What is Superior in Management of GAVE: Endoscopic Band Ligation versus Argon Plasma Coagulation versus Combined Therapy?

Hany Abdelbary Elbasuony, Elsayed Ibrahim Elshayeb, Ali Mohamed Abu Qura, Ezzat Mohamed Abdalla
Department of Internal Medicine, Faculty of Medicine, Menoufia University, Egypt
***Corresponding author:** Ali Mohamed Abu Qura, **Mobile:** (+20) 01554745645, **E-mail:** kabtnali2000@gmail.com

ABSTRACT

Background: Gastric antral vascular ectasia (GAVE) is a condition characterized by abnormal blood vessel growth in the stomach's antrum, leading to gastrointestinal bleeding. Treatment options typically include endoscopic band ligation (EBL) and argon plasma coagulation (APC), but their combined efficacy has not been thoroughly investigated.

Objective: To compare the effectiveness of EBL, APC, and a combined EBL + APC approach in treating GAVE.

Patients and Methods: A total of 75 patients with GAVE were enrolled and divided into three groups: Group I (EBL, n=25), Group II (APC, n=25), and Group III (Combined EBL + APC, n=25). Each patient underwent endoscopic treatment according to their group assignment. Pre- and post-treatment evaluations included hemoglobin levels, platelet counts, total leukocyte counts, and the presence of occult blood in stool. Follow-up assessments were conducted at 3 weeks and at 3 and 9 months to monitor recurrence and overall improvement.

Results: The combined EBL + APC approach demonstrated superior outcomes compared to EBL or APC alone. Hemoglobin levels increased significantly more in Group III (10.60 ± 0.32 g/dl) than in Groups I (9.00 ± 0.52 g/dl) and II (9.55 ± 0.20 g/dl). Additionally, Group III showed a significant reduction in recurrence rates and better endoscopic results. Statistical analysis revealed significant differences in hemoglobin levels and recurrence rates between the combined and individual treatment groups ($P < 0.001$ for all comparisons).

Conclusion: The combined EBL and APC approach is more effective in managing GAVE, leading to better clinical outcomes and fewer complications. Further research using greater sample sizes and extended follow-up are needed to confirm these findings and potentially establish this combined method as a standard treatment for GAVE.

Keywords: GAVE, Endoscopic band ligation, Argon plasma coagulation.

INTRODUCTION

GAVE is a disorder that can cause significant upper gastrointestinal (GI) bleeding, accounting for around 4% of all non-variceal upper GI hemorrhages [(1)]. GAVE causes intestinal hemorrhage comparable to that found in duodenal ulcers and portal hypertension. GAVE-related GI bleeding can lead to anemia and the development of occult blood in the stool. This bleeding is a direct consequence of the vascular abnormalities and ectasia (dilation) that characterize the condition[(2)].

The underlying cause of this illness remains unknown, but several possibilities have been presented. Hypergastrinemia, or increased gastrin levels, is one possible explanation. Furthermore, a link to connective tissue illnesses has been suspected in some cases. Autoimmunity has also been implicated as a possible contributing factor. Interestingly, around 25% of patients with a certain anti-RNA marker, a characteristic of certain autoimmune conditions, have been found to have GAVE. This observation has led to the hypothesis that RNA autoimmunity may play a role in the pathogenesis of GAVE, a notion that has been investigated since at least 1996 [(3)].

Research has shown a correlation between gender and the cause of GAVE, with research revealing that 65% of individuals diagnosed with both cirrhosis and GAVE are male. Nonetheless, there is insufficient evidence to definitively demonstrate a causal relationship between cirrhosis and GAVE. Numerous additional illnesses, such as chronic renal failure, portal hypertension, and collagen vascular diseases including systemic sclerosis (scleroderma), have been linked to GAVE [(4)]. GAVE (sometimes referred to as "watermelon stomach") is more common in scleroderma patients, particularly in those with systemic sclerosis subtype [(5)]. This suggests that there may be a connection between the development of GAVE and specific autoimmune or connective tissue illnesses [(5)].

GAVE is diagnosed mostly based on the typical endoscopic appearance of the afflicted stomach mucosa. The condition is typically characterized by a pathognomonic endoscopic pattern, which can manifest in one of two main forms. The first is the "watermelon stomach" appearance, where red spots are organized in radial stripes extending from the pylorus, resembling the pattern of a watermelon. The second is the "honeycomb stomach" presentation, where the red spots are arranged in a more diffuse, honeycomb-like pattern. In cases where the endoscopic findings are not conclusive, a histological examination can provide additional diagnostic support to confirm the diagnosis of GAVE [(6)].

While the endoscopic appearance is the primary diagnostic feature of GAVE, the histological pattern, though not pathognomonic, is characterized by four distinct alterations: 1) vascular ectasia of the mucosal capillaries, 2) focal thrombosis, 3) spindle cell proliferation, and 4) fibrohyalinosis, which involves the deposition of a homogeneous substance around the ectatic capillaries within the lamina propria. These histological findings, while not uniquely diagnostic, can provide supportive evidence for the diagnosis of GAVE when the endoscopic presentation is inconclusive [(7)].

While GAVE and portal hypertensive gastropathy share similarities in their endoscopic

Received: 01/04/2024
Accepted: 29/05/2024

appearance, they are not the same disorder, and GAVE may occur in conjunction with liver cirrhosis. Thirty percent of individuals develop GAVE-associated cirrhosis [8]. The usual course of treatment for GAVE is APC. Because EBL completely destroys the submucosal plexus in cases of esophageal varices, it has become the go-to treatment for varices [9]. The same technique that is used for variceal ligation has recently been utilized to treat GAVE by banding the stomach antrum, albeit the outcomes have not yet been assessed[10].

This study aimed to compare the effectiveness of EBL, APC, and a combined EBL + APC approach in treating GAVE.

PATIENTS AND METHODS

Study population:

Prospective randomized study was conducted on 66 patients presenting with frank or occult GIT bleeding diagnosed by upper endoscopy in internal medicine endoscopy unit Menoufia university hospital, Menoufia.

The study involved three groups, each consisting of 25 patients diagnosed with GAVE. Group 1 patients were treated with EBL, Group 2 patients received APC, and Group 3 patients underwent a combination of both EBL and APC techniques. Initially, the study was designed with a minimum sample size of 66 participants to ensure adequate statistical power for detecting significant differences between treatment groups. However, to enhance the reliability of the results and improve the generalizability of the findings, the sample size was increased to 75 participants.

Study Design:

All patients were subjected to a comprehensive evaluation, including history taking to document age, sex, type of bleeding, and the presence of chronic liver disease (CLD). A complete physical examination was performed, encompassing general aspects such as signs of CLD, and local examination, including abdominal assessment for organomegaly and ascites. Laboratory investigations included a CBC before and after endoscopic treatment, liver function tests (ALT, AST, PT, INR, albumin), as well as HCV antibody and HBsAg testing.

Standard APC equipment from ERBE (Germany) was used, featuring an automatically regulated argon source (APC 300) and an APC probe with a 2-3 mm Teflon-coated catheter. The argon fluid was administered at 2 L/min. For EBL, Boston Scientific's 6-shot band ligation sets were utilized to treat the abnormal GAVE mucosa, starting from the antrum and progressing proximally to cover as much abnormal mucosa as possible. Patients were reevaluated after 3 weeks, with follow-ups scheduled at 3 months and 9 months to assess recurrence and presence of GAVE, respectively.

Patients with advanced malignancy, lymphoproliferative disorders, bleeding ulcers in the stomach or esophagus, bleeding varices in the stomach or esophagus, or any other sources of active bleeding that were found during endoscopy, save for GAVE, were also excluded.

Ethical approval:

The study was authorized by the Ethics Committee of the Faculty of Medicine at Menoufia University. Each participant, received a full summary of the study's aims prior to signing an informed consent form. The Helsinki Declaration was followed at all stages of the inquiry.

Statistical analysis

Using SPSS version 26.0 on an IBM-compatible computer, the gathered data were tabulated and examined. Descriptive statistics included frequencies and percentages for qualitative data, and means±SD, and ranges for quantitative data. Analytic statistics employed various tests: the X^2-test and Fisher exact test were utilized to examine relationships between qualitative variables; one-way ANOVA and Kruskal-Wallis test were employed to compare quantitative variables among several groups; McNemar test was employed for paired categorical data, and paired t-test and Wilcoxon signed rank test were utilized to compare several readings of quantitative data within the same group. To find factors that would indicate an improvement following upper endoscopy, logistic regression analysis was performed. Statistical significance was defined as a P-value of less than 0.05.

RESULTS

Our study found that 48% of the participants were males and 52% were females, with a mean age of 59.37 ± 4.51 years. Hematemesis was the most common presentation, affecting 52% of the patients. Chronic liver disease was prevalent in 65.3% of participants, and the majority were classified as Child-Pugh B (53.3%) (Table 1).

Table (1): Baseline characteristics of studied participants (n=75)

Variable		No.=75	
		No.	%
Sex	**Male**	36	48
	Female	39	52
Age (Years)	**Mean ±SD**	59.37 ±4.51	
	Range	50-68	
Presentation	**MHA + occult blood in stool**	22	29.3
	Melena	14	18.7
	Hematemesis	39	52
Chronic liver disease	**Present**	49	65.3
	Absent	26	34.7
Child classification	**A**	13	17.3
	B	40	53.3
	C	22	29.3

SD: Standard deviation.

Pre-treatment there were significant variations in prothrombin time (PT), international normalized ratio (INR), and HBsAg levels across the study groups based on statistical analysis. Other laboratory results, however, showed no discernible variations. The results revealed no significant differences between the groups for hemoglobin levels, platelet counts, total leukocyte counts, ALT, AST, and albumin levels. However, significant differences were observed in PT and INR. Group I had significantly longer PT time than the other 2 groups. For INR, Group III had significantly higher level than Group I. HBsAg positivity was significantly different among groups, with Group III showing a lower prevalence compared to Groups I and II. No significant differences were found for HCV antibody positivity and occult blood in stool (Table 2).

Table (2): Comparison between studied groups regarding pre-endoscopic laboratory findings (n=75)

Parameter	Group I (EBL) (n=25)	Group II (APC) (n=25)	Group III (Combined) (n=25)	Test of significance	P value
Hemoglobin (g/dl) Mean ±SD	7.59 ±0.64	7.48 ±0.58	7.62 ±0.68	F=0.35	0.705 (NS)
Platelets $\times 10^3$/UL Mean ±SD	92.16 ±21.36	87.00 ±17.91	90.96 ±18.58	F=0.49	0.616 (NS)
TLC $\times 10^3$/UL Mean ±SD	4.76 ±1.88	6.18 ±1.48	5.38 ±1.21	K=5.28	0.071 (NS)
ALT (U/L) Mean ±SD	50.48 ±11.71	48.36 ±11.65	49.80 ±11.81	K=1.24	0.537 (NS)
AST (U/L) Mean ±SD	92.24 ±22.71	68.88 ±17.10	83.68 ±20.12	K=4.58	0.101 (NS)
PT (Seconds) Mean ±SD	16.84 ±2.12	14.51 ±3.29	15.08 ±1.66	F=6.13 **P=0.003***	**P1=0.004*** **P2=0.041*** P3=1.000
INR Mean ±SD	1.60 ±0.34	1.61 ±0.32	1.84 ±0.39	F=3.79 **P=0.027***	P1=1.000 **P2=0.047*** P3=0.071
Albumin (gm/dl) Mean ±SD	2.84 ±0.24	2.80 ±0.26	2.78 ±0.38	F=0.28	0.754 (NS)
HCV Ab Positive Negative	22 (88%) 3 (12%)	22 (88%) 3 (12%)	21 (84%) 4 (16%)	$\chi 2$=0.23	1.000 (NS)
HBs Ag Positive Negative	10 (40%) 15 (60%)	10 (40%) 15 (60%)	3 (12%) 22 (88%)	$\chi 2$=6.15	**0.046***
Occult blood in stool Present Absent	11 (44%) 14 (56%)	17 (68%) 8 (32%)	13 (52%) 12 (48%)	$\chi 2$=3.01	0.222 (NS)

SD: Standard deviation, *: Statistically significant, NS: Non-significant, $\chi 2$: Chi-squared test, F: One Way ANOVA test, K: Kruskal Wallis test, TLC: Total leukocytic count, ALT: Alanine transaminase, AST: Aspartate transaminase, PT: Prothrombin time, INR: International normalized ratio.

P1: P value between Group I (EBL) and Group II (APC)
P2: P value between Group I (EBL) and Group III (Combined)
P3: P value between Group II (APC) and Group III (Combined)

After 3 weeks of endoscopic treatment the results of the study revealed significant differences in hemoglobin levels among the three groups. There were no significant differences in platelet counts or occult blood in stool. Total leukocyte counts differed significantly among groups, with significant differences between Group I and Group II, and Group II and Group III.
Blood transfusion rates did not differ significantly among the groups. Recurrent bleeding and improvement rates showed significant differences, with Group I experiencing recurrence in 8% of cases, Group II in 32%, and Group III with no recurrences. Similarly, upper endoscopy results mirrored these findings, with significant differences in recurrence and improvement rates among the groups (Table 3).

Table (3): Comparison between studied groups, 3 weeks post-endoscopy (n=75)

Parameter	Group I (EBL) (n=25)	Group II (APC) (n=25)	Group III (Combined) (n=25)	Test of significance	P value
Hemoglobin (g/dl) Mean ±SD	9.00 ±0.52	9.55 ±0.20	10.60 ±0.32	F=121.78 **P<0.001***	**P1 <0.001*** **P2<0.001*** **P3<0.001***
Platelets ×10^3/UL Mean ±SD	96.64 ±19.97	92.40 ±18.44	102.76 ±21.51	F=1.69	0.191 (NS)
TLC ×10^3/UL Mean ±SD	4.30 ±1.03	4.82 ±0.57	5.46 ±1.73	K=7.39 **P=0.025***	P1=0.055 **P2=0.009*** P3=0.481
Occult blood in stool Present Absent	 1 (4%) 24 (96%)	 2 (8%) 23 (92%)	 0 (0%) 25 (100%)	 χ2=2.08	 0.353 (NS)
Blood transfusion Yes No	 8 (32%) 17 (68%)	 12 (48%) 13 (52%)	 9 (36%) 16 (64%)	 χ2=1.46	 0.481 (NS)
Recurrent bleeding Present Absent	 2 (8%) 23 (92%)	 8 (32%) 17 (68%)	 0 (0%) 25 (100%)	 χ2=12.00	 **0.002***
Upper endoscope Recurrence Improvement	 2 (8%) 23 (92%)	 8 (32%) 17 (68%)	 0 (0%) 25 (100%)	 χ2=12.00	 **0.002***

SD: Standard deviation, *: Statistically significant, NS: Non-significant, χ2: Chi-squared test, F: One Way ANOVA test, K: Kruskal Wallis test, TLC: Total leukocytic count
P1: P value between Group I (EBL) and Group II (APC)
P2: P value between Group I (EBL) and Group III (Combined)
P3: P value between Group II (APC) and Group III (Combined)

The table compares the recurrence and improvement rates after 3 months following upper endoscopy across three groups. In Group I, 2 patients (8%) experienced recurrence, while 23 patients (92%) showed improvement. Group III (Combined) demonstrated the best outcomes, with no patients experiencing recurrence and all 25 patients (100%) showing improvement. A chi-square test indicated a statistically significant difference between the groups (Table 4).

Table (4): Comparison between studied groups regarding follow up upper endoscope after 3 months (n=75)

Parameter	Group I (EBL) (n=25)	Group II (APC) (n=25)	Group III (Combined) (n=25)	Test of significance	P value
Upper endoscope Recurrence Improvement	 2 (8%) 23 (92%)	 8 (32%) 17 (68%)	 0 (0%) 25 (100%)	 χ2=12.00	 **0.002***

*: Statistically significant, χ2: Chi-squared test

After 9 months, we assessed the presence and absence of GAVE following upper endoscopy across three groups. In each of Group I and III, 3 patients had GAVE, while Group II showed a higher incidence, with 10 patients (40%) having GAVE. A statistically significant difference between the groups was found, (Table 5).

Table (5): Comparison between studied groups regarding follow up upper endoscope after 9 months (n=75)

Upper endoscope	Group I (EBL) (n=25)	Group II (APC) (n=25)	Group III (Combined) (n=25)	Test of significance	P value
GAVE					
Present	3 (12%)	10 (40%)	3 (12%)	$\chi2$=7.79	**0.020***
Absent	23 (88%)	15 (60%)	23 (88%)		

*: Statistically significant, $\chi2$: Chi-squared test

In Group I, hemoglobin levels and platelet counts increased significantly post-endoscopy. There wasn't significant change in total leukocyte count (TLC). Occult blood in stool decreased significantly at follow-up.
In Group II, hemoglobin levels and platelet counts increased significantly post-endoscopy. TLC and occult blood in stool decreased significantly at follow-up.
In Group III, hemoglobin levels and platelet counts increased significantly post-endoscopy. TLC remained unchanged. Occult blood in stool decreased significantly post-endoscopy (Table 6).

Table (6): Pre-endoscopic and 3 weeks follow up data among studied groups (n=75)

Parameter	Pre-endoscopic	Follow up	Test of significance	P value
Group I (EBL) (n=25)				
Hemoglobin (g/dl) Mean ±SD	7.59 ±0.64	9.00 ±0.52	t=8.89	**<0.001***
Platelets $\times10^3$/UL Mean ±SD	92.16 ±21.36	96.64 ±19.97	t=3.99	**0.001***
TLC $\times10^3$/UL Mean ±SD	4.76 ±1.12	4.30 ±1.04	W=1.55	0.122 (NS)
Occult blood in stool				
Present	11 (44%)	1 (4%)	Mc=8.10	**0.002***
Absent	14 (56%)	24 (96%)		
Group II (APC) (n=25)				
Hemoglobin (g/dl) Mean ±SD	7.48 ±0.58	9.55 ±0.20	t=22.63	**<0.001***
Platelets $\times10^3$/UL Mean ±SD	87.00 ±17.91	92.40 ±18.44	t=5.36	**<0.001***
TLC $\times10^3$/UL Mean ±SD	6.18 ±1.42	4.82 ±0.57	W=2.12	**0.034***
Occult blood in stool				
Present	17 (68%)	2 (8%)	Mc=11.53	**<0.001***
Absent	8 (32%)	23 (92%)		
Group III (Combined) (n=25)				
Hemoglobin (g/dl) Mean ±SD	7.62 ±0.68	10.60 ±0.32	t=22.12	**<0.001***
Platelets $\times10^3$/UL Mean ±SD	90.96 ±18.58	102.76 ±21.51	t=5.38	**<0.001***
TLC $\times10^3$/UL Mean ±SD	5.38 ±1.22	5.46 ±1.32	W=0.55	0.581 (NS)
Occult blood in stool				
Present	13 (52%)	0 (0%)	Mc=11.08	**0.001***
Absent	12 (48%)	25 (100%)		

SD: Standard deviation, *: Statistically significant, NS: Non-significant, t: Paired t test, W: Wilcoxon signed rank test, Mc: McNemar test, TLC: Total leukocytic count.

Binary logistic regression was conducted to ascertain the effects of pre-endoscopic hemoglobin level and platelets count on the likelihood of upper endoscopic improvement that showed that pre-endoscopic hemoglobin was a significant predictor for upper endoscopic improvement (P value <0.05) (Table 7).

Table (7): Multi-logistic regression for predictors of endoscopic improvement among studied participants

Parameter	B	P value	Odds ratio	95% Confidence interval	
				Lower	Upper
Hemoglobin (g/dl)	1.641	**0.038***	5.160	1.098	24.256
Platelets $\times 10^3$/UL	0.021	0.381	1.021	0.975	1.070

*: Statistically significant

DISCUSSION

GAVE stands for dilated blood vessels that radiate to the pylorus from the antrum. They were first identified by **Rider *et al.* [11].**

Many therapeutic methods, including surgical, endoscopic, and medicinal options, have been offered in the past 20 years. Surgery should only be attempted in extremely severe instances, as medical therapy has not demonstrated obvious satisfying results. This strategy has high risks of death and morbidity, particularly when combined with portal hypertension and liver cirrhosis. For patients experiencing bleeding linked to GAVE, endoscopic therapy—specifically, treatment with APC and EBL—should be the initial course of treatment since it has been demonstrated to be both safe and efficacious compared to surgery [6].

Here in, we aimed to evaluate the effectiveness of EBL, APC, and a combined EBL + APC approach in treating GAVE.

The objective behind alternating APC and EBL sessions is to treat mucosal lesions with APC before moving on to deeper submucosal resistant lesions with EBL. This may help to achieve the benefits of both approaches while also lowering the adverse effects associated with EBL use by reducing the number of rubber bands utilized.

We included 75 patients in our study, 48% were males and 52% were females, with a mean age of 59.37 ± 4.51 years. The most common clinical presentations were hematemesis (52%), MHA with occult blood in stool (29.3%), and melena (18.7%). CLD was present in 65.3% of patients.

These results agree with **Fabian *et al.*** [12] who assessed 63 patients with GAVE and found that mean age was 67.1 y and females were more prevalent with 54.0%.

In addition, most of our patients had CLD indicating the association between GAVE and liver disease. That aligns with **Sato *et al.*** [13] who studied 34 patients with GAVE and liver diseases. Liver cirrhosis was the underlying pathology of CLDs in 26 individuals, liver cirrhosis linked to hepatocellular carcinoma in six patients, and idiopathic portal hypertension in two patients.

Pre-endoscopic data showed that the mean hemoglobin levels across the groups were 7.59 ± 0.64 g/dl, 7.48 ± 0.58 g/dl, and 7.62 ± 0.68 g/dl, respectively, with no significant difference (P = 0.705). Platelet counts and total leukocyte counts (TLC) also showed no significant differences among the groups (P = 0.616 and P = 0.071, respectively). Liver function tests, including ALT and AST, similarly showed no significant variation (P = 0.537 and P = 0.101, respectively).

However, significant differences were noted in PT, with Group I showing a mean PT of 16.84 ± 2.12 seconds, Group II at 14.51 ± 3.29 seconds, and Group III at 15.08 ± 1.66 seconds (P = 0.003). The INR also differed significantly among the groups (P = 0.027). HBsAg positivity showed a significant difference, with 40% positivity in Groups I and II and 12% in Group III (P = 0.046). Occult blood in stool did not differ significantly among the groups (P = 0.222).

After 3 weeks of follow-up, our results indicated that hemoglobin levels were significantly different among the groups, with Group III (Combined) having the highest mean hemoglobin level (10.60 ± 0.32 g/dl) compared to Group I (9.00 ± 0.52 g/dl) and Group II (9.55 ± 0.20 g/dl), with a highly significant P value of <0.001.

These findings suggest that the combined approach (Group III) might be associated with better outcomes in terms of hemoglobin levels, reduced recurrent bleeding, and improved endoscopic findings.

Other studies found similar results regarding improvement of hemoglobin levels after management. According to a study by **Elhendawy *et al.*** [14], APC and EBL did not differ statistically significantly in the management of GAVE based on improvement in hemoglobin level. However, **Nassar *et al.*** [15] found that with monthly serial follow-up, there was a significant increase in mean hemoglobin levels. In the APC group, this improvement was from 9.47 g/dl before intervention to 10.27 after the first month to 10.90 after the second month to 11.46 g/dl after the third month/fourth endoscopic session; in the EBL group, it was from 9.45 g/dl before treatment to 10.21 after the first month to 10.79 after the second month to 11.38 g/dl after the third month/fourth endoscopic

session. There wasn't significant difference in the percentage of hemoglobin change between the two groups.

This suggests that the combination of APC and EBL in the management of GAVE results in augmentation of elevating hemoglobin levels.

Regarding bleeding recurrence, it was observed via upper endoscopy and was significantly more common in Group II (APC) (32%) compared to the other groups, with both showing a P value of 0.002. However, the combination group did not show any cases of rebleeding.

Rebleeding is common while using one method of management alone. **Nassar *et al.*** [15] stated that hemorrhage recurrence, the current study revealed that after the first month, it was 5/25 in the APC group and 6/25 in the EBL group. In contrast, **Ghaffar and Maguid** [16] found that compared to the EBL group, which had one patient out of twenty, the APC group had seven patients out of twenty with a recurrence of bleeding, a considerably higher rate.

Regarding occult blood test, although there wasn't statistically difference between all groups, the combination method group did not show any case after 3 weeks of follow-up. This was in line with **Zepeda-Gómez *et al.*** [17] who found substantial increase in serum ferritin levels following EBL's elimination of GAVE and improvement in serum iron levels.

Regarding upper endoscopy follow up, we noticed a significant difference in groups related to recurrence (P=0.002). The combined group had a 100% improvement rate, compared to 68% in the APC group and 92% in the EBL group. These results indicate that combined APC and EBL method is the best way to prevent recurrence of GAVE after 3 weeks of follow-up.

Similarly, after 3-month follow-up, we noticed a significant difference in groups related to recurrence (P=0.002). Group I had an 8% recurrence rate and 92% improvement, while Group II showed higher recurrence at 32% and 68% improvement. Group III (Combined) achieved the best results with no recurrences and 100% improvement.

A study by **Peng *et al.*** [18] found that although APC has a 40–100% endoscopic success rate, it requires multiple treatment sessions and has a significant recurrence rate of 10–78.9%, 90–100% and 77.8–100%, respectively, while for the endoscopic success rates with RFA and EBL; the corresponding recurrence rates are 21.4–33.3% and 8.3–48.1%.

A study of 204 individuals was carried out by **Hirsch *et al.*** [19]**.** Compared to APC, EBL was associated with lower bleeding recurrence (risk difference [RD], 0.29; 95% confidence interval [CI] [0.15, 0.44]; I2=0%) and greater endoscopic eradication rates (RD, 0.29; 95% CI [0.14, 0.44]; I2=0%). It was discovered that by the end of the follow-up period, only 1/25 cases in the EBL group and none in the APC group had experienced a GAVE recurrence. Additionally, two instances in each group needed additional sessions to eradicate GAVE. Nevertheless, recurrence of GAVE was observed in 3 patients (17%) in the EBL groups and 8 patients (44%) in the APC group after a 6-month follow-up [15].

Regarding the presence of GAVE post-upper endoscopy, a significant difference was observed between the groups (P = 0.02). The APC group had the highest incidence of GAVE at 40%, compared to 12% in both the EBL and combined groups. These results indicate that combined APC and EBL approach may be more effective in minimizing the occurrence of GAVE after the procedure.

Abdo *et al.* [20] conducted a study to find out if treating GAVE in cirrhotic patients with an APC alternating with EBL is safer and more effective than using EBL alone. It was discovered that both sets of patients had a notably elevated rate of hemoglobin level improvement, transfusion decrease, and hospitalization avoidance. When comparing the two groups' rates of GAVE recurrence, there was no statistically significant difference. The combination therapy group did not experience any problems. In the EBL group, hypertrophied polyp development and post-band ulcerations were among the problems that affected 20% of the patients.

They concurred with our findings that combination therapy may reduce the quantity of rubber bands and banding sessions needed to treat GAVE, hence lowering the frequency of band-related problems [20].

Our results revealed that patients who experienced improvement after upper endoscopy had significantly higher hemoglobin levels and platelet counts compared to those with recurrence (P value <0.05).

Moreover, binary logistic regression was conducted to ascertain the effects of pre-endoscopic hemoglobin level count on the likelihood of upper endoscopic improvement that showed that pre-endoscopic hemoglobin was a significant predictor for upper endoscopic improvement.

According to the scant evidence, the use of EBL is linked to much lower transfusion requirements as compared to endoscopic thermal treatments. It also appears to be connected with more encouraging post-procedural hemoglobin improvements and fewer procedures needed to eradicate GAVE. It may be possible to lower healthcare expenses and responsibilities by treating GAVE with a combination of EBL and APC [21].

CONCLUSION

The study indicates that the combined use of APC and EBL is more effective for managing GAVE, showing significant improvements in hemoglobin levels, reduced bleeding recurrence, and superior endoscopic outcomes. Further research with larger

cohorts and extended follow-ups is needed to validate this approach as a standard treatment.

No funding.
No conflict of interest.

REFERENCES

1. **Selinger C, Ang Y (2008):** Gastric antral vascular ectasia (GAVE): an update on clinical presentation, pathophysiology and treatment. Digestion, 77(2):131–7.
2. **Zuckerman G, Prakash C, Askin M *et al.* (2000):** AGA technical review on the evaluation and management of occult and obscure gastrointestinal bleeding. Gastroenterology, 118(1):201–21.
3. **Shirazian S, Radhakrishnan J (2010):** Gastrointestinal disorders and renal failure: exploring the connection. Nat Rev Nephrol., 6(8):480–92.
4. **Robic M, Procopet B, Métivier S *et al.* (2011):** Liver stiffness accurately predicts portal hypertension related complications in patients with chronic liver disease: a prospective study. J Hepatol., 55(5):1017–24.
5. **Mok C (2005):** Investigations and management of gastrointestinal and hepatic manifestations of systemic lupus erythematosus. Best Pract Res Clin Rheumatol., 19(5):741–66.
6. **Fuccio L, Mussetto A, Laterza L *et al.* (2013):** Diagnosis and management of gastric antral vascular ectasia. World J Gastrointest Endosc., 5(1):6-13.
7. **West A, Mitchell K (2009):** Vascular disorders of the GI tract. In: Surgical pathology of the GI tract, liver, biliary tract and pancreas. Elsevier, Philadelphia; pp. 185. https://shop.elsevier.com/books/surgical-pathology-of-the-gi-tract-liver-biliary-tract-and-pancreas/odze/978-0-323-67988-6
8. **Parikh K, Ali M, Wong R (2015):** Unusual causes of upper gastrointestinal bleeding. Gastrointestinal Endoscopy Clinics, 25(3):583–605.
9. **Wells C, Harrison M, Gurudu S *et al.* (2008):** Treatment of gastric antral vascular ectasia (watermelon stomach) with endoscopic band ligation. Gastrointest Endosc., 68(2):231–36.
10. **Ripoll C, Garcia-Tsao G (2011):** The management of portal hypertensive gastropathy and gastric antral vascular ectasia. Digestive and liver Disease, 43(5):345–51.
11. **Rider J, Klotz A, Kirsner J (1953):** Gastritis with veno-capillary ectasia as a source of massive gastric hemorrhage. Gastroenterology, 24(1):118–23.
12. **Fabian A, Bor R, Szabo E *et al.* (2016):** Endoscopic treatment of gastric antral vascular ectasia: a retrospective multicentre clinical study. United European Gastroenterol J., 4: 134. https://doi.org/10.1111/1751-2980.12958
13. **Sato T, Yamazaki K, Akaike J (2012):** Endoscopic band ligation versus argon plasma coagulation for gastric antral vascular ectasia associated with liver diseases. Digestive Endoscopy, 24(4):237–42.
14. **Elhendawy M, Mosaad S, Alkhalawany W *et al.* (2016):** Randomized controlled study of endoscopic band ligation and argon plasma coagulation in the treatment of gastric antral and fundal vascular ectasia. United European Gastroenterol J., 4(3):423–8.
15. **Nassar A, Mohamed H, Soliman M (2022):** Efficacy of endoscopic band ligation versus argon plasma coagulation in gastric antral vascular ectasia management. Benha Medical Journal, 39(2):666–79.
16. **Ghaffar M, Maguid H (2019):** Endoscopic band ligation versus argon plasma coagulation in management of bleeding from gastric antral vascular ectasia in patients with portal hypertension. Journal of Medicine in Scientific Research, 2(2):214–9.
17. **Zepeda-Gómez S, Sultanian R, Teshima C *et al.* (2015):** Gastric antral vascular ectasia: a prospective study of treatment with endoscopic band ligation. Endoscopy, 47(06):538–40.
18. **Peng M, Guo X, Yi F *et al.* (2021):** Endoscopic treatment for gastric antral vascular ectasia. Ther Adv Chronic Dis., 12:20406223211039696. doi: 10.1177/20406223211039696
19. **Hirsch B, Ribeiro I, Funari M *et al.* (2021):** Endoscopic band ligation versus argon plasma coagulation in the treatment of gastric antral vascular ectasia: a systematic review and meta-analysis of randomized controlled trials. Clin Endosc., 54(5):669–77.
20. **Abdo M, Moustafa A, Mostafa I *et al.* (2022):** To coagulate, ligate, or both: a randomized study comparing the safety and efficacy of two endoscopic approaches for managing gastric antral vascular ectasia in cirrhotic patients. Egyptian Liver Journal, 12(1):8. https://doi.org/10.1186/s43066-022-00173-4
21. **Chalhoub J, Umar J, Groudan K *et al.* (2021):** Endoscopic band ligation compared to thermal therapy for gastric antral vascular ectasia: A systematic review and meta- analysis. United European Gastroenterol J., 9(2):150–58.