

## Digestive Endoscopy

# Effectiveness of Endoscopic Ultrasonography during Double Balloon Enteroscopy for characterization and management of small bowel submucosal tumours



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## ABSTRACT

**Background:** Characterization of small bowel submucosal tumours is challenging, requiring additional investigations. Endoscopic Ultrasonography performed during Double Balloon Enteroscopy, appeared a promising technique although it has not been fully evaluated. The aim was to determine the effectiveness of this technique for characterization and management of sub mucosal tumours in a large cohort of patients.

**Methods:** Patients with suspected small bowel tumours, who underwent Endoscopic Ultrasonography performed during Double Balloon Enteroscopy in our Institution between 2005 and 2013, were reviewed. Demographic data, clinical, endoscopic and radiological findings, therapeutic management, final diagnosis and follow-up were analyzed.

**Results:** 30 patients (19 male; median age 61.5) affected by submucosal tumours were included in the study. Endoscopic Ultrasonography performed during Double Balloon Enteroscopy was successfully performed in all cases providing a correct characterization of 19 submucosal tumours (63%). Based on the ultrasonographic characteristics 8 patients were treated endoscopically, 16 were referred to surgery, and 6 were managed conservatively.

**Conclusion:** Our results suggest that Endoscopic Ultrasonography performed during Double Balloon Enteroscopy is a safe and useful technique for submucosal tumours characterization. This procedure may be applied in clinical practice when small bowel tumours are encountered, to confirm the diagnosis and provide the most appropriate management.

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## 1. Introduction

Until the advent of small bowel capsule endoscopy (SBCE) [1] and Double Balloon Enteroscopy (DBE) [2], small bowel tumours (SBT) were considered a rare disease accounting for approximately 3–6% of all gastrointestinal (GI) neoplasms and 1–3% of all GI malignancies [3]. However, several studies indicated that the incidence of SBT is around 6–20% in specific subgroups of patients that required an endoscopic or radiologic evaluation [4–7]. In this scenario, submucosal tumours (SMT), defined as any intramural

growth underneath the small bowel mucosa are more frequently encountered but their differentiation remains challenging.

Endoscopic Ultrasound (EUS) became world-widely used only from the last decades, following the improvements of endoscopic and ultrasound technologies [8]. The recent development of EUS miniprobe applicable during DBE has allowed the characterization of several small bowel (SB) lesions with encouraging results [8–14]. However, the use of EUS during DBE (DBE-EUS) is still infrequent and the characterization of SMT using this novel technique has not been fully investigated.

The aim of this retrospective study was to evaluate the impact of DBE-EUS on the management of small bowel SMT.

## 2. Materials and methods

Data of DBE-EUS procedures, performed between January 2005 and March 2013 at Nagoya University Hospital, including patients

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demographics, indications, route, endoscopic findings and follow-up were prospectively recorded.

### 2.1. DBE procedure

Insertion route (oral or rectal) was defined based on the SBT localization on SBCE and/or on CT scan. Overnight fast was adopted for both approaches, while bowel preparation consisting of 2 Polyethylenglicol and one sachets of Sodium Picosulfate were also administered the day before the procedure for rectal DBE. Written consent was obtained from patients before the examination. All procedures were performed with patients under conscious sedation and analgesia using intravenous Midazolam and Pentazocine.

The principles of DBE insertion technique have been previously described [2,15]. Since the EUS catheter diameter measured 2.6 mm, DBE-EUS was performed using exclusively the therapeutic enteroscope (EN-450T5, t-type, Fujifilm, Kanagawa, Japan) in addition to a video processor (EPX-4400 HD, Fujifilm, Kanagawa, Japan) and a pressure controlled pump (PB-20 balloon control unit, Fujifilm, Kanagawa, Japan). The T5 enteroscope has a 2.8 mm working channel diameter and a 9.5 mm outer diameter; the working length is 200 cm and the flexible overtube measures 145 cm.

All procedures were performed using CO<sub>2</sub> as insufflating agent. Biopsies and/or endoscopic therapy were applied if required. If the “targeted lesion” was not found during the first DBE, a reference India-ink tattoo was placed to indicate the maximum depth of insertion [16] of the scope and a further procedure was attempted via the opposite route in a distinct occasion.

### 2.2. EUS procedure

When a suspected SBT was encountered, both DBE balloons were inflated to ensure stability and to facilitate the water fill of the small bowel section involved in the examination [12]. An ultrasound miniprobe (Fujinon EUS miniprobe P2726, Fujifilm, Kanagawa, Japan; measuring 2620 mm of length and 2.6 mm of diameter) connected to the Endoscopic Ultrasound System was then passed through the working channel and EUS was performed. The type of ultrasound miniprobe was initially selected depending on the endoscopic aspect of the lesion: 12 MHz miniprobe was used for large and protruding lesions, 20 MHz miniprobe was used for small lesions or ulcerations and 15 MHz for further assessment. Echogenicity, and/or internal characteristics, size and numbers of layers involved were evaluated.

### 2.3. SBCE

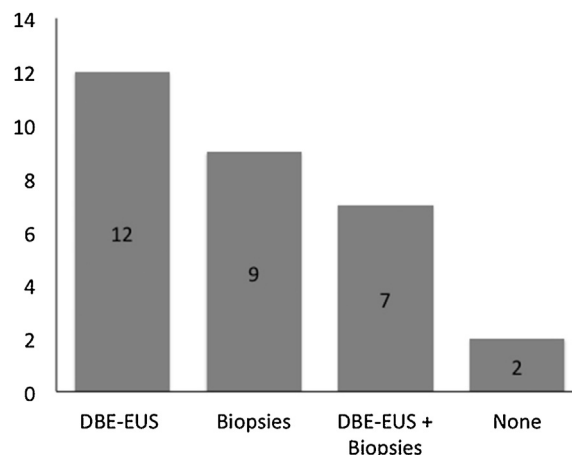
SBCE (PillCam SB and SB2; Given Imaging, Ltd, Yokneam, Israel) was performed before DBE-EUS for suspected SBT or obscure gastrointestinal bleeding. Bowel preparation for SBCE was not required; patients had a light dinner and overnight fasting.

### 2.4. Statistical analysis

The statistical software package SPSS for Windows (SPSS Inc., Chicago, USA) was used to analyze the data. Chi-square test or Fisher exact test were used for analyses of diagnostic rate and lesion characterization of SMT. In all analyses, a *p* value of less than 0.05 was considered statistically significant.

This study has been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Because of the nature of the study (retrospective), informed consent was not applicable. No identifying information about participants is available in the article and anonymity was preserved.



**Fig. 1.** SMT characterization rate provided by Endoscopic Ultrasound during Double Balloon Enteroscopy or biopsies. Abbreviations: Endoscopic Ultrasound during Double Balloon Enteroscopy (DBE-EUS); Small Bowel Tumour involving the Mucosa (m-SBT); not Small Bowel Tumour (not-SBT); Submucosal Tumour (SMT).

## 3. Results

Between January 2005 and March 2013, DBE-EUS was performed in 30 patients (19 males and 11 females) with a suspected SMT on CT scan or found during a previous DBE examination. The median age was 61.5 years (range: 25–81). Indications for DBE-EUS were obscure gastrointestinal bleeding in 18 patients (60%), suspected submucosal mass identified at CT scan in 6 patients (20%), stenosis in 4 patients (14%), abdominal pain and diarrhoea in 1 patient, respectively (3%).

DBE-EUS was successfully performed in all 30 patients, providing complete endosonographic information for 23/30 SMT (Table 1). Adverse events including perforation, pancreatitis and bleeding did not occurred. Depth grading of the lesion was described in 26 patients, size in 28 and echogenicity in 26. Endosonographic information were completely missing in one patient diagnosed with SB pancreatic cancer invasion.

DBE-EUS successfully characterized 19/30 (63%) SMT: 8/9 gastrointestinal stromal tumours (GISTs), 3/7 ectopic pancreas, 2/4 lymphangiomas, 3/3 haemangiomas, 1/2 pancreatic invasions, 0/2 lipomas, 1/1 carcinoid, 1/1 metastatic tumour and 0/1 leiomyoma.

Endoscopic biopsies were taken during 23/30 (77%) DBE-EUS providing a correct diagnose of 16 SMT (53%): 4/9 GISTs, 3/7 ectopic pancreas, 3/4 lymphangiomas, 0/3 haemangiomas, 1/2 pancreatic invasion, 2/2 lipomas, 1/1 carcinoid, 1/1 metastatic tumour and 1/1 leiomyoma.

Out of 30 SMT, 12 (40%) were characterized only by DBE-EUS while other diagnostic tools such as SBCE, abdominal CT scan and biopsies were not diagnostic or erroneous (Table 2, Fig. 1); in addition, DBE-EUS characterization was confirmed by histological analysis in another 7/30 (23%) patients. On the other hand, DBE-EUS failed to established the nature of 11/30 (37%) SMT, nine of which were correctly identified by endoscopic biopsies, while the remaining two SMT with negative biopsies, initially classified as GIST at DBE-EUS were referred for surgery, resulting ectopic pancreas afterwards (Table 2, Fig. 1).

Based on the endosonographic information provided during DBE-EUS (Table 1) 8 SMT arising from the 2nd/3rd layer were endoscopically treated: 4 SMT (1 pancreatic rest, 2 lipomas and 1 leiomyoma) were successfully resected by endoscopic mucosal resection, 2 haemangiomas were clipped and 2 lymphangiomas were incised; 8/9 patients had a complete remission, while 1/9 died for causes not related with the endoscopic procedure.

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