Beyond Palliation: Using EUS-Guided Choledochoduodenostomy with a Lumen-Apposing Metal Stent as a Bridge to Surgery. A Case Series

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INTRODUCTION

Endoscopic ultrasonography-guided choledochoduodenostomy (EUS-CD) for distal biliary obstructions due to malignancies in cases of a failed endoscopic retrograde cholangiopancreatography (ERCP), using a lumen-apposing metal stent (LAMS) is widely documented and its use is increasingly taken into consideration [1, 2]. Giovannini et al. [3] proposed the first EUS-guided biliary drainage, in 2001 and during the years this technique has been improved and a novel algorithm in the event of failed ERCP has been proposed [4].

ABSTRACT

We present five cases of pylorus-preserving pancreaticoduodenectomy (PPPD) after endoscopic ultrasonography-guided choledochoduodenostomy (EUS-CD) using a lumen-apposing metal stent (LAMS) as a bridge to surgery in patients with resectable distal malignant biliary obstruction and failed endoscopic retrograde cholangiopancreatography (ERCP). The patients underwent an EUS-CD using EC-LAMS, the bile duct being accessed using the transbulbar approach. The technical success rate of EUS-CD was 100%. No procedure-related adverse events occurred. All patients underwent PPPD with a technical success rate of 100%. The presence of a transduodenal LAMS did not impede surgery. No biliary or duodenal fistula occurred in the patients. Pancreatic fistulas with late bleeding were observed in two patients (one fatal). These few cases indicate that PPPD after EUS-CD using LAMS is feasible and safe. EUS-CD should be performed irrespective of the stage of the disease, also for patients fit for surgery. Additional larger prospective studies are required to confirm this preliminary data, in particular for possible interference with postoperative outcomes.

Key words: lumen-apposing metal stent – endoscopic ultrasound – EUS-guided choledochoduodenostomy – bridge-to-surgery – biliary drainage.

CASE SERIES

Five patients (mean age 75.6 ± 8.5 years), diagnosed with distal bile duct malignancy and failed ERCP. Patients and clinical characteristics are outlined in Table I. Endoscopic retrograde cholangiopancreatography failure was due to infiltration of the papilla by invasive cancer in 3 patients (60%), inability to get...
Deep biliary cannulation despite different alternative techniques in two patients (40%) (Fig. 1). We decided to perform EUS-CD for biliary drainage, during the same session of the ERCP.

### Table I. Demographic data and characteristics of patients

| Patient | Age (years) | Reason for failed ERCP | Etiology of biliary obstruction | Diameter of common bile duct, (mm) | Stent (mm) | Procedure time, (min) | Post procedure hospital length stay (days) | Delay between EUS-CD and surgery (days) |
|---------|-------------|------------------------|---------------------------------|-------------------------------------|-----------|-----------------------|------------------------------------------|----------------------------------------|
| 1       | 86          | IP                     | pancreatic cancer               | 18.2                                | 8x8       | 8                     | 3                                        | 31                                     |
| 2       | 63          | IDBC                   | ampullary cancer                | 18                                  | 8x8       | 5                     | 3                                        | 27                                     |
| 3       | 80          | IP                     | pancreatic cancer               | 15                                  | 8x8       | 5                     | 2                                        | 36                                     |
| 4       | 74          | IDBC                   | distal cholangiocarcinoma        | 30                                  | 10x10     | 5                     | 3                                        | 48                                     |
| 5       | 75          | IP                     | pancreatic cancer               | 20                                  | 8x8       | 7                     | 3                                        | 31                                     |

ERCP: endoscopic retrograde cholangiopancreatography; IP: infiltration of the papilla; IDBC: inability to get deep biliary cannulation; EUS-CD: Endoscopic ultrasonography guided choledochoduodenostomy

Fig. 1. Endoscopic view showing inability to get deep biliary cannulation despite fistulotomy in a patient with infiltration of the papilla by invasive cancer.

**EUS-CD technique**

The EUS procedures were performed using Linear array Olympus GF-UCT-180 series echoendoscopes (Olympus Europe, SE & CO, KG, Hamburg, Germany) and Pentax EG3870UTK (Pentax, Tokyo, Japan). The procedures were performed with carbon dioxide insufflation on patients under deep sedation or under general anesthesia at the discretion of an anesthesiologist. The bile duct was accessed using the transbulbar approach for all patients (Figs. 2, 3). We used the study device electrocautery-enhanced lumen apposing metal stent (EC-LAMS) delivery system and AXIOS Stent (Hot-Axios), Boston Scientific Corp., Marlborough, Massachusetts, USA. The EC-LAMS catheter was then inserted in the working channel and the delivery system was connected to the electrosurgical generator (settings: pure cut mode, 100 Watts, ICC 200, ERBE (AUTOCUT mode, effect 5; ERBE Electrosurgery, Tübingen, Germany). Once the delivery catheter was inside the common bile duct the stent was deployed completely under EUS guidance, as previously described [7].

The technical success rate of EUS-CD was 100%, with a mean procedural time of 6 min (range 5-8 min). No procedure-related adverse events occurred. Clinical success was achieved in all of these patients (100%) with a reduction in the total bilirubin level of 12.84 ± 3.81 mg/dl (81.95 %) within two weeks of the initial levels (Fig. 4). Median post-procedure hospitalization was 2.8 (range 2-3) days. After a median period of 34.6 ± 8.14 days surgery was attempted.

**Surgical technique**

Abdominal access was established and the entire abdomen was examined for the detection of any abnormalities or
peri-anastomotic pseudo-aneurysm, which resulted in multi-
the other case involved a late massive bleeding, probably from
bleeding, successfully treated with angiographic embolization;
fistula occurred in two patients, in one case it caused a late
follow-up was 145.2 ± 77.97 days.

In four cases, 8x8 mm EC-LAMS were placed, while in one
patient a 10x10 mm was used. These dimensions indicate
the length and the diameter of the stent, but do not consider
the range diameter of the anchor flanges, which measure 17
mm for the 8x8 mm and 10x10 mm for 21 mm EC-LAMS. Notwithstanding the increased diameter of the anchor flanges, the
LAMS did not interfere with subsequent surgery, in particular with pylorus preservation and biliary and gastric
reconstruction. The two pancreatic fistulas, with subsequent
late bleeding due to vessel erosion by the pancreatic juice
were related to the soft texture of pancreatic parenchyma; it is
unlikely that these major complications could have been linked
to the EUS-CD by EC-LAMS.

metastases. The duodenum was mobilized and the portal vein
and the superior mesenteric vein (SMV) were identified, so
that a tunnel was dissected posterior to the pancreatic neck
and anterior to the SMV and portal vein. Cholecystectomy
was performed, and the common hepatic duct was transected
up to the choledocoduodenostomy.

After identification of the common hepatic artery, right
gastric artery and gastroduodenal artery, the duodenum was
transected about 2 cm distally to the pylorus, the pancreas at
the neck and the jejunum approximately 15 cm from the ligament
of Treitz. The jejunal limb was brought up to the right of the
middle colic vessels in a retrocolic manner, and the blind end
was placed near the pancreatic remnant. Negative resection
margin status on the frozen section of the specimen was con-
firmed before reconstruction.

An end-to-side pancreaticojejunostomy (PJ) or
pancreaticogastrostomy (PG) was then performed. An end-
to-side hepaticejejunostomy was performed about 10 cm
distally and an antecolic end-to-side duodenal-jejunostomy
was performed about 40 cm distal to the biliary anastomosis.

All the five patients underwent PPPD with hepatico-
jejunostomy with a technical success rate of 100%. Pancreaticojejunostomy was performed in three patients and
PG in the two other patients. The presence of a transduodenal
EC-LAMS was not an impediment to surgery (Fig. 5). Three
patients started adjuvant chemotherapy because lymph nodes
involvement was detected at the histologic specimen. The mean
follow-up was 145.2 ± 77.97 days.

No cases of biliary or duodenal fistula occurred. Pancreatic
fistula occurred in two patients, in one case it caused a late
bleeding, successfully treated with angiographic embolization;
the other case involved a late massive bleeding, probably from
peri-anastomatic pseudo-aneurysm, which resulted in multi-
organ failure, and the patient died 35 days after surgery.

DISCUSSION

This case series confirms that EUS-CD could be considered
a compelling first therapeutic alternative option when
ERCP fails for patients affected by distal malignant biliary
obstruction. All patients in our series underwent an EUS-CD
during the same session as ERCP, avoiding the need for a
second procedure. Given its new releasing system, EC-LAMS
has remarkably reduced the time of stent placement during
EUS-CD, with a mean of 6 minutes in our case series, instead
of the 31 minutes reported with the self expandable metal
stent (SEMS) [5].

The technical success rate in our case series was 100%,
similar with the technical success rates reported in the largest
studies in which both LAMS and EC-LAMS were used [6, 8, 9].

The short time of procedure and the high technical success
rates should be considered as important factors to encourage
endoscopists skilled in interventional EUS-guided procedures
to perform EUS-CD in cases of failed ERCP, even during the
same session. Clinical outcome results are also convincing. For
all five patients there was a decrease in total serum bilirubin
level of 81.95% within two weeks, and they underwent surgery
with normal bilirubin levels. According to ESGE-guidelines
[10], all the patients underwent pre-operative drainage because
of the long waiting lists and the risk of a delayed surgery. In
our series, indeed, the time between biliary drainage and sur-
gery was 34.6 ± 8.14 days. Because the indications for EUS-CD
with LAMS after failed ERCP are restricted to patients unfit
for surgery or inoperable because of the advanced stage of
disease, to date there are no data on the impact of the LAMS
on the surgical outcomes.

A recent randomized study comparing EUS-CD and ERCP
as primary treatment for biliary obstruction in pancreatic
cancer [11] reported that 5 of the 33 patients of the EUS-CD
cohort underwent PPPD after neoadjuvant chemotherapy;
the presence of the stent was not an impediment to surgery.
However, the stent used in this group of patients was a SEMS
8 mm x 60 mm. Our case series is the first report on patients
who underwent pancreatic surgery after EUS-CD with EC-LAMS,
with encouraging results for this new approach.

In four cases, 8x8 mm EC-LAMS were placed, while in
one patient a 10x10 mm was used. These dimensions indicate
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unlikely that these major complications could have been linked
to the EUS-CD by EC-LAMS.
This case series indicates the possible efficacy of the EUS-CD: the high rates of technical and clinical success, the low rates of adverse events, in particular without any case of post procedure pancreatitis. The possibility of performing biliary drainage during the same session as ERCP should encourage the possibility of performing EUS-CD in all patients with previously failed ERCP, irrespective of the stage of the disease, thus including also those patients considered fit for surgery or for neoadjuvant chemotherapy.

**CONCLUSION**

Judging by our limited case series, the presence of the EC-LAMS does not affect subsequent surgery. Needless to say, larger and prospective studies will need to be done in order to confirm our data and better define possible interference on postoperative outcomes.

**Conflicts of interest:** No conflicts to declare.

**Authors’ contribution:** C.F., A.F., C.B., A.A. reviewed the literature, collected the data, wrote and revised the manuscript; A.Z. wrote and revised the manuscript; A.R., V.C., E.J. reviewed the literature and revised the manuscript. All authors approved the final version of the manuscript.

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