUTHORS**
  http://www.wjgnet.com/bpg/gerinfo/204
- **ONLINE SUBMISSION**
  http://www.f6publishing.com
Endoscopic resolution and recurrence of gastric antral vascular ectasia after serial treatment with argon plasma coagulation

Shashank Garg, Bilal Aslam, Nicholas Nickl

Shashank Garg, Nicholas Nickl, Division of Digestive Diseases and Nutrition, Department of Medicine, University of Kentucky, Lexington, KY 40536, United States

Bilal Aslam, Department of Medicine, University of Kentucky, Lexington, KY 40536, United States

Author contributions: Garg S contributed to study concept, IRB approval, and data analysis; Garg S and Aslam B drafted the initial manuscript and data entry; Nickl N critically and intellectually revised the manuscript, and approved the final manuscript.

Institutional review board statement: This study was approved by University of Kentucky’s Institutional Review Board.

Conflict-of-interest statement: All the authors have no conflict of interest related to the manuscript.

Data sharing statement: No additional data are available for sharing.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

Manuscript source: Invited manuscript

Correspondence to: Shashank Garg, MBBS, Division of Digestive Diseases and Nutrition, Department of Medicine, University of Kentucky, 800 Rose St, MN 649, Lexington, KY 40536, United States. shashank.garg@uky.edu
Telephone: +1-410-4467797
Fax: +1-859-2579287
Received: December 8, 2016

Abstract

AIM
To evaluate long-term endoscopic resolution and recurrence rate of gastric antral vascular ectasia (GAVE) after argon plasma coagulation (APC) treatment.

METHODS
This was an IRB-approved retrospective single center study that included patients endoscopically treated for GAVE between 1/1/2008 to 12/31/2014. The primary and secondary end points of the study were rate of endoscopic resolution of GAVE after APC treatment and recurrence rate of GAVE after endoscopic resolution, respectively. Endoscopic resolution of GAVE was defined as no endoscopic evidence of GAVE after treatment with APC. Recurrence of GAVE was defined as endoscopic reappearance of GAVE after prior resolution.

RESULTS
Twenty patients met the study criteria. Median age (range) of the patients was 59.5 years (42-74 years). GAVE was associated with underlying cirrhosis in 16 (80%) patients. Indications for initial esophagogastro-duodenoscopy (EGD) included hematemesis and/or melena (9/20, 45%), iron deficiency anemia (6/20, 30%), screening or surveillance of varices (4/20, 20%), and occult gastrointestinal bleeding (1/20, 5%). The patients were treated with a total of 55 APC sessions (range 1-7 sessions). Successful endoscopic resolution of GAVE was
achieved in 8 out of 20 patients (40%). There was no correlation between number of treatment sessions and GAVE treatment success \( (P = NS) \). Recurrence of GAVE was noted on a subsequent EGD in 2 out of 8 patients (25%) with prior endoscopic resolution of GAVE. Median follow-up period for the study population was 627 d (range 63-1953 d).

**CONCLUSION**

Endoscopic resolution rate of GAVE was low (40%) with a 25% recurrence rate after treatment with APC. These rates suggest that APC treatment of GAVE may not be optimal in many circumstances.

Key words: Gastric antral vascular ectasia; Argon plasma coagulation

© The Author(s) 2017. Published by Baishideng Publishing Group Inc. All rights reserved.

Core tip: Argon plasma coagulation (APC) has a good short-term success rate (> 80%) in improving symptoms related to gastric antral vascular ectasia (GAVE). However, GAVE related symptoms can recur in up to 50% of patients. This is the first study to evaluate resolution of GAVE after treatment with APC and its recurrence after successful treatment. The study showed a 40% resolution rate of GAVE after serial treatment with APC. The resolution of GAVE was not associated with number of APC sessions. GAVE was noted to recur in 25% of cases after successful resolution. These results suggest that APC may not be the best modality for treatment of symptomatic GAVE.

Garg S, Aslam B, Nickl N. Endoscopic resolution and recurrence of gastric antral vascular ectasia after serial treatment with argon plasma coagulation. *World J Gastrointest Endosc* 2017; 9(6): 263-266. Available from: URL: http://www.wjgnet.com/1948-5190/full/v9/i6/263.htm DOI: http://dx.doi.org/10.4253/wjge.v9.i6.263

**INTRODUCTION**

Gastric antral vascular ectasia (GAVE) is a well-defined clinical entity characterized endoscopically by prominent flat or erythematous streaks radiating in a spoke-like fashion from the pylorus to the antrum and pathologically by spindle cell proliferation in the mucosal blood vessels, intravascular fibrin thrombi and fibrinohyalinosis\(^1\). It is associated with portal hypertension or other systemic diseases like systemic sclerosis, and typically presents clinically as iron deficiency anemia and/or overt gastrointestinal (GI) bleeding\(^2\). In various case series, argon plasma coagulation (APC) has been shown to have > 80% success for treatment of GAVE related anemia or GI bleeding\(^3\)\(^{-}\)\(^6\). However, these results have not been uniformly confirmed; Boltin et al\(^7\), for example, reported a lower success rate (25.8%) of APC in treating GAVE related anemia or GI bleeding at a mean follow up period of 46.8 mo. Similarly in a recent systemic review, Swanson et al\(^8\) reported a 44%-50% failure rate of APC in the treatment of anemia or GI bleeding related to GAVE. They concluded that there is very low quality evidence for the use of APC in the treatment of GAVE. A possible reason for this observation is that APC is used for controlling GAVE related symptoms but not for complete eradication of GAVE itself. None of the prior studies have evaluated endoscopic resolution of GAVE after APC therapy. This study was undertaken to evaluate endoscopic resolution and recurrence rate of GAVE after therapy with APC.

**MATERIALS AND METHODS**

This was an IRB-approved retrospective study. Cases were identified by reviewing billing data for the period January 1, 2008 - December 31, 2014 to identify all patients who had an EGD (CPT codes 43200 - 43259 excluding 6 codes for EUS) at University of Kentucky Medical Center and with a billing diagnosis of GAVE (ICD-9 code 537.82). The diagnosis of GAVE was made endoscopically in each case.

The primary end point of the study was rate of endoscopic resolution of GAVE after APC treatment as seen on additional endoscopic exams subsequent to the index (first) exam which included treatment. The secondary end point of the study was GAVE recurrence rate after endoscopic resolution. Endoscopic resolution of GAVE was defined as no endoscopic evidence of GAVE after at least 1 treatment session with APC. Recurrence of GAVE was defined as endoscopic reappearance of GAVE on a subsequent EGD after successful resolution. Patients who did not undergo an APC session and at least one follow-up endoscopy, or had treatment of GAVE by a method other than APC were excluded from further analysis. The following information was collected from each patient’s medical record: Demographics, etiology of GAVE, indication and date of endoscopy(s), endoscopic findings, adverse effects during endoscopy, follow-up period and death.

Treatment for GAVE at this institution did not follow a standardized protocol, but was instead directed by individual physician and patient preference according to the clinical circumstances. GAVE was treated with APC during the initial endoscopy when it was assessed to be the cause of patient’s symptoms. Treatment of GAVE was repeated according to physician preference, generally every 4-8 wk; but not all patients underwent subsequent treatments. Procedures were done under appropriate sedation or anesthesia. APC treatment was performed using a high-frequency electrosurgical ERBE generator coupled to an argon gas delivery unit. The settings used for APC treatment were 20-60 Watts of power and 0.3 to 2 L/min of argon gas flow rate. In each APC session, affected areas were coagulated as much as
Statistical analysis

Categorical data were described in fractions or percentages, and analyzed using Fischer’s exact or χ² test depending on sample size. Continuous data were described as mean or median, and analyzed using t test or Wilcoxon rank-sum test depending on the distribution. Multivariate logistic regression was used to analyze the relationship between number of APC sessions and resolution of GAVE with APC. Two-sided P value of ≤ 0.05 was considered significant. The data were analyzed using STATA 13.1 (Statacorp® Texas).

RESULTS

A total of 45 patients with GAVE were identified by the initial screen for review: Twenty five patients were excluded from the final analysis: 8 patients did not get any treatment, 14 patients did not have a follow up EGD, and 3 patients had treatment of GAVE by other modalities. Twenty patients were included in the final analysis (Table 1). Median age (range) at the time of first EGD was 59.5 years (42-74 years). Ten patients were males (50%) and all the patients were Caucasians. GAVE was associated with underlying cirrhosis in 16 (80%) patients.

Indications for initial EGD were hematemesis and/or melena (9/20, 45%), iron deficiency anemia (6/20, 30%), screening or surveillance of varices (4/20, 20%), and occult gastrointestinal bleeding (1/20, 5%). A total of 55 APC sessions were done for the treatment of GAVE (2.75 sessions per patient, range 1-7 sessions). Successful endoscopic resolution of GAVE was achieved in 8 out of 20 patients (40%, 95%CI: 19%-64%). In all these 8 patients, GAVE was associated with underlying cirrhosis whereas none of the patients without cirrhosis had endoscopic resolution of GAVE. However, this difference was not statistically significant (P = 0.12).

There was no correlation between number of treatment sessions and GAVE treatment success (P = 0.33, Table 2). In 2 out of 8 patients (25%, 95%CI: 3%-65%) who had endoscopic resolution of GAVE, it was noted again on a subsequent EGD that was performed for a different indication. Median follow-up period for the study population was 627 d (range 63-1953 d).

Portal hypertensive gastropathy (PHG) was noted in 3 out of 16 (18.75%) patients with GAVE and cirrhosis. GAVE resolution with APC treatment was noted in 2 of these 3 patients with PHG. PHG was not noted in patients with recurrence of GAVE after initial resolution. No endoscopy related adverse events were found during the study period. Three patients (15%) died during the follow-up period. Time to death ranged from 123-986 d. None of the deaths were related to the endoscopy or symptoms related to GAVE.

DISCUSSION

This is the first study to evaluate endoscopic resolution of GAVE and its recurrence rate after APC therapy. In this study, APC had a low success rate (40%) for endoscopic resolution of GAVE, with recurrence of GAVE seen in 25% of patients after documented endoscopic resolution on a subsequent EGD. Historically, APC has been reported to have > 80% success rate for treatment of anemia or GI bleeding related to GAVE. However, most of these case series did not evaluate endoscopic resolution or recurrence of GAVE[1-7].

Findings in this study support the low success rate of APC in the treatment of GAVE related anemia or GI bleeding as reported by Boltin et al[7] and Swanson et al[8]. It would be empirically expected that endoscopic appearance of GAVE would correlate with improvement in GAVE-related anemia or GI bleeding. Therefore, if the 70% rate of combined endoscopic non-resolution and recurrence seen in this series is correct, then APC would be expected to show suboptimal rates of improvement in GAVE-related symptoms.

There are several possible reasons for the low success rate of APC in endoscopic resolution of GAVE. GAVE varies significantly in morphology (flat vs nodular)
and severity (striped distribution in the antrum vs diffuse involvement of antral mucosa) between patients. APC may not work with similar effectiveness in all these situations. Additionally, the abnormal dilated capillaries and fibromuscular hyperplasia in GAVE extend to the lamina propria[9]. However, the coagulation effect of APC rarely (4.8%) ablates the entire thickness of lamina propria. Moreover, coagulation of the entire thickness of the lamina propria needs power of 90-Watts or more which is significantly higher than the usual power settings (30-80 W) used to treat GAVE[4,7,10].

There are some limitations of this study. The study has a small sample size. It is retrospective in nature and does not have a control group or a second intervention group to compare the outcomes with APC treatment. The study did not follow a defined program of consecutive APC sessions to achieve GAVE eradication, nor was there a defined surveillance protocol to search for recurrence. However, the lack of correlation between number of APC sessions and treatment success in this study suggests that this might not be an effective modality even in principle, or might require an excessive number of APC sessions. A prospective, protocol-driven study will be needed to resolve these questions.

In summary, APC may not be an effective therapy in long term for the treatment of symptomatic GAVE. Alternate therapies including radiofrequency ablation and/or banding should be evaluated in a prospective, randomized fashion against APC in order to determine the appropriate endoscopic approach for the treatment of symptomatic GAVE.

**COMMENTS**

**Background**

Argon plasma coagulation (APC) is the most widely used treatment method for gastric antral vascular ectasia (GAVE). However, a recent systematic review reported 44%-50% recurrence rate of symptoms related to GAVE after treatment with APC. None of the prior studies have evaluated endoscopic resolution of GAVE after therapy with APC.

**Research frontiers**

This is the first study to evaluate endoscopic resolution of GAVE after treatment with APC and its recurrence rate after successful treatment with APC therapy.

**Innovations and breakthrough**

The results of this study showed that serial treatment with APC was associated with only 40% resolution of GAVE as evaluated by endoscopy. Out of these 40% cases, GAVE was noted to recur during a subsequent esophago-gastroduodenoscopy (EGD) in 25% of cases. The resolution of GAVE was not associated with number of APC sessions performed to treat GAVE.

**Applications**

The results of this study suggest that APC may not be an effective therapy in long term for the treatment of symptomatic GAVE. Alternate therapies including radiofrequency ablation and/or banding should be evaluated in a prospective, randomized fashion against APC in order to determine the appropriate endoscopic approach for the treatment of symptomatic GAVE.

**Terminology**

GAVE is a distinct clinical entity characterized endoscopically by prominent flat or erythematous streaks radiating in a spoke-like fashion from the pylorus to the antrum and pathologically by spindle cell proliferation in the mucosal blood vessels, intravascular fibrin thrombi and fibroinhyalinosis. ESG is a procedure used to examine the upper gastrointestinal tract (from esophagus to forth part of duodenum) using a flexible video endoscope. APC is a type of non-contact thermal therapy used during EGD to obtain hemostasis or tissue destruction. It involves infusion of argon gas through a catheter into the lumen of gastrointestinal tract. The gas is converted into plasma by passing electricity through the catheter. The plasma then conducts the electricity to the tissue to achieve hemostasis or tissue destruction. The catheter does not come into direct contact with the tissue.

**Peer-review**

The authors have looked into the outcomes of 20 patients with GAVE who underwent endoscopic APC treatment and concluded that endoscopic resolution rate of GAVE was low (40%) with a 25% recurrence rate after treatment with APC. The manuscript is interesting and provided some insight on the treatment of GAVE using APC.

**REFERENCES**

1. Sebastian S, McLoughlin R, Qasim A, O’Morain CA, Buckley MJ. Endoscopic argon plasma coagulation for the treatment of gastric antral vascular ectasia (watermelon stomach): long-term results. *Dig Liver Dis* 2004; 36: 212-217 [PMID: 15046192 DOI: 10.1016/j.dld.2003.11.028]

2. Chiu YC, Lu LS, Wu KL, Tam W, Hu ML, Tai WC, Chiu KW, Chuaah SK. Comparison of argon plasma coagulation in management of upper gastrointestinal angiodysplasia and gastric antral vascular ectasia hemorrage. *BMC Gastroenterology* 2012; 12: 67 [PMID: 22681987 DOI: 10.1186/1471-230X-12-67]

3. Yusoff I, Brennan F, Ormonde D, Laurence B. Argon plasma coagulation for treatment of watermelon stomach. *Endoscopy* 2002; 34: 407-410 [PMID: 11972274 DOI: 10.1055/s-2002-25287]

4. Roman S, Saurin JC, Dumortier J, Perreira A, Bernard G, Ponchon T. Tolerance and efficacy of argon plasma coagulation for controlling bleeding in patients with typical and atypical manifestations of watermelon stomach. *Endoscopy* 2003; 35: 1024-1028 [PMID: 14648415 DOI: 10.1055/s-2003-44594]

5. Leclerc S, Ben-Sousan A, Antonietti M, Goria O, Riachi G, Lerebours E, Ducrotté P. Bleeding gastric vascular ectasia treated by argon plasma coagulation: a comparison between patients with and without cirrhosis. *Gastrointest Endosc* 2008; 67: 219-225 [PMID: 18226684 DOI: 10.1016/j.gie.2007.10.016]

6. Herrera S, Bordas JM, Liach J, Giné A, Pellisé M, Fernandez-Esparrach G, Mondelo F, Mata A, Cárdenas A, Castells A. The beneficial effects of argon plasma coagulation in the management of different types of gastric vascular ectasia lesions in patients admitted for GI hemorrhage. *Gastrointest Endosc* 2008; 68: 440-446 [PMID: 18423466 DOI: 10.1016/j.gie.2008.02.009]

7. Boltin D, Gingold-Belfer R, Lichtenstein L, Levi Z, Niv Y. Long-term treatment outcome of patients with gastric vascular ectasia treated with argon plasma coagulation. *Eur J Gastroenterol Hepatol* 2014; 26: 588-593 [PMID: 24743501 DOI: 10.1097/MEG.0000000000000447]

8. Swanson E, Mahgoub A, MacDonald R, Shaukat A. Medical and endoscopic therapies for angiodysplasia and gastric antral vascular ectasia: a systematic review. *Clin Gastroenterol Hepatol* 2014; 12: 571-582 [PMID: 24013107 DOI: 10.1016/j.cgh.2013.08.038]

9. Gilliam JH, Geisinger KR, Wu WC, Weidner N, Richter JE. Endoscopic biopsy is diagnostic in gastric antral vascular ectasia. The “watermelon stomach”. *Dig Dis Sci* 1989; 34: 885-888 [PMID: 2721320]

10. Watson JP, Bennett MK, Griffin SM, Matthewson K. The tissue effect of argon plasma coagulation on esophageal and gastric mucosa. *Gastrointest Endosc* 2000; 52: 342-345 [PMID: 10968847 DOI: 10.1016/mge.2000.108412]
