NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of radiofrequency ablation for gastric antral vascular ectasia

Gastric antral vascular ectasia is a condition in which enlarged blood vessels in the lower part of the stomach can bleed and cause anaemia. In this procedure, a thin flexible tube with a camera on the end (an endoscope) is passed through the mouth and into the stomach to deliver radiofrequency heat energy to destroy the enlarged blood vessels.

Introduction

The National Institute for Health and Care Excellence (NICE) has prepared this interventional procedure (IP) overview to help members of the Interventional Procedures Advisory Committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This IP overview was prepared in June 2014.

Procedure name

- Radiofrequency ablation for gastric antral vascular ectasia

Specialist societies

- British Society of Gastroenterology
- Royal College of Radiologists

Description

Indications and current treatment

Gastric antral vascular ectasia (GAVE) syndrome, also known as ‘watermelon stomach’, is a rare but well recognised cause of chronic upper gastrointestinal blood loss. It is more common in older people. It may lead to iron-deficiency anaemia and transfusion dependence. Rarely, it can cause acute haemorrhage. GAVE is associated with heterogeneous medical conditions, including hepatic, renal, cardiac and autoimmune diseases, but its pathogenesis is unknown. GAVE is characterised endoscopically by diffuse or linear red patches or spots in the antrum of the stomach, which can give a ‘watermelon’ type of appearance. The classic histopathological findings are vascular ectasia of mucosal capillaries, focal thrombosis, spindle cell proliferation and fibrohyalinosis.

Initial treatment for GAVE includes endoscopic thermoablation techniques (such as argon plasma coagulation (APC), laser photoablation, cryotherapy and band ligation). Some patients continue to need blood transfusions despite repeat endoscopic treatments. When endoscopic therapy is not successful, antrectomy may be considered. Surgical resection of the affected part of the stomach is curative, but is associated with risks of morbidity and mortality.

What the procedure involves

The aim of endoscopic radiofrequency ablation for GAVE is to ablate the dilated blood vessels and stop internal bleeding. The procedure is usually done with the patient under conscious sedation. A specially designed radiofrequency catheter is inserted into the gastric antrum under endoscopic guidance. The target area for treatment is identified, and the catheter electrode is positioned by manoeuvring the endoscope. The electrode is in the form of a plate, which allows a broad area to be treated in a few seconds, by the application of several pulses of radiofrequency energy. The electrode is applied to further areas of GAVE until all have been treated. If necessary, the procedure can be repeated after a few weeks: it is often carried out 2 or 3 times.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to radiofrequency ablation for gastric antral vascular ectasia. Searches were conducted of the following databases, covering the period from their commencement to 17 June 2014: MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches (see appendix C

for details of search strategy). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with gastric antral vascular ectasia.
Intervention/test	Radiofrequency ablation.
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the IP overview

This IP overview is based on 63 patients from 7 case series and case reports[1–7].

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Table 2 Summary of key efficacy and safety findings on radiofrequency ablation for gastric antral vascular ectasia

Study 1 Dray X (2014)

Details

Study type	**Case series**
Country	8 centres: France (2), Italy, Spain, Denmark, US, Israel, Sweden.
Recruitment period	Not reported
Study population and number	n=**24** patients with gastric antral vascular ectasia (GAVE).
Age and sex	Mean 74 years [range 52-89 years]; 33 % (8/24) male
Patient selection criteria	GAVE patients over 18 years old, with endoscopic diagnosis of GAVE and with evidence of gastrointestinal haemorrhage or iron deficiency anaemia. Exclusion criteria: contraindication to endoscopy, coagulopathy (international normalised ratio>2 or platelet count<50,000/mm^3), active variceal bleeding.
Technique	Endoscopic radiofrequency ablation (RFA) to the gastric antrum using the Halo^{90} or the Halo^{90} Ultra ablation catheter (Covidien, GI Solutions) until complete ablation of the pathological gastric mucosa has been achieved. 2 pulses per location were delivered. Minimum of 6 weeks between 2 consecutive sessions of RFA. Patients prescribed proton-pump inhibitors for at least 6 weeks after the RFA sessions.
Follow-up	**6 months after the last RFA session**
Conflict of interest/source of funding	One of the authors has received lecture and consultancy fees from Given Imaging, Mayoli Spindler Norgine, and Covidien.

Analysis

Follow-up issues: none.

Study design issues:

- Each centre managed 1-6 patients.
- Each individual senior endoscopist carried out or supervised 1-12 RFA sessions for GAVE.
- Retrospective series.

Study population issues:

- Diagnosis of GAVE based on endoscopy in 96% (23/24) of patients and on biopsy for 1 patient.
- Comorbidities: cirrhosis, 46% (11/24); hypertension, 46% (11/24); diabetes 38% (9/24), chronic renal failure 21% (5/24); chronic heart failure, 13% (3/24); chronic obstructive pulmonary disease, 13% (3/24); hypothyroidism, 8% (2/24); ischaemic heart disease, 8% (2/24); Sjögren's syndrome, 8% (2/24); atrial fibrillation, 8% (2/24).
- Treatments: 21% (5/24) of patients had aspirin and 1 patient had warfarin before the procedure. Antiplatelet agents and anticoagulants were stopped before the procedure.
- Previous treatments for GAVE: argon plasma coagulation (APC), 63% (15/24) of patients had 1-24 sessions; bipolar coagulation, 17% (4/24) of patients had 1-2 sessions; Nd:Yag laser, 1 patient; cryotherapy, 1 patient; sclerosant injections, 1 patient; transjugular intrahepatic portosystemic shunt, 8% (2/24) of patients; and thalidomide, 1 patient.
- Active oozing or clot present at initial endoscopy in 63% (15/24) of patients.

Other issues: none

Key efficacy and safety findings

<table>
<tr><td>Efficacy</td><td>Safety</td></tr>
<tr><td>Number of patients analysed: 24

Complete independence from the need for transfusions after 6 months achieved in 65% (15/23) of patients who were transfusion-dependent during the 6-month period before RFA.

One patient was referred for additional APC treatment during the 6 months after the last RFA session.

Transfusion requirement and mean haemoglobin before and after RFA.
<table>
<tr><th></th><th>Mean number of PRBC transfused in patients who were transfusion-dependent during the 6-month period before RFA (n=23)</th><th>Haemoglobin levels (g/dl) in all patients (n=24)</th></tr>
<tr><td>Pre-RFA
(6 months before)</td><td>10.6±12.1</td><td>6.8±1.4</td></tr>
<tr><td>Post-RFA
(6 months after)</td><td>2.5±5.9</td><td>9.8±1.8</td></tr>
<tr><td>p value</td><td><0.001</td><td><0.001</td></tr>
</table>
Number of RFA sessions: mean 1.8±0.8 RFA sessions (median 2, range 1-3) per patient.

Duration of each RFA session: mean 43±23 minutes (median 40, range 20-140).

Number of pulses per session: mean 63.</td><td>Authors state that no perioperative or inpatient complications after the procedure were reported in these patients.</td></tr>
<tr><td colspan="2">Abbreviations used: APC, argon plasma coagulation; PRBC, packed red blood cells; RFA, radiofrequency ablation.</td></tr>
</table>

Study 2 McGorisk T (2013)

Details

Study type	**Case series**
Country	USA
Recruitment period	Not reported
Study population and number	n=**21** patients with GAVE refractory to APC therapy
Age and sex	Mean 61 years [range 38-74 years]; 62 % (13/21) male
Patient selection criteria	GAVE patients between 18 and 80 years old, with at least 2 previous failed APC treatments, recurrent gastrointestinal bleeding or chronic iron-deficiency anaemia, and transfusion dependence. Exclusion criteria: coagulopathy with an international normalised ratio >2, platelet count <50, active variceal bleeding or severe portal hypertensive gastropathy, contraindication to endoscopy, or presence of a pacemaker or defibrillator.
Technique	Endoscopic RFA to the gastric antrum using the Halo^{90} Ultra ablation catheter (Covidien, GI Solutions) until transfusion independence was achieved or a maximum of 4 sessions were done. RFA was done at 4- to 6-week intervals until there was no significant GAVE visualised on endoscopy. After each procedure, patients were on a liquid diet for 24 hours and were prescribed sucralfate and a proton pump inhibitor.
Follow-up	**6 months after the last RFA session**
Conflict of interest/source of funding	One of the authors is a speaker for Covidien Medical and a consultant to Boston Scientific and Cook Medical. The other authors disclosed no financial relationships relevant to this publication.

Analysis

Follow-up issues:

- Patients had a complete blood count 2 weeks after each RFA treatment session. If no visual evidence of GAVE was found at any follow-up endoscopy, RFA was not done and GAVE was considered eradicated.
- Complete blood counts were done every 4 to 6 weeks for 6 months after the last RFA.
- Endoscopy was done 6 months after the last RFA session to confirm resolution.

Study design issues:

- Single centre, single operator.
- The first 3 patients had treatment using 4 pulses per location. From the fourth patient onwards, a 2-pulse protocol was used.

Study population issues:

- Causes of GAVE: cirrhosis, 86% (18/21) [hepatitis C virus, 57% (12/21); non-alcoholic steatohepatitis, 14% (3/21); alcohol, 10% (2/21); hepatitis B virus (1/21)] and scleroderma, 14% (3/21).
- 86% (18/21) of patients had at least 3 previous APC treatments and 14% (3/21) had only 2 (mean 3.04 [range 2-5]).

Other issues: none.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **21**

Technical success (defined as feasibility of therapy and complete endoscopic ablation of the visible GAVE) was achieved in 90% (19/21) of patients.

Number of RFA sessions: mean 1.9 RFA sessions (standard deviation [SD] 0.6) [range 1-3] per patient.

Clinical success (defined as complete independence from the need for transfusions for the 6-month follow-up period) was achieved in 86% (18/21) of patients and no evidence of GAVE on follow-up endoscopy at 6 months was found.

Transfusion requirement and mean haemoglobin before and after RFA in patients who achieved clinical success (n=18)

	Number of transfusion events mean (SD)	**Haemoglobin levels (g/dl) mean (SD)**
Pre-RFA (6 months before)	8.1 (3.1)	7.8 (1.0)
Post-RFA (6 months after)	0.0	10.2 (1.4)
p value	<0.001	<0.001

Safety

Minor adverse events

Type of adverse event	**Patients**	**Other**
Ulcerations	10% (2/21)	1 superficial ulcer and 1 bleeding ulcer. Both patients had to discontinue RFA therapy. Both adverse events were discovered incidentally on repeat endoscopy and both resolved without intervention. Both ulcers occurred in the first 3 patients treated using 4 pulses per location.

Abbreviations used: APC, argon plasma coagulation; GAVE, gastric antral vascular ectasia; RFA, radiofrequency ablation; SD, standard deviation.

Study 3 Raza N (2014)

Details

Study type	**Case series**
Country	USA
Recruitment period	2010-2012
Study population and number	n=**9** patients with gastric antral vascular ectasia (GAVE) refractory to APC therapy
Age and sex	Mean 68 years (range 62-77 years [calculated by IP analyst]); 44 % (4/9) male
Patient selection criteria	GAVE patients with at least 2 previous failed APC treatments and transfusion dependence
Technique	The Halo^{90} RF ablation probe (Covidien, GI Solutions) was attached to the tip of a standard diagnostic endoscope (Olympus GIF-180, 9.9mm outer diameter). Four pulses per location applied in quick succession. Twice daily proton-pump inhibitor was prescribed until the follow-up examination 8 weeks later. RFA was done again at follow-up endoscopies until complete ablation of GAVE.
Follow-up	**Median 11 months** (range 6-21)
Conflict of interest/source of funding	None reported.

Analysis

Follow-up issues: after GAVE eradication, patients were followed-up clinically with serial haemoglobin assessment. Repeat endoscopy was carried out if patients needed blood transfusions.

Study design issues: patients were treated by a single physician accompanied by a gastroenterology fellow.

Study population issues:

- Medical conditions associated with GAVE: portal hypertension with cirrhosis (44% [4/9] of patients), renal insufficiency (44% [4/9] of patients) and both cirrhosis and renal insufficiency (1 patient).
- In 1 patient, 2 catheters were used to deliver 160 pulses for extensive GAVE present in the fundus, body and antrum (1 HALO90 catheter can deliver a maximum of 80 pulses).
- Endoscopic treatments before RFA over a period of up to 2 years: median 4 (range 2-15), interquartile range (IQR) 6.5.
- 1 patient had APC and cryotherapy before RFA.

Other issues: none.

Key efficacy and safety findings

<table>
<tr><th>Efficacy</th><th>Safety</th></tr>
<tr><td>Number of patients analysed: 9

Complete endoscopic ablation of GAVE achieved in 100% (9/9) of patients.

Number of RFA sessions:
• Median 3 RFA sessions (IQR 4) [range 2-6] per patient.
• 67% (6/9) of patients did not need repeat endoscopies for GAVE.

Recurrence of GAVE:
• 33% (3/9) of patients needed transfusion and retreatment of recurrent GAVE: 22% (2/9) of patients had recurrence of GAVE 11 months after the last RFA session and 1 patient had 2 recurrences of GAVE (one 3 months after the initial round of treatment and another one 3 months after the second round of treatment).

Transfusion requirements and Hgb levels before and after RFA
<table>
<tr><th></th><th>Mean total transfusion (Units PRBC)*</th><th>Mean Hgb levels (g/dl)*</th></tr>
<tr><td>Before RFA**</td><td>10.2</td><td>7.3</td></tr>
<tr><td>After RFA6**</td><td>2.7</td><td>10.5</td></tr>
</table>
*Calculated by IP analyst.
**Timing not reported</td><td>Minor abdominal discomfort that lasted a few days in the patient who had 160 pulses in a single session.</td></tr>
<tr><td colspan="2">Abbreviations used: GAVE, gastric antral vascular ectasia; Hgb, haemoglobin; IQR, interquartile range; PRBC, packed red blood cells; RFA, radiofrequency ablation.</td></tr>
</table>

Study 4 Gross A (2008)

Details

Study type	**Case series**
Country	USA
Recruitment period	Not reported.
Study population and number	n=**6** consecutive patients with GAVE
Age and sex	Mean 58 years [range 47-65 years]; 67 % (4/6) male
Patient selection criteria	Endoscopic confirmation of GAVE, chronic bleeding and blood transfusion dependence.
Technique	The HALO^{90} ablation system was used. Patients underwent upper endoscopy on an outpatient basis. They received intravenous sedation with midazolam and fentanyl. A proton pump inhibitor was prescribed to the patients during the treatment phase. A follow-up endoscopy every 4 to 6 weeks and further ablation were done for persistent bleeding until cessation of bleeding and transfusion independency.
Follow-up	**Mean 2 months**
Conflict of interest/source of funding	None reported

Analysis

Follow-up issues: the haemoglobin level of all patients was obtained at least 4 weeks after the last ablation reviewed in the case series.

Study design issues: none.

Study population issues:

- Medical conditions associated with GAVE: 83% (5/6) of patients had liver disease.
- 67% (4/6) of patients had APC which failed to treat the disease and 33% (2/6) of patients had no other prior treatment.
- 33% (2/6) of patients had also involvement of the gastric cardia.

Other issues: none.

Key efficacy and safety findings

<table>
<tr><th>Efficacy</th><th>Safety</th></tr>
<tr><td>
Number of patients analysed: 6

Complete independence from the need for transfusions achieved in 83 % (5/6) of patients. One patient remained transfusion dependent after 3 sessions and was undergoing further RFA. He required 4 units of PRBC between treatment sessions.

Number of RFA sessions:
<table>
<tr><th>Number RFA sessions/ patient</th><th>Number of patients</th><th>Mean number of RFA session/patient</th></tr>
<tr><td>1</td><td>50% (3/6)</td><td rowspan="3">1.7</td></tr>
<tr><td>2</td><td>33% (2/6)</td></tr>
<tr><td>3</td><td>1/6</td></tr>
</table>
Mean haemoglobin level before and after RFA
<table>
<tr><th></th><th>Haemoglobin level (g/dl)</th></tr>
<tr><td>Pre-RFA</td><td>8.6*</td></tr>
<tr><td>Post-RFA</td><td>10.2**</td></tr>
</table>
*Hgb level obtained at variable time intervals after a prior transfusion.
**Hgb level obtained at mean 2 months after the last RFA session.

Median number of applications during a single procedure session: 33.
Mean procedure time: 29 minutes.
</td><td>
• Complications during the procedure:
The introduction of the device was challenging in 50% (3/6) of the patients because of their pharyngeal and oesophageal inlet anatomy (no further details).

• A superficial ulcer was found in 1 patient at endoscopic follow-up.
</td></tr>
<tr><td colspan="2">Abbreviations used: APC, argon plasma coagulation; Hgb, haemoglobin; PRBC, packed red blood cells; RFA, radiofrequency ablation.</td></tr>
</table>

Study 5 Gutkin E (2011)

Details

Study type	**Case report**
Country	USA
Recruitment period	Not reported
Study population and number	n=**1** patient with alcohol-induced cirrhosis and gastrointestinal bleeding from GAVE.
Age and sex	56-year-old male
Patient selection criteria	GAVE patient who had multiple bipolar electric coagulation and APC treatments over the past 2 years, blood transfusion dependent.
Technique	HALO^{90} RFA used.
Follow-up	**1 month**
Conflict of interest/source of funding	Not reported

Analysis

Follow-up issues: none

Study design issues: none

Study population issues: patient needed 4 units of PRBC/ month before RFA and his disease had 3 treatments with APC without lessening of bleeding. He was maintained on proton pump inhibitors, sucralfate suspension, oestrogen and beta-blockers.

Other issues: none

Key efficacy and safety findings

Efficacy	Safety
Number of patients analysed: **1** **Haemoglobin level after RFA:** reported in paper as 15 mg/ dl. **Transfusion requirement after RFA:** 0.	**Submucosal tear** causing bleeding at the gastro-oesophageal (GO) junction revealed by repeat endoscopy. The bleeding was self-limited and stopped spontaneously. There was no endoscopic evidence of perforation. The cause of the tear might be the dislodgement of the device probe from the endoscope. The patient was admitted to hospital for 24 hours for monitoring; no free air was seen on X-ray and his blood counts remained stable. At 1 month, an endoscopy revealed healing of the GO junction tear.
Abbreviations used: APC, argon plasma coagulation; GAVE, gastric antral vascular ectasia; GO, gastroesophageal; RFA, radiofrequency ablation.	

Study 6 Quevedo R (2011) [conference abstract only]

Details

Study type	**Case report**
Country	USA
Recruitment period	Not reported
Study population and number	n=**1** patient with hepatitis C and GAVE.
Age and sex	63 years old male
Patient selection criteria	Patient with GAVE had APC treatment without significant response.
Technique	RFA with HALO^{90} System done every 8 weeks over a 4-month period.
Follow-up	**6 months after the last RFA session.**
Conflict of interest/source of funding	Not reported.

Analysis

Follow-up issues: none

Study design issues: none

Study population issues: none

Other issues: none

Key efficacy and safety findings

Efficacy	Safety
Efficacy findings from conference abstracts are not normally considered adequate to support decisions on efficacy and are not generally selected for presentation in the overview.	**Gastric inflammatory hyperplastic polyps** in the distal body and antrum at the 4th planned RFA session. They were removed using heat cautery polypectomy.
Abbreviations used: APC, argon plasma coagulation; GAVE, gastric antral vascular ectasia; RFA, radiofrequency ablation.	

Study 7 Gaslightwala I (2014) [letter to the editor]

Details

Study type	**Case report**
Country	USA
Recruitment period	2010
Study population and number	n=**1** patient with GAVE and Child's A cirrhosis which did not respond to treatments with APC.
Age and sex	67 years old female
Patient selection criteria	Patient whose GAVE was not responding to APC.
Technique	HALO^{90} RFA used.
Follow-up	**Not reported.**
Conflict of interest/source of funding	Not reported.

Analysis

Follow-up issues: none

Study design issues: none

Study population issues: none

Other issues: none

Key efficacy and safety findings

Efficacy	Safety
Efficacy findings from conference abstracts are not normally considered adequate to support decisions on efficacy and are not generally selected for presentation in the overview.	**Sepsis** diagnosed 17 days after the 4th session of RFA. Blood cultures grew *Streptococcus intermedius*. The patient received 5 days of intravenous daptomycin and imipenem, followed by oral amoxicillin-clavulanic acid with resolution of sepsis. Authors suspect the infection was related to mucosal injury caused by RFA.
Abbreviations used: APC, argon plasma coagulation; GAVE, gastric antral vascular ectasia; RFA, radiofrequency ablation.	

Efficacy

Transfusion requirement and recurrence of gastric antral vascular ectasia (GAVE)

A case series of 24 patients with GAVE treated by radiofrequency ablation (RFA) reported that 65% (15) of the 23 patients who were transfusion-dependent during the 6 months before RFA did not need any transfusions during the 6 months after RFA. In these patients, a significant drop in the mean number of packed red blood cells (PRBC) 6 months before and 6 months after radiofrequency ablation (RFA) from 10.6±12.1 to 2.5±5.9 ($p<0.001$) was reported[1].

A case series of 21 patients with GAVE refractory to argon plasma coagulation (APC) therapy, who were treated by RFA, reported clinical success (defined as complete independence from the need for transfusions during the 6-month follow-up period) in 86% (18/21) of patients, with no evidence of GAVE on follow-up endoscopy. In these patients, a significant drop in the mean number of transfusion events 6 months before and 6 months after RFA from 8.1 (standard deviation [SD] 3.1) to none ($p<0.001$) was reported[2].

A case series of 9 patients with GAVE refractory to APC therapy undergoing RFA reported that 67% (6/9) of patients did not need transfusion and retreatment of recurrent GAVE. For the patients who had recurrences of GAVE, 67% (2/3) of patients had recurrence 11 months after the last RFA session and 1 patient had 2 recurrences of GAVE (one 3 months after the initial round of treatment and one 3 months after the second round of treatment). In this study, the mean number of units of PRBC per patient decreased from 10.2 before RFA to 2.7 after RFA (timing not reported)[3].

A case series of 6 patients undergoing RFA for GAVE reported complete independence from the need for transfusions in 83% (5/6) of patients. The patient who remained transfusion dependent after 3 sessions was having further RFA. He required 4 units of PRBC between treatment sessions[4].

A case report of 1 patient with alcohol-induced cirrhosis and gastrointestinal bleeding from GAVE reported a decrease in the units of PRBC used per month before RFA and after RFA from 4 to none[5].

Haemoglobin levels

The case series of 24 patients reported a significant increase in their mean haemoglobin level from 6.8±1.4 g/dl 6 months before RFA to 9.8±1.8 g/dl 6 months after RFA ($p<0.001$)[1].

The case series of 21 patients reported a significant increase in their mean haemoglobin level from 7.8 g/dl (SD 1.0) 6 months before RFA to 10.2 g/dl (SD 1.4) 6 months after RFA for the 86% (18/21) of patients in whom there was clinical success ($p<0.001$)[2].

The case series of 9 patients refractory to APC therapy reported an increase in the mean haemoglobin levels before and after RFA from 7.3 g/dl to 10.5 g/dl (timing not reported)[3].

The case series of 6 patients reported an increase in the mean (range) haemoglobin levels before and at a mean of 2 months after the last RFA session from 8.6 (7–10.4) g/dl to 10.2 (9.4–11.5) g/dl[4].

Technical success (defined as feasibility of therapy and complete endoscopic ablation of the visible GAVE)

The case series of 21 patients refractory to APC therapy reported technical success in 90% (19/21) of patients. The case series of 9 patients with GAVE refractory to APC therapy reported complete endoscopic ablation of GAVE in 100% (9/9) of patients[2].

Safety

Ulceration

Ulceration (1 superficial ulcer and 1 bleeding ulcer) was reported in 10% (2/21) of patients in a case series of 21 patients with gastric antral vascular ectasia (GAVE) refractory to argon plasma coagulation (APC) therapy. Both ulcers resolved without intervention. The ulcers occurred in 2 of the first 3 patients in the series who were treated using 4 pulses per location. From the fourth patient onwards, a 2-pulse-per-location protocol was used. A superficial ulcer was detected in 1 patient at endoscopic follow-up 4–6 weeks after the last RFA session in a case series of 6 patients with GAVE (no further details provided)[2]. A superficial ulcer was detected in 1 patient at endoscopic follow-up 4–6 weeks after the last radiofrequency ablation (RFA) session in a case series of 6 patients with GAVE[4].

Bleeding

A submucosal tear at the gastro-oesophageal junction was revealed by repeat endoscopy in 1 patient with alcohol-induced cirrhosis and gastrointestinal bleeding from GAVE in a single case report. Dislodgement of the device probe from the endoscope may have caused the tear, which healed within 1 month[5].

Sepsis

Sepsis was diagnosed 17 days after the fourth session of RFA in 1 patient with GAVE and Child's A cirrhosis whose GAVE did not respond to APC treatments, in a single case report. Blood cultures grew *Streptococcus intermedius*. The sepsis resolved following treatment with oral and intravenous antibiotics[7].

Gastric inflammatory hyperplastic polyps

Gastric inflammatory hyperplastic polyps in the distal body and antrum were detected at a fourth RFA session in 1 patient with hepatitis C and GAVE, in a

single case report. The polyps were removed using heat cautery polypectomy (no further details provided)[6].

Validity and generalisability of the studies

Limitations of the evidence base: non-randomised studies only, no comparative studies between RFA and APC, no long-term follow-up of therapy and recurrence data, small number of patients.

Existing assessments of this procedure

There were no published assessments from other organisations identified at the time of the literature search.

Related NICE guidance

Below is a list of NICE guidance related to this procedure. Appendix B gives details of the recommendations made in each piece of guidance listed.

Interventional procedures

- Endoscopic radiofrequency ablation for squamous dysplasia of the oesophagus. NICE interventional procedure guidance 497 (2014). Available from https://www.nice.org.uk/guidance/IPG497
- Endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia or no dysplasia. NICE interventional procedure guidance 496 (2014). Available from https://www.nice.org.uk/guidance/IPG496
- Radiofrequency ablation of the soft palate for snoring. NICE interventional procedure guidance 476 (2014). Available from http://www.nice.org.uk/guidance/ipg476
- Endoscopic radiofrequency ablation for gastro-oesophageal reflux disease. NICE interventional procedure guidance 461 (2013). Available from http://www.nice.org.uk/guidance/ipg461
- Endoscopic radiofrequency ablation for Barrett's oesophagus with low grade dysplasia or no dysplasia. NICE interventional procedure guidance 344 (2010). Available from http://www.nice.org.uk/guidance/ipg344

Clinical guidelines

- Acute upper gastrointestinal bleeding management. NICE clinical guideline 141 (2012). Available from http://www.nice.org.uk/guidance/cg141

Specialist advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their specialist society or royal college. The advice received is their individual opinion and does not represent the view of the society.

Professor Pradeep Bhandari, Professor Krish Ragunath, Dr Terry Wong (British Society of Gastroenterology).

- One specialist adviser stated that he had done the procedure at least once, 1 specialist adviser did RFA regularly for removing dysplasia occurring in Barrett's oesophagus and 1 specialist adviser had never done the procedure.
- Two specialist advisers considered the procedure to be a minor variation on an existing procedure (RFA for Barrett's oesophagus) and 1 specialist adviser considered it to be definitely novel and of uncertain safety and efficacy.
- Argon plasma coagulation is the comparator to this procedure.
- Two specialist advisers estimated that fewer than 10% of specialists were engaged in this area of work and 1 specialist adviser estimated that 10% to 50% of specialists were engaged in this area of work.
- Theoretical adverse events: stricture, perforation, abdominal pain, laceration and bleeding.
- Anecdotal adverse events: stricture, perforation, bleeding and abdominal pain.
- Adverse events reported in the literature: bleeding and laceration.
- Key efficacy outcomes: eradication of GAVE, resolution of anaemia and reduction in need for blood transfusion.
- One specialist adviser stated that there were uncertainties about the efficacy of the procedure because data is limited and 1 specialist adviser stated that 'the studies to date have focused on the most severe patients and consist of

case series of patients with transfusion-dependent GAVE who have failed APC. There are no randomised controlled studies.'

- One specialist adviser stated that therapeutic endoscopy training was needed to undertake this procedure and 1 specialist adviser stated that 'this procedure does have a training programme with centres of excellence and requires specialised equipment'.
- Two specialist advisers mentioned the National RFA register (Halo registry) that includes Barrett's oesophagus and squamous dysplasia for data collection.
- Audit criteria for outcome measures of benefit: improvement in haemoglobin levels from baseline; reduction in blood transfusion requirement; endoscopic clearance of GAVE; rate of eradication of GAVE; and long-term sustained response.
- Audit criteria for adverse outcomes: bleeding, perforation and stricture.
- One specialist adviser stated the speed of diffusion of this procedure should be rapid since many centres are already doing RFA for Barrett's oesophagus, 1 specialist adviser stated it should be slow, and 1 specialist adviser stated the diffusion of the procedure is likely to be limited to centres already doing RFA to treat Barrett's oesophagus.
- Three specialist advisers stated the procedure was likely to be carried out in a minority of hospitals, but at least 10 in the UK (in all University/ Tertiary referral hospitals).
- Two specialist advisers stated that the potential impact of this procedure on the NHS was minor and 1 stated it was moderate.
- One specialist adviser stated that 'RFA is proven to be safe and effective for treatment of Barrett's oesophagus. About 20 centres in the UK are currently doing this procedure and they will be ideally placed to start this new procedure which requires the same kit that they already have.'

Patient commentators' opinions

NICE's Public Involvement Programme sent 4 questionnaires to 3 NHS trusts for distribution to patients who had the procedure (or their carers). NICE received 0 completed questionnaires.

NICE's Public Involvement Programme was unable to gather patient commentary for this procedure.

Issues for consideration by IPAC

- No ongoing trials were found.
- 1 conference abstract and 1 letter to the editor of a journal were included in table 2 for safety data.
- Patients in the studies were generally in very poor health with existing comorbidities.

References

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4. Gross SA, Al-Haddad M, Gill KR et al. (2008) Endoscopic mucosal ablation for the treatment of gastric antral vascular ectasia with the HALO90 system: a pilot study. Gastrointestinal Endoscopy 67:324-327.
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Appendix A: Additional papers on radiofrequency ablation for gastric antral vascular ectasia

There were no additional papers identified.

Appendix B: Related NICE guidance for radiofrequency ablation for gastric antral vascular ectasia

Guidance	Recommendations
Interventional procedures	**Endoscopic radiofrequency ablation for squamous dysplasia of the oesophagus. NICE interventional procedure guidance 497 (2014).** 1.1 Current evidence on the efficacy of endoscopic radiofrequency ablation for squamous dysplasia of the oesophagus is inadequate in quality and quantity. With regard to safety, there are well-recognised complications, particularly oesophageal strictures. Therefore, this procedure should only be used with special arrangements for clinical governance, consent and audit or research. 1.2 Clinicians wishing to undertake endoscopic radiofrequency ablation for squamous dysplasia of the oesophagus should take the following actions. Inform the clinical governance leads in their NHS trusts. Ensure that patients understand the uncertainties about the procedure's safety and efficacy, inform them about alternative treatment options and provide them with clear written information. In addition, the use of NICE's information for the public is recommended. 1.3 Patient selection for endoscopic radiofrequency ablation for squamous dysplasia of the oesophagus should be done by a multidisciplinary team experienced in the management of oesophageal dysplasia. 1.4 Endoscopic radiofrequency ablation for squamous dysplasia of the oesophagus should only be done by endoscopists experienced in treating oesophageal dysplasia. 1.5 NICE encourages further research into endoscopic radiofrequency ablation for squamous dysplasia of the oesophagus, including observational data collection. Studies should clearly define patient selection. Outcomes should include completeness of ablation, resolution of squamous dysplasia, progression to cancer and quality of life. All complications should be reported, particularly development of oesophageal strictures.

	1.6 Clinicians should enter details about all patients undergoing endoscopic radiofrequency ablation for squamous dysplasia of the oesophagus onto the UK National HALO patient register, and review clinical outcomes locally. **Endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia or no dysplasia. NICE interventional procedure guidance 496 (2014).** (This partially replaces previous guidance on endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia or no dysplasia (IPG 344)). 1.1 Current evidence on the efficacy of endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia is adequate provided that patients are followed up in the long term. There are no major safety concerns. Therefore, this procedure may be used in patients with Barrett's oesophagus with low-grade dysplasia with normal arrangements for clinical governance, consent and audit or research. 1.2 Current evidence on the efficacy and safety of endoscopic radiofrequency ablation for Barrett's oesophagus with no dysplasia is limited in quality and quantity. Therefore, this procedure should only be used in patients with no dysplasia in the context of research. 1.3 Patient selection for endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia should be done by a multidisciplinary team experienced in managing Barrett's oesophagus, as described in the British Society of Gastroenterology guidelines. 1.4 Endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia should only be done by endoscopists experienced in treating Barrett's oesophagus, as described in the British Society of Gastroenterology guidelines. 1.5 Clinicians should enter details of all patients undergoing endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia or no dysplasia onto the UK National HALO Patient Registry, and review clinical outcomes locally. 1.6 NICE encourages further research into endoscopic radiofrequency ablation for Barrett's oesophagus with no dysplasia. Studies should define clearly the policies used for histological diagnosis. Outcomes should include complete resolution of Barrett's oesophagus, change and progression to

	low-grade dysplasia, high-grade dysplasia or cancer. All complications should be reported, particularly development of strictures. Comparative studies against surveillance would be useful. **Radiofrequency ablation of the soft palate for snoring. NICE interventional procedure guidance 476 (2014).** 1.1 Current evidence suggests that there are no major safety concerns associated with radiofrequency ablation of the soft palate for snoring. The evidence on the short-term efficacy of the procedure is adequate, although uncertainties remain about its efficacy in the longer term. Therefore this procedure may be used with normal arrangements for clinical governance, consent and audit. 1.2 During the consent process clinicians should, in particular, inform patients of the uncertainty about the procedure's long-term efficacy and of the possible need for further procedures if symptoms recur. 1.3 Patient selection is important: the sound of snoring can arise from several different levels in the upper airway and this procedure should only be used for patients whose snoring has been shown to be caused by abnormal movement of the soft palate and in whom sleep apnoea has been excluded. 1.4 NICE encourages further research into radiofrequency ablation of the soft palate for snoring. This could take the form of data collection, with the specific aim of documenting long-term outcomes and the need for further treatment. **Endoscopic radiofrequency ablation for gastro-oesophageal reflux disease. NICE interventional procedure guidance 461 (2013).** 1.1 The evidence on the safety of endoscopic radiofrequency ablation for gastro-oesophageal reflux disease (GORD) is adequate in the short and medium term but there is uncertainty about longer-term outcomes. With regard to efficacy, there is evidence of symptomatic relief but objective evidence on reduction of reflux is inconclusive. Therefore, this procedure should only be used with special arrangements for clinical governance, consent and audit or research. 1.2 Clinicians wishing to undertake endoscopic radiofrequency ablation for GORD should take the following actions. •Inform the clinical governance leads in their NHS trusts. •Ensure that patients understand the uncertainty about the

	procedure's safety and efficacy and provide them with clear written information. In addition, the use of NICE's information for the public is recommended. •Audit and review clinical outcomes of all patients having endoscopic radiofrequency ablation for GORD (see section 7.1). 1.3 Future review of the guidance might consider evidence from research that includes objective outcome measures such as oesophageal pH, long-term follow-up data, comparison with Nissen fundoplication, information about patient selection and further insight into the mechanism of action of the procedure. **Epithelial radiofrequency ablation for Barrett's oesophagus. NICE interventional procedure guidance 344 (2010).** 1.1 Current evidence on the efficacy of epithelial radiofrequency ablation (RFA) in patients with Barrett's oesophagus with high-grade dysplasia (HGD) is adequate, provided that patients are followed up in the long term. There are no major safety concerns. Therefore this procedure may be used in patients with Barrett's oesophagus with HGD provided that normal arrangements are in place for clinical governance, consent and audit. 1.2 This recommendation has been updated and replaced by NICE interventional procedure guidance 496 (Endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia or no dysplasia). 1.3 This recommendation has been updated and replaced by NICE interventional procedure guidance 496 (Endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia or no dysplasia). 1.4 Patient selection for epithelial RFA for Barrett's oesophagus should be done by a multidisciplinary team experienced in the management of Barrett's oesophagus. 1.5 Epithelial RFA for Barrett's oesophagus should only be carried out by endoscopists with specific training in this procedure. 1.6 NICE encourages further research into epithelial RFA for Barrett's oesophagus. This should address the balance of risks and benefits of the procedure in patients with Barrett's oesophagus and either LGD or no dysplasia, and long-term

	outcomes in patients with Barrett's oesophagus of any histological type. This recommendation has been partially updated by NICE interventional procedure guidance 496 (Endoscopic radiofrequency ablation for Barrett's oesophagus with low-grade dysplasia or no dysplasia).
Clinical guidelines	**Acute upper gastrointestinal bleeding management. NICE clinical guideline 141 (2012).** 1.4 Management of non-variceal bleeding Endoscopic treatment 1.4.1 Do not use adrenaline as monotherapy for the endoscopic treatment of non-variceal upper gastrointestinal bleeding. 1.4.2 For the endoscopic treatment of non-variceal upper gastrointestinal bleeding, use one of the following: •a mechanical method (for example, clips) with or without adrenaline •thermal coagulation with adrenaline •fibrin or thrombin with adrenaline. Proton pump inhibitors 1.4.3 Do not offer acid-suppression drugs (proton pump inhibitors or H2-receptor antagonists) before endoscopy to patients with suspected non-variceal upper gastrointestinal bleeding. 1.4.4 Offer proton pump inhibitors to patients with non-variceal upper gastrointestinal bleeding and stigmata of recent haemorrhage shown at endoscopy. Treatment after first or failed endoscopic treatment 1.4.5 Consider a repeat endoscopy, with treatment as appropriate, for all patients at high risk of re-bleeding, particularly if there is doubt about adequate haemostasis at the first endoscopy. 1.4.6 Offer a repeat endoscopy to patients who re-bleed with a view to further endoscopic treatment or emergency surgery. 1.4.7 Offer interventional radiology to unstable patients who re-bleed after endoscopic treatment. Refer urgently for surgery if interventional radiology is not promptly available. 1.5 Management of variceal bleeding 1.5.1 Offer terlipressin to patients with suspected variceal bleeding at presentation. Stop treatment after definitive haemostasis has been achieved, or after 5 days, unless there is another indication for its use [1]. 1.5.2 Offer prophylactic antibiotic therapy at presentation to

	patients with suspected or confirmed variceal bleeding. Oesophageal varices 1.5.3 Use band ligation in patients with upper gastrointestinal bleeding from oesophageal varices. 1.5.4 Consider transjugular intrahepatic portosystemic shunts (TIPS) if bleeding from oesophageal varices is not controlled by band ligation. Gastric varices 1.5.5 Offer endoscopic injection of N-butyl-2-cyanoacrylate to patients with upper gastrointestinal bleeding from gastric varices. 1.5.6 Offer TIPS if bleeding from gastric varices is not controlled by endoscopic injection of N-butyl-2-cyanoacrylate.

Appendix C: Literature search for radiofrequency ablation for gastric antral vascular ectasia

Databases	Date searched	Version/files	No. retrieved
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	17/06/2014	Issue 5 of 12, June 2014	88
Database of Abstracts of Reviews of Effects – DARE (CRD website)	17/06/2014	Issue 5 of 12, April 2014	118
HTA database (CRD website)	17/06/2014	Issue 5 of 12, April 2014	3
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	17/06/2014	Issue 5 of 12, May 2014	71
MEDLINE (Ovid)	17/06/2014	1946 to June Week 1 2014	117
MEDLINE In-Process (Ovid)	17/06/2014	June 17, 2014	9
PubMed	17/06/2014	N/A	11
EMBASE (Ovid)	17/06/2014	1974 to 2014 June 17	293
BLIC (Dialog DataStar)	17/06/2014	N/A	0

Trial sources searched on 17 06 2014:

- National Institute for Health Research Clinical Research Network Coordinating Centre (NIHR CRN CC) Portfolio Database
- Current Controlled Trials *meta*Register of Controlled Trials – *m*RCT
- Clinicaltrials.gov

Websites searched on 17 06 2014:

- National Institute for Health and Clinical Excellence (NICE)
- NHS England
- Food and Drug Administration (FDA) - MAUDE database
- French Health Authority (FHA)
- Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP – S)
- Australia and New Zealand Horizon Scanning Network (ANZHSN)
- General internet search

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1	Catheter Ablation/
2	(catheter adj4 ablat*).tw.
3	((needle* or electrode* or heat*) adj4 ablat*).tw.
4	(radiofrequen* adj4 ablat*).tw.
5	(radio frequen* adj4 ablat*).tw.
6	(radio-frequen* adj4 ablat*).tw.
7	(rf adj4 ablat*).tw.
8	rfa.tw.
9	(radio* adj4 frequenc* adj4 ablation*).tw.
10	(endoscop* adj4 ablation* adj4 therap*).tw.
11	or/1-10
12	Gastric Antral Vascular Ectasia/
13	GAVE.tw.
14	Gastrointestinal Hemorrhage/
15	(stomach* adj4 watermelon*).tw.
16	(Antral* adj4 Vascul* adj4 Ectasia).tw.
17	((Gastr* or stomach* or intestin*) adj4 (bleed* or blood* or haemorr* or hemorr*)).tw.
18	WMS.tw.
19	GVE.tw.
20	((pyloric or gastric) adj4 antrum*).tw.
21	Pyloric antrum/
22	hematochezia*.tw.
23	or/12-22
24	11 and 23
25	Barrx RFA system.tw.
26	Halo360.tw.
27	HALO 90.tw.

28	HALO 90 ultra probe.tw.
29	or/24-28
30	animals/ not humans/
31	**29 not 30**