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ORIGINAL PAPERS

Endoscopic mucosal resection for proximal superficial lesions: efficacy and safety study in 59 consecutive resections

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ABSTRACT

Introduction: endoscopic mucosal resection is an accepted technique for the treatment of proximal gastrointestinal tract superficial lesions.

Objectives: to evaluate the efficacy and safety of this procedure in the proximal gastrointestinal tract.

Material and methods: forty one consecutive patients (23 males and 18 females, mean age of 61 ± 11.5 years) were included in our study. Fifty nine resections were performed in these patients in 69 sessions. Lesions treated consisted of elevated lesions with high grade dysplasia in the context of Barrett's esophagus (group A), high grade dysplasia appearing in random biopsies taken during the follow-up of Barrett's esophagus (group B) and superficial gastroduodenal lesions (group C). Snare resection after submucosal injection, band ligator-assisted or cap-assisted mucosal resection were the chosen techniques.

Results: we resected 7 elevated lesions with high grade dysplasia in the context of Barrett's esophagus, 6 complete Barrett's esophagus with high grade dysplasia in 16 sequential sessions and 46 gastroduodenal superficial lesions (10 adenomas, 9 gastric superficial carcinomas, 18 carcinoid tumours and 9 lesions of different histological nature). Resections in the two first groups were complete in 100% of the cases, and in 97.9% of the cases in group C. Complications included 2 cases of limited deferred bleeding (groups A and B) and another two cases of stenosis with little clinical relevance in Group B.

Conclusions: a) endoscopic mucosal resection is an efficient technique for the treatment of proximal gastrointestinal tract superficial lesions; b) it is a safe procedure with a low percentage of complications, which can generally be managed endoscopically; and c) in contrast with other ablative techniques, endoscopic mucosal resection offers the possibility of a pathologic analysis of the samples.

Key words: Endoscopic mucosal resection. Barrett's esophagus. Superficial gastric carcinoma.

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ABBREVIATIONS

EMR: endoscopic mucosal resection.
ESD: endoscopic submucosal dissection.
BE: Barrett's esophagus.
HGD: high grade dysplasia.
NBI: narrow band imaging.

INTRODUCTION

Endoscopic mucosal resection (EMR) is an accepted and extended technique for the treatment of proximal gastrointestinal tract superficial lesions (1). Although Rosemberg initially introduced the submucosal injection of normal saline solution as an idea to assist polipectomy using a rigid sigmoidoscope in 1955 (2), then used by Dehyle in 1973 applied to flexible sigmoidoscopes (3), this procedure was principally developed in Japan in the 1980-1990's (4).

The main aim of this method is the curative treatment of those superficial lesions and neoplasms without lymph node involvement or distant metastases. Thus, its indication requires a correct disease staging which can include endoscopic, endosonographic, histological and sometimes radiographic criteria (1). In contrast with other ablative techniques, EMR permits a correct T staging as well as determining if an adequate oncologic treatment has been achieved (5,6). Endoscopic mucosal resection is used for the *en-bloc* excision of lesions smaller than 2 cm or for the

resection of greater lesions in various fragments, which is called a "piecemeal" resection (1). From a technical point of view, EMR includes several systematic steps of which submucosal injection is very useful; it allows the creation of a "security chamber" that minimizes the complication risks. Subsequent resection using a diathermy snare as well as forceps, band ligator and cap-assisted techniques can then be performed (7-11).

For the treatment of lesions greater than 2 cm endoscopic submucosal dissection (ESD) procedure has been developed. This technique uses several modified scalpels in order to make circumferential incisions and then proceed in the dissection from the submucosal layer. ESD achieves a greater number of *en-bloc* resections and presents smaller recurrence rates. However, complications due to deferred bleeding or perforation are more frequent, especially in centres with limited experience or when it is operated by endoscopists at the beginning of the learning curve (12-14).

OBJECTIVES

The aim of this study was to evaluate the efficacy and safety of EMR in superficial benign or malignant lesions at different sites in the proximal gastrointestinal tract.

PATIENTS AND METHODS

We carried out a retrospective study from January 2009 to December 2010 and a prospective study from this date onward until September 2011. Retrospective data were extracted from our computerized clinical history, which includes's entire health web from the year 2000 onwards. Working out of this setting is not permitted, and any medical act, comment or incidence must be registered in this system. Patients were collected using the "procedure" field (item name: "mucosal resection") appearing in the endoscopy report. This field is a default and obligatory item which must be always filled in. This way, consecutive patient inclusion was ensured from the beginning of data collection. Methodology and follow-up were similar in cases from the 2009-2011 period as well as in those cases of 2011, because they were based on protocols which were established in our department. Separate analyses for the samples of both periods were performed. A homogenous behaviour was found in the main variables of both subsamples. Thus, the sample was considered as a whole from then on. Minimization of bias and underestimation of certain variables such as complications was achieved this way. Forty one consecutive patients were included in our study (23 males and 18 females, mean age 61 ± 11.5 years, range 44-88). These patients underwent 59 EMR in 69 sessions. Three groups of pathologies were treated: elevated lesions with high grade dysplasia (HGD) in the context of Barrett's esophagus (BE) (group A), HGD appearing in random biopsies taken during the follow-up of BE (group B) and superficial gastroduodenal lesions (group C) (Tables I and II). These resections were performed by three endoscopists with experience in therapeutic endoscopy, and which use EMR in upper gastrointestinal tract, small bowel (enteroscopy) or large bowel in their ordinary practice.

Techniques used were loop resection after submucosal injection, band ligator-assisted resection and cap-assisted resection. Lesions were delimited preferably using high definition endoscopy and Narrow Band Imaging (NBI) (GIF H180, Olympus®). For lesions presenting poorly defined margins we systematically used chromoendoscopy with indigo carmine stain. In BE we occasionally attached a cap (Disposable distal Attachment D-201. Olympus®. Japan) to the end of the endoscope tube in order to prevent distortion caused by esophageal motility and to keep an adequate 2-4 mm focal distance from the mucosa. Lesions were marked using argon plasma with a 40 W power and a 1 lpm flux. Submucosal injection was performed with isotonic saline or glycerol 10-20% mixture solutions. We used the "Snare inflator POL 1-H3" (Medwork®) diathermy loop which combines injection and cut functions. For lesion cutting and coagulation "endo-cut" function with a 60-120 W power was always used. Band ligator-assisted EMR were performed using the "Duette-Multiband Mucosectomy" (Cook medical®), cap-assisted EMR were carried out with the EMR kit (Olympus®). Resection was considered complete when the excised piece showed lesion-free borders and when an absence of residual lesion was shown at least after one endoscopic control. Fragments from large lesions were fixed to paraffin blocks before they were sent to the Pathology Department. Special attention was put in determining whether the resections contained all of the lesion borders with the delimitation marks performed at the beginning.

Staging of the lesions was completed by CT scan and/or endoscopic ultrasonography if necessary. All procedures were made in outpatients and under deep sedation controlled by an anaesthesiologist. In extended or complex resections patients were discharged after a 24 hour observation period. All patients received information concerning the technique used, its possible complications and other available alternative treatments. Informed consent for EMR performance and for non-personal data treatment with scientific purposes was obtained from every patient. In addition, malignant neoplasm cases were evaluated by an interdisciplinary committee specialized in upper gastrointestinal tract tumours. Our centre's Ethics Committee gave its approval to our work. Patients were followed in our hospital's outpatient service and by endoscopic controls. Checkups were spaced according to the resected lesion types. Patients with malignant neoplasms underwent gastroscopies at 3, 6 and 12 months after resection. Further on, endoscopy was performed annually, with the exception of patients with multiple morbidities or those who refused monitoring. Data analysis was performed using the 16.0 version of SPSS statistics programme (SPSS Inc. Chicago. USA).

Table I. Type of lesion treated, location and applied technique

Patient number	*Sex/Age*	*Lesion description*	*Paris Classification*	*Size (mm)*	*Location*	*EMR technique*
1	♂ 79	4 elevated lesions with intramucosal adenocarcinoma over BE	0IIa	10,12,10,20	Distal esophagus	Cap-assisted 2 sessions
2	♂ 77	Adenocarcinoma with submucosal microinvasion over BE	0IIa	10	Distal esophagus	Cap-assisted 1 session
3	♂ 56	2 elevated lesions with HGD over BE	0IIa	18,18	Distal esophagus	Cap-assisted 1 session
4	♂ 51	Complete BE with HGD C3M5 resection	/	50	Distal esophagus	Band ligator-assisted 5 sessions
5	♂ 48	Complete BE with HGD C1M2 resection	/	20	Distal esophagus	Band ligator-assisted 2 sessions
6	♂ 44	Complete BE with HGD C4M5 resection	/	50	Distal esophagus	Band ligator-assisted 2 sessions
7	♂ 46	Complete BE with HGD C1M2 resection	/	20	Distal esophagus	Band ligator-assisted 2 sessions
8	♂ 48	Complete BE with HGD C3M4 resection	/	40	Distal esophagus	Band ligator-assisted 2 sessions
9	♂ 64	Complete BE with HGD C4M5.5 resection	/	55	Distal esophagus	Band ligator-assisted 3 sessions
10	♂ 74	2 gastric adenomas	0IIa	10,13	Antrum	Injection-diathermy loop
11	♂ 50	Gastric adenoma	0IIa+0IIc	30	Antrum	Injection-diathermy loop
12	♂ 69	Gastric adenoma	0Is	10	Body	Injection-diathermy loop
13	♂ 71	Gastric adenoma	0Is	10	Antrum	Injection-diathermy loop
14	♂ 63	Gastric adenoma	0IIa	15	Duodenum	Injection-diathermy loop
15	♂ 68	Gastric adenoma	0Is	10	Antrum	Injection-diathermy loop
16	♂ 60	Gastric adenoma	0IIa	20	Antrum	Injection-diathermy loop
17	♂ 71	Gastric adenoma	0IIa	15	Incisure	Injection-diathermy loop
18	♂ 69	Gastric adenoma	0IIa	20	Antrum	Injection-diathermy loop
19	♂ 63	2 gastric *in situ* adenocarcinomas	0IIa/0IIa+0IIc	10,20	Incisure	Cap-assisted/Injection-diathermy loop
20	♂ 74	Gastric *in situ* adenocarcinoma	0IIa+0IIc	20	Antrum	Injection-diathermy loop
21	♂ 70	Intramucosal gastric adenocarcinoma	0IIa	20	Antrum	Injection-diathermy loop
22	♂ 79	Gastric *in situ* adenocarcinoma	0Is	15	Body	Injection-diathermy loop
23	♂ 78	Gastric *in situ* adenocarcinoma	0IIa+0IIc	30	Antrum	Injection-diathermy loop
24	♂ 88	Gastric stump adenocarcinoma T1b	0Is	16	Body	Injection-diathermy loop/surgery
25	♂ 55	Gastric *in situ* adenocarcinoma	0IIa+0IIc	25	Antrum	Injection-diathermy loop
26	♂ 53	Intramucosal gastric adenocarcinoma	0Ip	22	Body	Band ligator-assisted
27	♂ 46	4 carcinoid tumours	0IIa	10,12,10,10	Body	Band ligator-assisted/Injection-diathermy loop
28	♂ 50	4 carcinoid tumours	0IIa	10,8,12,10	Body	Injection-diathermy loop
29	♂ 60	2 carcinoid tumours	0Is	15,15	Duodenum	Injection-diathermy loop
30	♂ 63	6 carcinoid tumours	0IIa	10	Body	Injection-diathermy loop
31	♂ 47	Carcinoid tumour	0IIa	10	Body	Injection-diathermy loop
32	♂ 71	Carcinoid tumour	0Is	16	Body	Injection-diathermy loop
33	♂ 72	Leiomyoma	0Is	10	Antrum	Injection-diathermy loop
34	♂ 60	Solitary hamartomatous polyp	0Is	20	Antrum	Injection-diathermy loop
35	♂ 46	Ulcerated ectopic pancreas	0Is	20	Antrum	Injection-diathermy loop
36	♂ 53	Inflammatory fibroid polyp	0Is	10	Antrum	Injection-diathermy loop
37	♂ 74	Lipoma	0Is	10	Duodenum	Injection-diathermy loop
38	♂ 63	Ectopic pancreas	0Is	10	Antrum	Injection-diathermy loop
39	♂ 58	Leiomyoma	0Is	15	Antrum	Injection-diathermy loop
40	♂ 64	Inflammatory fibroid polyp	0Is	10	Antrum	Injection-diathermy loop
41	♂ 71	Leiomyoma	0Is	10	Antrum	Injection-diathermy loop

BE: Barrett's esophagus; HGD: high grade dysplasia. Prague Classification of BE: length of the circumferential Barrett segment in cm (C), maximal length of BE (including tongues) in cm (M). Paris Classification: polypoid sessile lesion (0Is), polypoid pedunculated lesion (0Ip), non-polypoid and nonexcavated slightly elevated lesion (0IIa), non-polypoid and nonexcavated slightly depressed lesion (0IIc).

Table II. EMR results according to the treated pathology

	Group A	*Group B*	*Group C*
Pathology	*Elevated lesions with HGD in BE*	*Complete resection of BE with HGD in random biopsies*	*Gastroduodenal lesions*
Number of patients	3	6	32
*Number of EMR**	*7 EMR* -4 sessions	*6 EMR* -16 sessions -14.3 ± 9.9 (5-29) resected mucosa fragments/patient	*46 EMR* -10 adenomas -9 in situ carcinomas -18 carcinoid tumors -9 lesions of different nature
*Age (years)**	70.7 ± 12.7 (56-79)	50.2 ± 7.2 (44-64)	62 ± 10.6 (46-88)
Sex (♂/♀)	2 / 1	5 / 1	16/16
*Size (mm)**	14 ± 4.5 (10-20)	39 ± 15.6 (20-55)	Adenomas: 15 ± 6.5 (10-30) *In situ* carcinomas: 20 ± 5.8 (10-30) Carcinoid tumors: 11 ± 2 (10-16) Other lesions: 13 ± 4.4 (10-20)
Paris classification	7 0IIa lesions	/	0Ip: 2.2% 0Is: 37% 0IIa: 47.8% 0IIa+0IIc: 13%
Technique	Cap-assisted/ diathermy loop	Band ligator-assisted/diathermy loop	43: injection/diathermy loop 2: band ligator-assisted/ diathermy loop 1: cap-assisted/diathermy loop
Resection/ complete eradication	100%	100%	45/46: 97.9%
Complications:			
-Deferred bleeding	No	1/16 (6.25%/session)	1/46: 2.2%
-Need for transfusion	No	1/6 (16%/patient)	No
-Perforation	No	No	No
-Other complications	1 aspiration pneumonia	No Esophageal stenosis: 2/6 (33%), 1/6 (16%) required endoscopic dilation	No

*Values expressed as means, standard deviations and ranges.

RESULTS

Group A

Seven elevated lesions with HGD in the context of BE were treated in 3 patients (2 males, 1 female) that were classified as 0-IIa based on the Paris classification (15). Lesion mean size was 14 ± 4.5 mm, range 10-20. EMR were performed using cap-loop technique; favourable outcomes were achieved in all 3 cases. One of the patients developed aspiration pneumonia. No other complications were reported (Table II).

The first case was a 79 year old male with multiple morbidities. He had 4 elevated lesions, resected in 2 sessions, which showed intramucosal carcinoma in all of the 4 pieces. This patient rejected the treatment of the remaining BE, as well as a further follow-up endoscopies.

The second case was a 77 year old female who presented vascular co-morbidity. The endoscopist who carried out the resection found no difficulty in aspirating the lesion with the cap device. However, the histological analysis showed an adenocarcinoma with minimal superficial submucosal microinvasion. Both lateral and deep borders of the resected piece were lesion-free, and therefore EMR was considered complete. Due to the theoretical risk of lymphatic dissemination which exists in these cases, this patient was remitted for esophagectomy, and died during the post-operative period. Surgical piece analysis exhibited an absence of residual tumour or lymph-node invasion.

The third case was a 56 year old male with multiple morbidities in which surgery was ruled out because of high anaesthetic risk. Two elevated lesions with HGD were resected by EMR in one session. He died 3 months after the last resection due to complications concerning his chronic hepatic affection.

Group B

Complete BE eradication was performed in 6 patients (5 males and 1 female, mean age of 50.2 ± 7.2 years, range 44-64) after HGD was found in random biopsies taken during the follow-up of BE. These resections were done sequentially every 4 weeks using the Cook Multiband Mucosectomy®, making up a total of 16 EMR sessions. We consider the number of sessions an important fact which must be reported, as it allows the estimation of complication rates appearing per day or per session, and not only per patient. The first patient needed 5 sessions, the following 4 patients required 2 sessions (only 1 EB hemicylinder was taken per session in order to reduce esophageal stenosis risk). The last patient, who had the largest BE (55 mm), required 3 sessions in which 17, 10 and 2 mucosal fragments were sequentially resected. A total of 94 mucosal fragments were resected, with a mean number of 15.6 ± 9.9 (range 5-29) fragments per patient (Figs. 1 and *2*). BE typification was determined according to the Prague Classification, although BE's maximum length (39 ± 15.6, range 20-55) was the only parameter taken in account for the statistical analysis (16).

Fulguration with argon plasma was performed when any residual microisland including metaplastic mucosa persisted. This treatment was applied in every patient, although it was only administered over a small tissue extension. With the combination of both resection and fulguration with argon plasma, complete BE eradication was achieved in 100% of the cases. Complications consisted of a mild hemorrhage 24 hours after the first EMR session which did not require endoscopic treatment or transfusion; this makes a deferred bleeding rate of 6.25% out of the total number of sessions, and a 16% rate out of the total number of patients. Esophageal stenosis rate was 33% (2/6 patients). In one occasion, stenosis appeared after the first EMR, and was solved spontaneously during follow-up. Only one patient (16%) needed a single session of endoscopic dilation.

After complete BE eradication, endoscopic controls were planned quarterly during the first semester, then after six months and finally once a year. Median follow-up was 11 months (inter-quartile range of 15) and no recurrence was reported in this period.

Group C

Forty six lesions with a 14 ± 5.4 mm (range 10-30) mean size were resected in 32 patients (16 males, 16 females), whose mean age was 62 ± 10.6 years (range 46-88). Among the resected lesions there were 10 adenomas, 9 gastric superficial carcinomas (Fig. 3), 18 carcinoid tumours and 9 polypoid or subepithelial lesions of different histological nature. According to the Paris Classification, most lesions were 0-Is (37%) or 0-IIa (47.8%). Complete resection was achieved in 45 out of the 46 cases (97.9%). In the EMR of one of the gastric carcinomas, although the lesion had been correctly elevated previously, submucosal invasion was found. The histological study of the piece was difficult due to the artefact produced by the cauterization, and the depth of the invasion could not be determined. Surgical treatment was subsequently needed in this patient. As preventive measures against deferred bleeding, argon was applied on the mucosal defect in 37% of the lesions (with a 1 lpm flux and a 30 W power) and hemoclips were placed in 52.2% of the cases. These techniques were applied on seeping polypectomy scars, on visible vessels, or for a complete closure of mucosal defects according to the endoscopist's criteria. These procedures are being evaluated at our centre in a prospective study which has been designed for this purpose (17). One case of self-limited deferred bleeding was reported 24 hours after resection. It did not require endoscopic treatment or transfusion. No other complications appeared.

Out of our global results, the median endoscopic follow-up time in which patients were lesion-free was 12.5 months (inter-quartile range of 17.2). All of our patients except two, which are detailed in the elevated lesions section, were alive at the end of our study. Regarding hospital stay, uncomplicated EMR cases required 0.38 ± 0.8 hospitalization days (range 0-4) per session. Additional time required due to complications was 0.28 ± 1.1 days per session (range 0-7); this meant a mean total hospital stay of 0.67 ± 1.3 days per EMR session.

DISCUSION

EMR is one of the endoscopic techniques that has changed the therapeutic panorama concerning superficial gastrointestinal tract lesions and neoplasms (18).

Consecutive systematic steps must be followed in order to perform an EMR correctly. Initially, lesion limits are marked, generally using argon plasma. As we have previously explained, high definition with or without magnification, NBI and chromoendoscopy play an essential role in characterization and delimitation of these lesions. The experience acquired with NBI has made us choose this technique instead of conventional chromoendoscopy for many lesions of the proximal gastrointestinal tract, although both procedures are sometimes used complementarily. It is important to note that we have abandoned the staining methods for the BE study, because NBI precisely limits the metaplastic mucosa and also permits taking direct biopsies from areas which present mucosa irregularities or an altered microvascular pattern. An adequate focal distance to the mucosa (2-4 mm) is achieved by using transparent caps. Distortion caused by digestive motility is significantly avoided this way (19,20).

The second step consists of a submucosal injection with various solutions including saline solution, hypertonic saline solution, hydroxypropyl-methylcellulose, glycerol, hyaluronic acid, dextrose, albumin, fibrinogen and autologous blood. At this moment, an ideal acces-

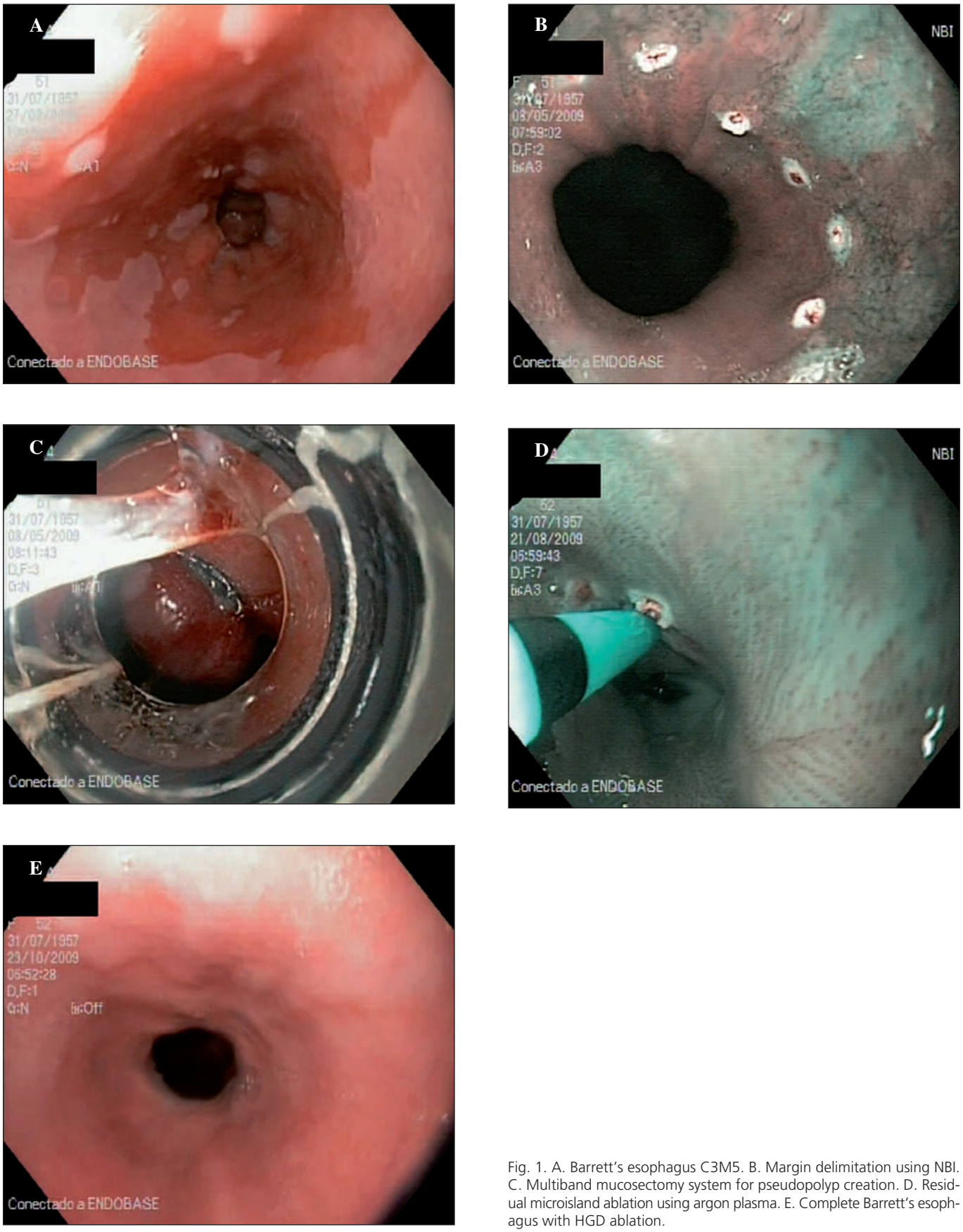

Fig. 1. A. Barrett's esophagus C3M5. B. Margin delimitation using NBI. C. Multiband mucosectomy system for pseudopolyp creation. D. Residual microisland ablation using argon plasma. E. Complete Barrett's esophagus with HGD ablation.

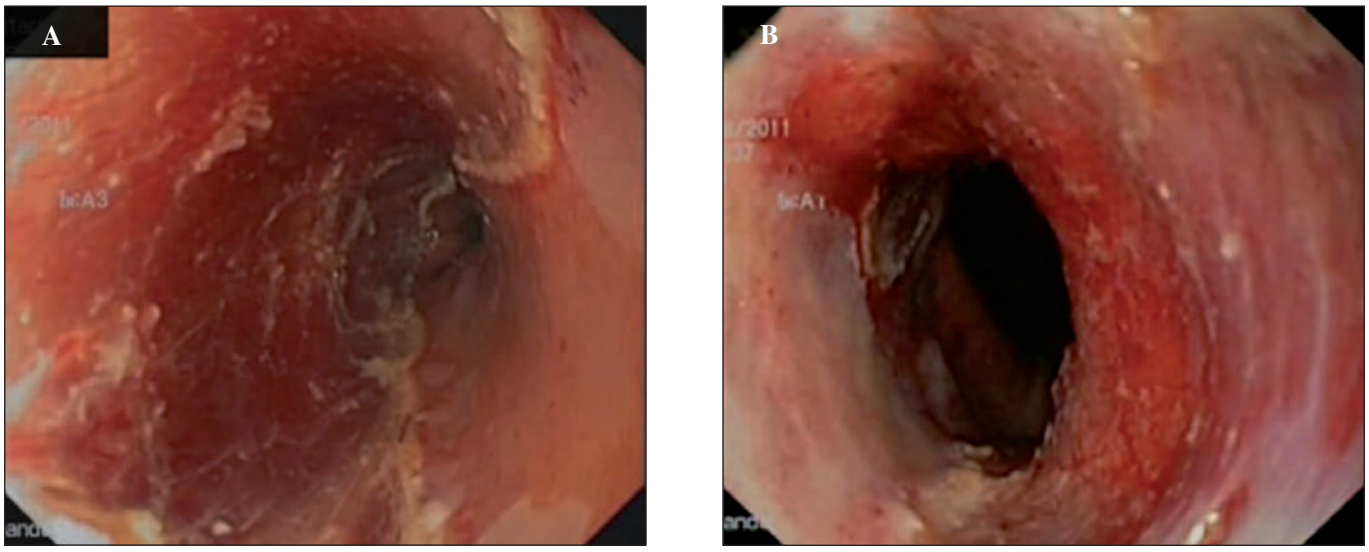

Fig. 2. BE with HGD C4M5.5; a two-step resection was performed in order to minimize esophageal stenosis risk.

sible, cheap, innocuous and long-lasting solution is not available (21-29). Similarly to what happens in colonic disease, lesions that are not correctly elevated by EMR should not be endoscopically resected, as invasion depth is almost always present (30). In our routine practise, saline or glycerol 10-20% mixture solutions are usually applied due to their accessibility and price. Although some studies have shown that glycerol is more long-lasting (26), we have found no subjective differences in previous "in vivo" experiences with ESD in animals. Disparity also exists in terms of volumes; each case requires different quantities in order to achieve an adequate elevation of the mucosa. As an exception, band-ligator assisted resections do not usually need submucosal injection; this permits the resection of a broader surface, with a highly safe profile (9).

Once the correct injection has been done, resection of the lesions can be either directly performed using a diathermy snare or it can be assisted by different techniques: forceps-assisted traction, cap-assisted resection or band ligator-assisted resection (4-7). Although we initially carried out cap-assisted resection for esophageal lesions, we later replaced this modality with band ligator-assisted resection because of its greater simplicity. We also applied band-ligator assisted resections on small sized lesions at other sites. Gastroduodenal lesions were generally resected using a diathermy loop after a submucosal injection. This method permits obtaining larger fragments compared to other resection methods.

EMR is used for treating benign and malignant superficial neoplasms, especially of the proximal gastrointestinal tract esophageal superficial adenocarcinomas developing over BE lesions and early gastric cancer (1,5-11).

Nowadays, treatment possibilities of HGD in BE include surgical resection, ablation using radiofrequency and endoscopic resection. EMR obtains large treatment rates, higher than 95%, with a low recurrence index (9,31-33), and it also permits treating complete BE segments and metachronous lesions that can appear during the follow-up (34).

In comparison with surgery, morbidity and mortality occurring in EMR is notably less. In contrast, up to 50% of the patients having a radical BE resection can show a certain degree of stenosis. This percentage is reduced to 25% if the procedure is done sequentially. Other complications such as deferred bleeding or perforation are rare (31,35). Mortality is practically null in EMR, whereas conventional surgical treatment, performed at highly experienced centres with a large volume of patients, can reach up to 3% mortality (32,36).

In contrast to ablative therapies, EMR permits the recovery of the resected piece and therefore a further histological analysis, which can modify the staging of the lesions (37). However, although we consider EMR the most reasonable option for the initial treatment of these lesions, it does not exclude other treatment techniques. EMR can be complemented with radiofrequency and it can also be the diagnostic test that refers some of these patients to surgical treatment.

In our series, complete resections in elevated lesions with HGD and eradication of BE with HGD has been achieved in 100% of the cases. Only one case of bleeding with no clinical relevance and two cases of mild stenosis which permitted the endoscope passing through it were reported. A fact worth reiterating is that one of the cases of stenosis was solved spontaneously during follow-up and only one of the patients (16%) required a single session of endoscopic dilation. We have not found any metachronous lesions during our study, although our follow-up period is still limited.

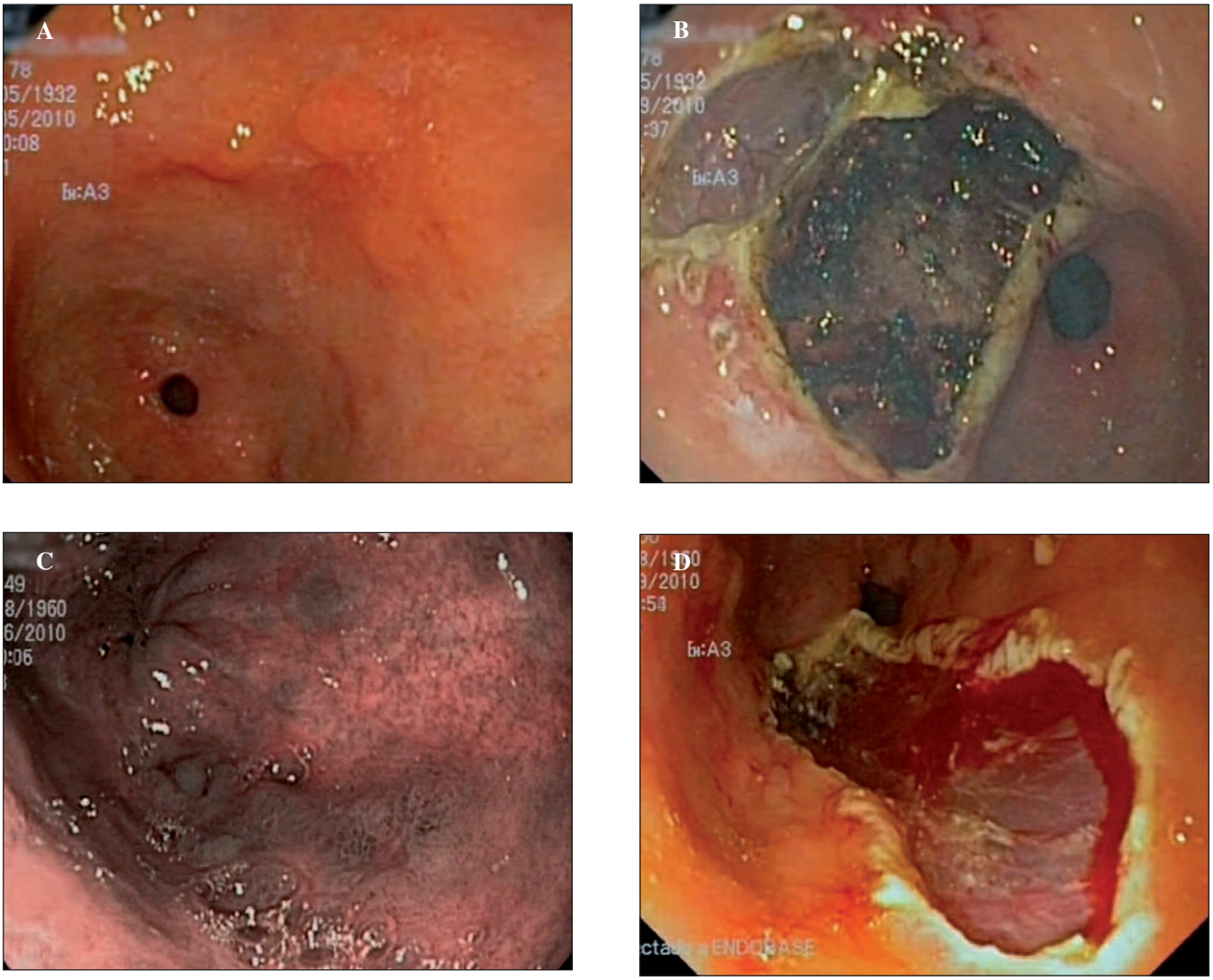

Fig. 3. Resection of two gastric *in situ* carcinomas.

EMR also constitutes a valid alternative in the treatment of early gastric cancer. This technique, as well as ESD, is widely established in several Asian countries where there is a high incidence of gastric cancer and defined screening programmes exist (6,38-41).

Indications for endoscopic treatment are based on the expanded criteria of the Japanese Gastric Cancer Association: any size intramucosal differentiated-type non-ulcerated gastric cancer, intramucosal differentiated-type ulcerated gastric cancer less than 3 cm in diameter, differentiated-type gastric cancer with less than 500 micrometer submucosal invasion and less than 3 cm in diameter, and intramucosal undifferentiated-type non-ulcerated gastric cancer less than 2 cm in diameter (39).

ESD is preferred to EMR for lesions larger than 20 mm, in which en-bloc resection is difficult, because EMR-associated recurrence can reach 4 to 15% of the cases. In western countries, particularly in Spain, ESD is still a poorly extended technique. Training is complex due to the lower prevalence of gastric cancer, the absence of early detection programmes and because of the difficulty to achieve a correct learning curve. Additionally, ESD has higher complication rates, such as deferred bleeding and perforation, especially in centres with limited experience (40-42).

At the moment, the accepted endoscopic procedure for the treatment of early gastric cancer in our country is still EMR, although some groups have reported results from initial experiences in ESD with porcine "ex vivo" and "in vivo" models or short series of patients (43,44).

When compared to surgical outcomes, EMR shows a greater risk of metachronous neoplasms in patients with superficial gastric cancer. Nevertheless, these patients could be efficiently treated with EMR, achieving a similar long-term global mortality with either method (45).

Our series includes 10 adenomas and 9 mucosa-limited adenocarcinomas. In all of our cases a complete macro-

scopic resection was achieved, although one of the patients presented a pT1b stage (submucosal affection) and had therefore indication for surgical treatment. No cases of recurrence have been reported in our study although we must make clear that our follow-up time is still limited. Hospital stay and economic cost seem visibly favourable to EMR; studies show that surgical-related costs can be even double when compared to EMR (45). In our series, mean hospital stay was less than one day per session.

Obviously, EMR is not an innovative technique, since it was described more than 25 years ago (4). The most important medical data bases contain numerous articles related of this procedure, most of which have been written in Asian countries. In contrast, literature coming from our country is limited (46-49).

This paper, with its methodological limitations which in our opinion have been overcome with the information collection method and with the sample homogeneity shown in the analysis of the two sub-samples, reports one of the largest series published in our country. Furthermore, a wide variety of pathologies which can be treated with EMR have been described; this means our paper goes beyond the extent of a monographic study.

We consider that EMR's role in the eradication of BE with HGD is worth highlighting. In contrast with other ablative procedures, EMR permits a pathological study of the lesions which allows a correct staging and subsequent treatment if needed. Additionally, a correct indication of EMR in the remaining pathologies avoids unnecessary surgical interventions. We also believe that the experience obtained in the EMR method is an essential step in the ESD learning process.

In conclusion, EMR is an efficient technique for the treatment of upper gastrointestinal tract lesions and superficial neoplasms. It is a safe procedure, with a low number of complications which can be endoscopically treated in most cases.

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