Endoscopic management of Barrett’s esophagus with dysplasia
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Citation for published version (APA):
A SIMPLIFIED REGIMEN FOR FOCAL RADIOFREQUENCY ABLATION OF BARRETT’S MUCOSA: A RANDOMIZED MULTICENTER TRIAL COMPARING TWO ABLATION REGIMENS


Gastrointestinal Endoscopy 2013; 78: 30-8
ABSTRACT

BACKGROUND: The currently recommended regimen for focal radiofrequency ablation (RFA) of Barrett’s esophagus (BE) comprises 2 applications of energy, cleaning of the device and ablation zone, and 2 additional applications of energy. A simplified regimen may be of clinical utility if it is faster, easier and equally safe and effective.

OBJECTIVE: To compare the efficacy of 2 focal RFA regimens.

SETTING: Three tertiary referral centers.

PATIENTS: Consecutive patients scheduled for focal RFA of BE with flat type BE with at least 2 BE islands or mosaic groups of islands were enrolled.

INTERVENTIONS: BE areas were paired: 1 area was randomized to the ‘standard’ regimen (2x15J/cm²-clean-2x15J/cm²) or to the ‘simplified’ regimen (3x15J/cm²-no clean), allocating the second area automatically to the other regimen. The percentage of surface area regression of each area was scored at 2 months by the endoscopist (blinded).

OUTCOME MEASURES: Proportion of completely removed BE areas at 2 months. Calculated sample size was 46 pairs of BE areas using a non-inferiority design. Non-inferiority was defined as <20% difference in the paired proportions.

RESULTS: Forty-five equivalent pairs of BE areas were included in 41 patients. The proportion of completely removed BE areas at 2 months after focal RFA was 30 (67%) for standard and 33 (73%) for simplified. Non-inferiority was demonstrated by a 7% difference (95%CI, -10.6 to +20.9).

LIMITATIONS: Tertiary referral centers.

CONCLUSIONS: The results of this multicenter randomized trial suggest that a simplified 3x15J/cm² focal ablation regimen is not inferior to the standard regimen, regarding the endoscopic removal of residual Barrett’s islands.
INTRODUCTION

Endoscopic therapy is the treatment of choice for patients with Barrett’s esophagus (BE) containing high-grade dysplasia (HGD) or early carcinoma. Currently, the best available treatment approach is a combination of endoscopic resection (ER) of visible lesions followed by endoscopic ablation of the residual flat BE using radiofrequency ablation (RFA).1-4

RFA is a recently introduced endoscopic treatment modality for the complete removal of BE with or without dysplasia. Several large-scale multicenter studies have shown that RFA is safe and effective, with reported rates of complete histologic removal of BE and dysplasia in 77 to 100% of patients.3-7

RFA can be performed with a balloon-based ablation catheter for circumferential ablation (HALO360+ catheter; BÂRRX/Covidien Medical Inc, Sunnyvale, CA) or a focal ablation device attached to the tip of the endoscope (HALO90 catheter) for ablation of smaller areas of residual BE, such as remaining BE islands, small BE tongues, or an irregular squamocolumnar junction. Generally, patients require about 3 RFA sessions to achieve histologic eradication of dysplastic BE, usually 1 circumferential and 2 focal RFA sessions, performed over 2- to 3- month intervals.3, 7 The advised ablation regimen for both circumferential balloon-based or focal HALO90 ablation consists of 2 ablation passes in the same endoscopic session, with a cleaning step in between ablation passes to remove debris from the surface of the ablation zone and electrode.8 Although focal ablation with the HALO90 catheter is relatively easy to perform, cleaning of the ablation zone and removing, cleaning and reintroducing the HALO90 catheter are impractical, time consuming, and uncomfortable to the patient. In this study, we evaluated a simplified HALO90 ablation regimen in which cleaning of the ablation zone is abandoned, thereby reducing the number of introductions with the endoscope and the HALO90 ablation device. We hypothesized that this simplified HALO90 ablation procedure results in an easier and faster ablation procedure with fewer introductions, while maintaining efficacy and safety. The study aim was to compare the safety and efficacy of the current standard HALO90 ablation regimen with a simplified HALO90 ablation regimen in a randomized trial using a non-inferiority design.

METHODS

The inception cohort of this study consisted of patients who underwent RFA treatment for the complete removal of BE in 1 of 3 tertiary referral centers. The indication for RFA was the complete removal of all BE with or without a prior ER of a focal lesion containing high-grade dysplasia or early cancer.9

RADIOFREQUENCY ABLATION RFA was performed using the HALO system (BÂRRX/ Covidien Medical Inc), which is based on the use of bipolar electrodes and a preset radiofrequency (RF) energy density to ensure a uniform ablation depth of 0.5 to 1 mm. For initial circumferential ablation, the HALO360 balloon catheter was used, as described elsewhere.5, 8 For subsequent focal ablation of BE areas or islands smaller
than 2 cm in longitudinal length and ≤50% of the circumference, the HALO® catheter was used, which consists of a cap-based electrode of 20 mm x 13 mm attached to the tip of the endoscope (Figure 1). RFA was repeated every 2 to 3 months with a maximum of 5 RFA sessions (≤2 HALO®), until complete endoscopic and histologic removal of all BE was achieved. Endoscopic work-up and preprocedural and postprocedural care of the RFA procedures have been previously described. 2, 8

Figure 1: HALO® device for radiofrequency ablation (RFA). The HALO® device is used for secondary RFA of residual Barrett epithelium after initial circumferential ablation using the HALO® system or for primary RFA. The HALO® device is fitted on the tip of the endoscope and consists of a bipolar electrode array (20 mm x 13 mm) on an articulated platform for optimal contact with the esophageal wall. The use of a bipolar electrode and a generator that delivers a fixed amount of RF energy results in uniform, controlled ablation with an ablation depth of ~0.5 mm (Permission for use from Covidien, GI Solutions (formerly BARRX Medical).

SELECTION CRITERIA Patients were eligible if they met the following criteria: scheduled for a first, second or third HALO® procedure for BE with or without dysplasia; absence of endoscopically visible active inflammation in the treatment zone; absence of esophageal stenosis (esophageal diameter <18 mm) preventing introduction of the endoscope and/or the HALO® catheter; and no previous randomization of BE areas for the purpose of this study. All patients provided written informed consent.

BE areas had to meet the following criteria: presence of ≥2 BE islands with a size of ≥2 mm, or clusters of BE islands, with a total surface area smaller than 2 adjacent HALO® applications and <50% of the circumference; a distance of >20 mm or >33% of the circumference in between BE areas (to prevent overlap of 2 ablation zones treated with different RFA regimens); and a distance of ≥10 mm from the neosquamous-columnar junction (to prevent that ablation of the neosquamous-columnar junction would interfere with the allocated RFA regimen). BE islands that were elevated or contained endoscopic visible abnormalities suspicious for carcinoma were not eligible.

HALO® REGIMENS During high-resolution endoscopy with white light and narrow band imaging (NBI) or Fuji intelligent chromo endoscopy (FICE), the BE was flushed with the mucolytic agent acetylcysteine (1%) followed by flushing with tap water. The BE was inspected to exclude the presence of visible lesions and stenosis. The number, size (maximum diameter) and localization (insertion depth of the endoscope, and the circumferential position in the endoscopic view) of all BE islands and tongues were registered and documented on still images (white light + NBI/FICE).
Eligible BE areas were numbered sequentially from distal to proximal. Area 1 was randomized and treated first, and area 2 was automatically allocated to the other ablation regimen, thus forming a pair. The ‘standard’ regimen (‘double-double-15’) consisted of a double application of RF energy at 15J/cm², cleaning debris from the ablation zone and cleaning the HALO™ electrode outside the patient, followed by another double ablation at 15 J/cm². The ‘simplified’ regimen (‘triple-15’) consisted of 3 consecutive ablations at 15J/cm² without cleaning the ablation zone or HALO™ electrode. A maximum of 2 pairs were randomized. Before switching over to the other ablation regimen, the surface of the ablation electrode was cleaned outside of the patient. In case BE areas were localized close to each other, 1- to 2-mm-sized endoscopic tattoos were placed to enable localization of both areas at 2 months (Endo Spot, GI Supply, Camp Hill, PA). After focal ablation of the included BE areas according to the allocated regimens, all other remaining BE areas, including the neosquamocolumnar junction, were treated with the standard regimen for focal RFA.

SCORING OF OUTCOME PARAMETERS DURING FOLLOW-UP ENDOSCOPY AT 2 MONTHS Patients were scheduled for high-resolution endoscopy with NBI/FICE after 2 months, and outcome parameters were scored at that time. Endoscopists were provided with information on the localization of included areas and the number and size of BE islands per area at baseline and were allowed to review endoscopic images from baseline; however, they were blinded to the administered HALO™ treatment regimen. After thorough inspection, still images were made of any residual columnar epithelium (white light + NBI/FICE) at included BE areas, and the endoscopist scored the outcome parameters per included BE area after the endoscopy.

OUTCOME PARAMETERS AT 2 MONTHS The primary outcome parameter consisted of the complete endoscopic eradication of the BE area, defined as absence of any endoscopically visible columnar epithelium as judged by the endoscopist. The secondary outcome parameter consisted of the surface regression of the BE area as compared with baseline, defined as the percentage of surface regression of endoscopically visible columnar epithelium observed by the endoscopist.

FOLLOW-UP PROTOCOL When endoscopic BE eradication was achieved, 4 quadrants/2 cm random biopsy specimens were obtained of the neosquamous epithelium of the original BE and immediately distal (<5 mm) to the neosquamocolumnar junction. If histologic assessment of the biopsy confirmed complete response (CR) for early neoplasia and intestinal metaplasia (CR-IM), patients were scheduled for high-resolution endoscopy with NBI/FICE and 4 quadrants/2 cm biopsies at 6 months and annually thereafter.

ETHICS AND STATISTICS The study was approved by the medical ethics committees of all study centers (NTR 2510, www.trialregister.nl). Written informed consent was obtained from all participants. Randomization was performed by a study monitor according to a computer-generated random order in sealed opaque envelopes during baseline endoscopy. The study monitor attended the baseline endoscopy and follow-up endoscopy at 2 months for prospective data registration using standardized case record forms.

The sample size was based on the assumption that a difference of 20% or more in the proportions of completely eradicated BE areas in both arms would be of
clinical relevance. To reject the hypothesis that the simplified regimen is inferior to the standard regimen, 46 pairs of BE areas were required, with non-inferiority defined as <20% difference in the paired proportions of completely eradicated BE areas (one-sided, \( P = .025 \), 80% power, 10% drop-out). For sample size calculation and random sequence generation, nQuery Advisor (Version 7, Statistical Solutions Ltd, Cork, Ireland) was used. Data analysis was performed using SPSS statistical software package (Version 16.0.2, SPSS INC, Chicago, IL). For descriptive statistics, mean (±SD) was used for parametric distribution and median (inter-quartile range, IQR) was used for non-parametric distribution. To compare groups, McNemar’s test for paired data was used. Fisher exact test and Mann-Whitney U test were used when appropriate. Differences were considered statistically significant if \( P \leq .05 \). To calculate confidence intervals, the Confidence Interval Analysis package was used (CIA 2.2.0, London, UK).

RESULTS

PATIENTS This study was performed in 3 tertiary referral centers in The Netherlands for the endoscopic treatment of early neoplasia in the upper GI tract: Academic Medical Center, Amsterdam; Sint Antonius Hospital, Nieuwegein; and Catharina Hospital, Eindhoven. In total, 89 patients were screened for the study, of whom 48 did not meet the inclusion criteria (too small islands, too close to each other, or the squamocolumnar junction within 10-mm distance \( n=20 \); no remaining islands \( n=11 \); only a single island \( n=11 \); esophageal stenosis \( n=2 \); need for circumferential balloon-based RFA for remaining BE \( n=2 \); visible lesion requiring ER \( n=1 \); and no consent \( n=1 \)). Forty-one patients were included (29 men, median age 63 ± 11 years with a median BE length before any treatment of C5M7 (IQR C2-9; M5-10) (Table 1, Figure 2).

| Table 1: Baseline characteristics of 41 patients with dysplastic BE treated with endoscopic RFA and in whom pairs of Barrett areas were randomized to 2 different focal RFA regimes. |
|---------------------------------|---------------------------------|
| n= 41                           |                                 |
| Male: female                    | 29 : 12                         |
| Mean age, yr (±SD)              | 63 (±11)                        |
| Median BE length (in cm) before RFA | CSM7 (C2-9; M5-10)             |
| Most advanced histology overall | Carcinoma 22, HGD 12, LGD 5, NDBE 2 |
| (biopsies or ER specimens)      |                                 |
| ER before randomization         | 28                              |
| Histology before any RFA (biopsies) | HGD 20, LGD 12, NDBE 9         |

BE= Barrett’s esophagus, C= circumferential BE length, M= maximal BE length, RFA= radiofrequency ablation, ER= endoscopic resection, HGD= high-grade dysplasia, LGD= low grade dysplasia, NDBE= non dysplastic Barrett epithelium.
Before RFA, 28 patients underwent ER of focal lesions. Initial circumferential balloon-based RFA was performed in 39 of 41 patients, whereas 2 patients underwent initial focal RFA. Primary focal RFA was performed for the removal of a residual Barrett tongue of 3 cm in 1 patient; and for optimal electrode contact in another patient with reflux-related scarring in a C3M6 BE. Patients were included during the first focal RFA session in 34 cases, whereas in 7 others this was the second (n=5) or third (n=2) focal RFA session. The most advanced histology (biopsies or ER specimens) overall was carcinoma in 22 patients, high-grade dysplasia in 12 patients and low-grade dysplasia in 5 patients, and non-dysplastic BE in 2 patients. Two patients with non-dysplastic BE underwent RFA treatment (long-segment BE of C9M10 in a 39-year-old man and a C7M8 BE in a 64-year-old woman with 2 first-degree relatives with esophageal adenocarcinoma). Before any RFA, the most advanced histology (biopsies) was high-grade dysplasia in 20 patients, low-grade dysplasia in 12 patients, and non-dysplastic BE in 9 patients.
HALO® PROCEDURE  In total, 92 BE areas (46 pairs) were randomized to the standard or simplified regimen. One patient with one pair of BE areas was excluded from analysis because the second area was accidentally ablated with the wrong regimen, leaving 45 pairs for the final analysis (Table 2). Of 41 patients, 36 patients had a single pair of BE areas (2 BE areas per patient) and 5 patients had 2 pairs of BE areas (4 BE areas per patient). BE areas contained 1 island (n=54, median size 10 mm (IQR 6-15)) or multiple islands (n=38) (Figure 3). In 3 cases, BE areas were marked with an endoscopic tattoo (Figure 4). Baseline characteristics were similar in both groups (Table 2). There were no acute or severe adverse events. Two patients, both treated with an extensive ER before balloon-based RFA, developed a symptomatic stenosis after a second focal RFA procedure. Symptoms resolved after endoscopic dilation.

Figure 3: Endoscopic images of areas of Barrett epithelium that were randomized to the simplified or standard regimen for focal radiofrequency ablation using the HALO® device.
Table 2: Baseline characteristics of 45 pairs of Barrett areas randomized to 2 different treatment regimens (‘Standard’ or ‘Simplified’) for focal radiofrequency ablation.

<table>
<thead>
<tr>
<th></th>
<th>Overall (n=45)</th>
<th>Standard (n=45)</th>
<th>Simplified (n=45)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single island to multiple BE islands per area</td>
<td>54:36</td>
<td>26:19</td>
<td>28:17</td>
<td>.77</td>
</tr>
<tr>
<td>Islands per BE area in case of multiple islands, median (range)</td>
<td>2 (2-10)</td>
<td>2 (2-5)</td>
<td>2 (2-10)</td>
<td>.79</td>
</tr>
<tr>
<td>Size of single BE islands, median (IQR)</td>
<td>10 mm (6-15)</td>
<td>10 mm (5-16)</td>
<td>10 mm (7-10)</td>
<td>.60</td>
</tr>
</tbody>
</table>

OUTCOME PARAMETERS AT 2-MONTH FOLLOW-UP  At the 2-month follow-up endoscopy, the proportion of completely eradicated BE areas was 30 of 45 patients (67%) for the standard RFA regimen and 33 of 45 patients (73%) for the simplified regimen: a difference of 7% (95%CI, -10.6% to 20.9%) (Table 3 and 4). The median surface regression for each BE area at 2 months was 100% in both groups. The median surface regression for not completely eradicated areas was 78% (IQR, 50-90) for the standard regimen and 80% (IQR, 50-90) for the simplified regimen (p=1.0).

Of 40 patients included in the study, CR for early neoplasia and CR-IM were achieved in 100% and 93% (37 of 40) of patients, respectively, in a median of 3 RFA sessions (IQR, 2-4) overall during the endoscopic treatment period. In 6 patients, additional ER was performed after RFA to remove a focal lesion during the RFA treatment phase (n=3) or to remove persisting BE after 5 RFA sessions (n=3). ER specimens showed a T1m3 carcinoma in 1 patient, BE without dysplasia in 4 patients, and no IM in 1 patient. None of the focal lesions was localized at the BE areas included in this study. In 5 patients, additional argon plasma coagulation was used for ablation of tiny islands < 2 mm.

SUBSEQUENT TREATMENT  Of 40 patients included in the study, CR for early neoplasia and CR-IM were achieved in 100% and 93% (37 of 40) of patients, respectively, in a median of 3 RFA sessions (IQR, 2-4) overall during the endoscopic treatment period. In 6 patients, additional ER was performed after RFA to remove a focal lesion during the RFA treatment phase (n=3) or to remove persisting BE after 5 RFA sessions (n=3). ER specimens showed a T1m3 carcinoma in 1 patient, BE without dysplasia in 4 patients, and no IM in 1 patient. None of the focal lesions was localized at the BE areas included in this study. In 5 patients, additional argon plasma coagulation was used for ablation of tiny islands < 2 mm.

In 3 patients who failed CR-IM, focal IM was found at the squamocolumnar junction in 2 patients, whereas in 1 patient a single focus of buried IM was detected in the proximal esophagus, which was not reproduced during follow-up.
DISCUSSION

RFA is an endoscopic ablation technique shown to be a safe and effective treatment modality for the histologic eradication of dysplastic BE in 77% to 100% of patients.\textsuperscript{3, 5, 7} With more endoscopists having access to the technique and more patients being treated, it is important to improve the practicality of the treatment while preserving efficacy and safety.\textsuperscript{11, 12}

In this randomized trial we compared two different treatment regimens for focal RFA of Barrett’s epithelium in patients with early BE neoplasia. We hypothesized that a new, simplified focal ablation regimen would result in an easier and faster focal ablation procedure with fewer introductions, while maintaining efficacy and safety.

In this study, we used a non-inferiority design to evaluate whether the simplified regimen has a comparable efficacy as the standard focal RFA treatment. Our results show that the proportion of completely eradicated BE areas was 67% for the standard regimen and 73% for the simplified regimen: a difference of 7%. Because the lower border of the 95% confidence interval of this difference does not exceed the predefined limit of -10% (7%; 95%CI, -10.6% to +20.9%), we conclude that the simplified regimen is not inferior to the standard regimen. Although in this study we were not able to separately compare the adverse event rate of both regimens, there were only two late adverse events and no serious or acute adverse events occurred, which is in accordance with other RFA series.\textsuperscript{3, 5}

The currently used double-double-15 J/cm\textsuperscript{2} regimen has its origin in initial balloon-based RFA dose-escalation studies in animals and human patients before esophagectomy and in subsequent clinical trials.\textsuperscript{1, 2, 5, 13-16} These studies demonstrated a dose-response relation between the energy density (J/cm\textsuperscript{2}) and the number of RF energy applications versus the ablation depth.\textsuperscript{13, 14, 16} Cleaning debris from the ablation surface and electrode was first introduced for circumferential RFA, because the debris was thought to insulate ablated areas from further ablation damage. When the HALO\textsuperscript{90} catheter became available, a similar ablation regimen used for circumferential RFA was applied to focal RFA. Subsequent dose-escalation from 2x12 J/cm\textsuperscript{2} to 2x2x12 J/cm\textsuperscript{2} to 2x2x15 J/cm\textsuperscript{2} suggested that a double-double-15 J/cm\textsuperscript{2} regimen was the most effective regimen.\textsuperscript{1, 2}

Improvement of the surface regression of Barrett epithelium and reduction of the number of RFA sessions was observed in uncontrolled cohort studies in which the cleaning step was implemented for circumferential balloon-based RFA.\textsuperscript{1, 2, 5, 15} However, other modifications were made to the ablation protocol at the same time: the ablation was performed under endoscopic visualization to optimize positioning of the balloon catheter, whereas at first this was performed blindly using the shaft of the balloon catheter as a reference. Second, a dose adjustment from 10 to 12 J/cm\textsuperscript{2} for circumferential balloon-based RFA was adopted by most centers at this time. Third, a learning curve in performing RFA may have played a role in improved results. During the cleaning step, however, the mucosa may become edematous, hyperemic, and thicker as a reaction to the ablation and the manipulation by pushing, spraying and sloughing off the debris. These effects might neutralize the beneficial effect of removing the debris. Therefore, we used a triple application instead of a double-double application of RFA based on the hypothesis that the cleaning step may neutralize or even decrease the efficacy and to avoid the potential deeper damage of 4 RFA applications without a cleaning step.
The simplified ablation regimen we propose in this study has several advantages over the currently used ablation regimen, while the safety and efficacy of focal RFA is maintained. Only a single introduction of the HALO\textsuperscript{90} catheter is required in the simplified ablation regimen, whereas 2 introductions of the endoscope and the HALO\textsuperscript{90} catheter are needed in the standard protocol.\textsuperscript{4} Apart from being more practical for the endoscopist, this likely reduces discomfort to the patient and makes the procedure safe because each introduction can potentially harm the hypopharynx or esophageal wall. This is of relevance because in an estimated 10\% of the cases, based on our own clinical experiences, the introduction of the HALO\textsuperscript{90} catheter into the esophagus is difficult. In most cases, simple tricks suffice, such as asking the patient to swallow, or the introduction of a spraying catheter or biopsy forceps into the esophagus as a conduit. Incidentally, however, dilatation of the upper esophageal sphincter with a controlled radial expansion balloon is required. Also, in rare cases, the removal of the HALO\textsuperscript{90} catheter may be troublesome, when the HALO\textsuperscript{90} electrode platform tilts downward and becomes stuck distal to a stenosis or the upper esophageal sphincter. In patients with a relative stenosis caused by scarring due to prior ER or reflux, it may be especially complicated to introduce or remove the HALO\textsuperscript{90} catheter. Therefore, this patient group in particular may benefit from an ablation regimen that requires only a single introduction of the HALO\textsuperscript{90} catheter into the esophagus versus 2 introductions with the standard regimen. Currently, the smaller HALO\textsuperscript{60} electrode (electrode surface 60\% of the HALO\textsuperscript{90}) is also available for small residual BE islands and tongues, which is easier to introduce. Furthermore, the duration of focal RFA using the simplified regimen may be shorter because cleaning the ablation surface with the cap-electrode and spraying catheter and cleaning the ablation surface and the RFA electrode outside the patient is abandoned.

A strength of our study was the randomization of pairs of islands within one patient, instead of randomizing individual patients. This ensured that both ablation regimens were performed and compared under equal circumstances, ruling out interpatient variation and interprocedure variation.

The most important limitation of our study is that we compared both ablation regimens exclusively for the treatment of BE islands, whereas in clinical practice, focal RFA is performed for larger BE areas, such as tongues and for the circumferential ablation of the gastroesophageal junction.\textsuperscript{8} Theoretically, areas with more exposure to reflux such as the gastroesophageal junction may respond differently to the two regimens. Additionally, in our study, each BE area was treated with a clean HALO\textsuperscript{90} catheter. Hypothetically, the HALO\textsuperscript{90} catheter may become more and more covered with debris after repeated RF applications, which may act as an isolation layer and reduce the efficacy of the ablation. Therefore, after a certain number of RF applications, it may be necessary to clean the debris from the HALO\textsuperscript{90} electrode to keep the efficacy of the ablation optimal.

Another limitation of our study is that our study set-up did not allow for comparison of the duration of both regimens because both regimens were applied during the same procedure. Further, we were not able to match islands of the exact same size. First, it would be difficult to find two equally sized BE areas within one patient. Second, it is currently not possible to quantify the exact surface of a BE island in mm\textsuperscript{2}. The randomized design of our study, however, makes it unlikely that this has influenced the results. We did not use a histologic endpoint, which is a further limitation. No biopsy specimens were taken from the included areas.
before ablation to assess the presence of IM and dysplasia. Obtaining a biopsy specimen would have changed the size of the BE island and would therefore interfere with the results of the study. Because the baseline histology of each specific BE area was unknown, we were not able to compare histology before and after focal RFA per randomized BE area. It is, however, unknown if the grade of dysplasia of flat type BE islands is related to the success rate of RFA. 

Although we cannot guarantee an equal spread of dysplastic areas over both groups because we did not perform a biopsy before RFA, our randomized study set-up makes any influences of this issue small.

In conclusion, in this study, we evaluated a simplified ablation regimen for focal RFA using the HALO catheter by comparing it with the currently used focal ablation regimen in a randomized multicenter trial. The simplified regimen (3x15J/cm² without cleaning) has the advantages of requiring fewer introductions and, theoretically, a shorter procedure time. Our findings suggest that the proposed simplified focal ablation regimen is not inferior to the standard regimen for focal RFA of residual BE islands after circumferential RFA. In future studies of focal RFA regimens, patients with Barrett areas should be randomized to the simplified or the standard RFA regimen to allow for comparison of procedure time, safety, complete histologic response rates for neoplasia and IM, and long-term follow-up.
REFERENCE LIST


