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REVIEW ARTICLE

Palliative management for malignant biliary obstruction and gastric outlet obstruction from pancreatic cancer

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Abstract

Pancreatic cancer is among the leading causes of gastrointestinal cancer-related death, with a dismal prognosis. Over 80% of pancreatic cancer patients present with advanced disease, making curative resection unfeasible. These patients are often presented with malignant biliary obstruction (MBO) and gastric outlet obstruction (GOO). In these cases, palliative management is aimed to alleviate symptoms, enhance quality of life, and facilitate subsequent chemotherapy. Currently, neoadjuvant chemotherapy is frequently used in both borderline resectable and resectable pancreatic cancer, necessitating effective biliary and gastrointestinal drainage in a growing number of patients. Traditionally, surgical bypass was the gold standard, performed via either a minimally invasive or open approach. However, notable progress has emerged in developing endoscopic techniques, such as endoscopic retrograde cholangiopancreatography (ERCP) stenting for MBO and endoscopic enteral stenting for GOO. While these procedures provide rapid symptom relief, they are associated with higher stent dysfunction rates and more frequent re-intervention needs. When ERCP fails, percutaneous transhepatic biliary drainage is a widely accepted alternative for MBO. Endoscopic ultrasound (EUS)-guided techniques, including EUS-guided biliary drainage and EUS-guided gastroenterostomy, have recently gained prominence. Emerging clinical data suggest that these methods may be superior, potentially becoming the preferred first-line palliative treatment for unresectable pancreatic cancer. This review will summarize the current evidence on managing MBO and GOO in patients with pancreatic cancer.

KEYWORDS
biliary tract, drainage, gastric outlet, obstruction, pancreatic neoplasms

1 | INTRODUCTION

Pancreatic cancer is associated with poor prognosis, with an overall 5-year survival of 13% across all stages.[1] In 2024, it is estimated that 66 440 new cases of pancreatic cancer will be diagnosed in the United States, and 51 750 people will die from this disease. Surgery remains the only potential cure, but this option is viable only if the tumor is identified at a resectable stage. Unfortunately, at the time of diagnosis, up to 80% of pancreatic cancer patients are deemed unresectable due to extensive vessel involvement or distant metastasis.[2]

In advanced stages of pancreatic cancer, the tumor often infiltrates or compresses the biliary tract, duodenum, or gastric outlet, leading to malignant biliary obstruction (MBO) or gastric outlet obstruction (GOO). MBO can result in complications such as cholangitis or liver dysfunction, while GOO may cause symptoms like decreased oral intake, nausea, and vomiting. These obstructions significantly diminish patients' quality of life and performance status and deprive them of the opportunity to receive further anti-cancer treatment. Therefore, prompt and appropriate management is essential to alleviate these symptoms.

Historically, surgical bypass procedures, such as choledocho(hepatico)jejunostomy and gastrojejunostomy, were the primary treatment for MBO and GOO in patients with unresectable pancreatic cancer.[3,4] Minimally invasive surgical techniques, including robotic or laparoscopic approaches, have been introduced as alternatives.[5–7] Endoscopic stenting has currently become the first-line treatment due to its convenience and minimally invasive nature.[8,9] Percutaneous transhepatic biliary drainage (PTBD) is an alternate approach after failed endoscopic retrograde cholangiopancreatography (ERCP).[10] Recently, endoscopic ultrasound (EUS)-guided techniques have emerged as a novel platform for managing MBO and GOO, with increasing utilization in clinical practice.[11,12] Patients with unresectable pancreatic cancer need effective control of their MBO and GOO before the chemotherapy.[13–16]

In this article, we aim to review the treatment strategies for MBO and GOO from the perspective of surgeons within a multidisciplinary team, drawing on the latest clinical evidence.

1.1 | Treatment of MBO

Painless jaundice caused by MBO is perceived as a common symptom in patients with pancreatic head cancer, affecting approximately 80% of this population.[17] Jaundice patients are at high risk of developing complications such as cholangitis and organ failure involving the liver, kidney, and heart. Clinically, these patients may experience pruritus, pain, diarrhea, and malnutrition due to fat malabsorption, all of which severely impact their quality of life. Prompt management of MBO through either surgical or nonsurgical biliary drainage is crucial, with consideration given to a variety of influencing factors (Table 1).[18] For patients with potentially resectable pancreatic cancer, preoperative biliary drainage is indicated when patients have acute cholangitis, severe hyperbilirubinemia, the necessity of neoadjuvant chemotherapy, or the need to improve performance status.[19] However, routine preoperative biliary drainage for resectable pancreatic cancer is not recommended due to the increased risk of drainage-related complications such as bleeding, pancreatitis, and wound infections.[20]

Endoscopic retrograde cholangiopancreatography (ERCP) with biliary stent placement is currently the first-line nonsurgical treatment for MBO, with percutaneous transhepatic biliary drainage (PTBD) serving as a backup option. Surgical biliary drainage may be considered for the following indications: (1) the expertise of ERCP or PTBD is not feasible or available; (2) persistent MBO after ERCP stent or PTBD due to stent migration or disease progression; (3) pancreatic cancer is deemed unresectable during a curative-intent operation.[18] Roux-en-Y choledocho(hepatico)jejunostomy is the most widely accepted and performed surgical bypass procedure. Choledocho(hepatico)jujunostomy connects the common bile duct or hepatic duct and the jejunum with tension-free anastomosis. Choledochoduodenostomy is used less frequently and is typically reserved for cases where mesocolon invaded by pancreatic cancer prevents the use of a standard jejunal Roux limb.[21]

Publications on surgical bypass procedure showed low rates of recurrent jaundice 1.5% (0%–2.1%). However, open surgical bypass carries a significant high risk of postoperative complications (49.5%, range 20.0%–60.0%), and 30-day mortality reaching up to 16.3%(0%–24.0%) in some randomized controlled trials (RCTs), likely due to the combination of gastroenterostomy (51.2%) in these surgical bypass groups.[22–25] Currently, laparoscopic and robot-assisted approaches, owing to their minimally invasive nature, have been recognized as effective treatment options for managing MBO.[6,26,27] However, no RCTs have been conducted to compare minimally invasive surgical bypass with open surgical bypass procedure.

Since its first development as a diagnostic tool in 1968, ERCP has progressed into a therapeutic procedure.[28] ERCP with transpapillary stenting has been an effective and safe method for relieving biliary obstruction and enhancing quality of life.[29] Clinical success rates for ERCP are high (88.0%, 95%CI: 79.1–93.4), but its complication rates (15.6%, 95%CI: 10.9–21.9), and reintervention rates (12.7%, 95%CI: 5.4–27.0) still pose challenges.[30,31] Post-ERCP complications include pancreatitis, bleeding, acute cholangitis, and perforation, along with stent-related issues like migration, occlusion, and cholecystitis, often necessitating reintervention.[32] Compared to surgical biliary drainage, ERCP was associated with lower procedure-related complications (risk difference[RD], −0.24, $p<0.001$), and reduced 30-day mortality (RD, −0.07, $p=0.05$), though it has a relatively higher rate of recurrent jaundice (RD, 0.30, $p<0.001$).[33] There are several types of stents that can be used for biliary drainage, including plastic stents and self-expandable metal stents (SEMSs). Robust evidence supports the use of SEMSs over plastic stents, as they offer higher stent patency (weighted mean difference [WMD], +4.45 months, $p=0.04$) and fewer reinterventions (odds ratio [OR], 0.37, $p<0.001$).[34] The 2022 American College of Gastroenterology guideline suggests SEMSs over plastic stents for draining malignant extrahepatic biliary stricture.[19] However, no specific design of SEMSs (covered, partially-covered, and uncovered) has demonstrated a clear advantage in clinical outcomes for patients with unresectable or borderline resectable pancreatic cancer.[35]

PTBD is a valuable rescue method when ERCP fails, particularly in patients with unsuccessful biliary cannulation, surgically altered anatomy, or duodenal obstruction.[36] PTBD involves the sterile cannulation of a peripheral biliary radicle after percutaneous puncture, followed by imaging-guided wire and catheter manipulation, and the placement of a tube or stent for external and/or internal drainage. However, PTBD can be difficult to perform in patients with ascites,

TABLE 1 Comparison of surgical bypass, ERCP, PTBD, and EUS-BD approaches for the management of malignant biliary obstruction.

	Surgical bypass	ERCP	PTBD	EUS-BD
Clinical success rates	88.7%	88.0%	78.4%	89.0%
Reintervention rates	1.5%	12.7%	42.2%	9.8%
Specifical complications	Anastomotic leaks (bile and jejunum), wound infection	Pancreatitis, cholecystitis, stent dysfunction	Bile leak, hepatic and biliary bleeding, tube dislodgement	Bile leak, perforation, stent migration
Strengths	Widely available, less reintervention	Widely available, shorter length of stay	Widely available, effective in advanced hilar obstruction	Less pancreatitis and longer stent patency
Weaknesses	Higher complication rate and mortality	Higher risk of pancreatitis and cholecystitis	External drainage, more reintervention, risk of tumor seeding	Safety issue, reimbursement issue
Limitations of the indication	Not suitable for patients in poor performance status	Inaccessible papilla in patients with surgically altered anatomy, or duodenal obstruction	Multiple liver metastasis, ascites, bleeding tendency, non-dilated bile duct	Technical complexity, difficulty in training, bleeding tendency, non-dilated bile duct

Abbreviations: ERCP, endoscopic retrograde cholangiopancreatography; EUS-BD, endoscopic ultrasound-guided biliary drainage; PTBD, percutaneous transhepatic biliary drainage.

extensive liver metastases, or a tendency to bleed. Clinical success rates for PTBD are generally good (78.4%, 95%CI: 71.2–85.6), but complications (27.0%, 95%CI: 21.1–32.9) and reintervention rates (42.2%, 95%CI: 29.1–55.4) remain concerns.[37] Complications include bile leakage, portal vein or hepatic artery injury and bleeding into the biliary tract, abscess formation, and cholangitis, with the most worrisome being tumor seeding along the catheter tract.[8,38]

A national-wide retrospective analysis comparing PTBD and ERCP for biliary drainage in pancreatic cancer patients found that PTBD was associated with a higher rate of adverse events (6.2% vs. 2.9%, $p<0.001$).[39] Similarly, a single-center retrospective study noted that patients after upfront surgery for resectable pancreatic cancer who underwent preoperative PTBD had increased liver metastasis (44.8% vs. 23.3%, $p=0.02$) when compared with no-PTBD patients and worse overall survival (median survival time, 17.5 vs. 22.4, 28.9 months, $p=0.002$) when compared with ERCP and no biliary drainage patients.[40] However, another multi-center retrospective study observed a higher major complication rate (21.9% vs. 9.7%, $p=0.001$) after pancreaticoduodenectomy in ERCP patients compared to PTBD patients, with comparable liver metastasis rate (27.4% vs. 31.4%, $p=0.50$), disease-free (26.0 vs. 25.6 months, $p=0.73$) and overall survival (27.4 vs. 25.1 months, $p=0.94$) between PTBD and ERCP in pancreatic cancer.[41]

More recently, endoscopic ultrasound-guided biliary drainage (EUS-BD) has emerged as an effective method for biliary drainage after unsuccessful ERCP.[10,42] In cases where ERCP fails, EUS-BD can be performed immediately in the same session, providing the advantage of draining bile internally, similar to ERCP.[43] EUS-BD can be carried out through different techniques, such as transmural stenting, antegrade stenting, and rendezvous techniques, with transmural stenting being the representative method.[44] Transmural stenting can be achieved through two approaches: EUS-guided hepaticogastrostomy (EUS-HGS) via the intrahepatic duct and EUS-guided choledochoduodenostomy (EUS-CDS) via the common bile duct.[45] The clinical success, complications, and reintervention rates of EUS-BD were 89.0% (95%CI: 80.9–93.9), 8.3% (95%CI: 4.3–15.5), and 9.8% (95%CI: 6.00–15.5).[30] Procedure-related complications commonly include bile leakage, cholangitis, bleeding, and perforation. Stent-related complications may encompass stent mal-deployment, dislodgement, and occlusion.[46]

In a meta-analysis of 24 studies comparing EUS-BD with PTBD in patients with biliary obstruction after failed ERCP, the technical success rate (96.9% vs. 97.1%, $p=0.59$) and procedure-related mortality (0.5% vs. 2.0%, $p=0.08$) were comparable between the two methods. However, EUS-BD was associated with a higher clinical success rate (90.6% vs. 78.4%, $p<0.001$), lower reintervention rate (10.7% vs. 42.2%, $p<0.001$), and decreased hospital stay (14.4 vs. 8.1 days, $p=0.002$).[37]

EUS-BD also has been compared with ERCP in six RCTs for primary drainage of distal MBO.[47–51] A systemic review and meta-analysis of these trials reported similar technical success (risk ratio [RR], 1.05, $p=0.25$), clinical success rates (RR, 1.02, $p=0.55$), and overall adverse events (RR, 0.58, $p=0.24$) when EUS-BD compared with ERCP. However, the results showed less procedure-related pancreatitis (RR, 0.15, $p=0.01$) and tumor in/overgrowth (RR, 0.28, $p<0.01$) favoring EUS-BD.[30] Two other systematic reviews and meta-analysis also yielded similar findings.[31,52] The outcomes of patients undergoing surgical resection after EUS-BD for malignancy remain unclear, with one multi-center retrospective study enrolled 156 patients reporting lower overall surgical complications (77.3% vs. 93.7%, $p=0.01$) and shorter postoperative length of stay (17 vs. 20 days, $p=0.01$) in the EUS-BD group, albeit with a higher incidence of revision surgery (20.5% vs. 8.0%, $p=0.05$) and a marginally increased postoperative death rate (9.3% vs. 2.7%, $p=0.09$).[53] Due to the insufficient availability of high-quality evidence, EUS-BD is not currently recommended as the primary biliary drainage in patients who may undergo surgery or in borderline resectable patients where surgery could still become an option following chemotherapy. In

these cases, ERCP should remain the first-line therapy, with EUS-BD being considered if ERCP fails or for unresectable MBOs in clinical practice.[46,54]

1.2 | Treatment of GOO

Malignant gastric outlet obstruction (GOO) occurs when pancreatic cancer causes a mechanical blockage in the pyloric region or the proximal duodenum. Approximately 10%–25% of patients with pancreatic cancer experience GOO, which often manifests as nausea, bloating, vomiting, and abdominal pain. This condition significantly impacts patients' quality of life, delays cancer treatment, and indicates a poor prognosis.[21] Some experts preferred to adapt the patient's diet with prokinetics and continue chemotherapy, delaying GOO treatment as much as possible while waiting for complete occlusion. However, it is important to recognize that maintaining an appropriate nutritional status is closely linked to better oncological outcomes.

Palliative treatment options for patients with GOO focus on re-enabling the passage of food and liquids at the site of obstruction or creating a new gastrointestinal pathway to bypass the blockage. Historically, some studies recommended performing prophylactic surgical gastrojejunostomy (SGJ) in patients who were found with unresectable periampullary cancer during exploratory laparotomy to reduce the incidence of late GOO.[3,4] However, more recent studies demonstrated that surgical bypass does not necessarily prevent future occurrences of GOO, and patients undergoing chemotherapy after a prophylactic double bypass have shorter median overall survival compared to those who only undergo exploratory laparotomy in unresectable pancreatic cancer (16.3 vs. 10.3 months, $p=0.04$).[55,56] Therefore, it is pivotal to carefully consider the timing and indication for SGJ in pancreatic cancer patients to avoid unnecessary delays or over-intervention. Although both endoscopic and surgical options are available, no gold standard currently exists, and various factors must be considered (Table 2). The main factors influencing treatment decisions include life expectancy, patient frailty, and the oncological stage.

Open SGJ was once the primary treatment for GOO, where a side-to-side anastomosis between the stomach and the jejunum below the level of obstruction is performed, either antecolically or retrocolically. Although SGJ is generally effective, with a clinical success rate of 85.8% (95%CI: 79.8–90.2), it carries a complication rate of 27.7% (95%CI: 21.8–34.5), a 30-day mortality rate of 8.2% (95%CI: 4.4–14.8), and a reintervention rate of 10.3% (95%CI: 7.6–13.8).[57] The main complications remain delayed gastric emptying (DGE), wound infection, postoperative bleeding, and anastomotic leaks. The introduction of minimally invasive surgical approaches, laparoscopic or robotic SGJ, has led to improved clinical outcomes. Compared with open-SGJ, laparoscopic-SGJ has been associated with an earlier oral intake recovery and a shorter length of stay.[58,59] Some surgeons have further refined the SGJ technique by adding partial stomach partitioning to ensure more complete passage of food into the jejunum.[60] Compared to conventional SGJ, the stomach-partitioning SGJ has been associated with lower rates of DGE, higher rates of normal oral intake, and a potential survival benefit.[61] A recent network meta-analysis suggested that stomach-partitioning SGJ was one of the optimal approaches regarding clinical success (97.2%, 95%CI: 89.5–99.3, *p*-scores: 0.95) and reintervention rates (0%, 95%CI: 0.0–100.0, *p*-scores: 0.90).[57]

However, the high complication rate associated with SGJ and the increased availability of high-quality gastrointestinal endoscopy has led to the increased use of endoscopic enteral stenting (ES) as an effective modality to treat GOO, particularly in patients with a short life expectancy or those who are not suitable surgical candidates. The overall clinical success, complications, 30-day mortality, and reintervention rates of ES were 89.6% (95%CI: 84.7–93.0), 15.8% (95%CI: 11.8–20.8), 6.3% (95%CI: 3.2–12.1), and 25.3% (95%CI: 20.1–31.4).[57] Under endoscopic and/or fluoroscopic guidance, a wire is passed through the stenosis or the obstruction, and then an enteral SEMS is deployed to alleviate the obstruction. SEMS can be covered, partially covered, or uncovered. Covered SEMS was associated with less tumor ingrowth and less reintervention rate, while uncovered SEMS was associated with less migration rate.[62] Partially

TABLE 2 Comparison of SGJ, ES, and EUS-GE approaches for the management of malignant gastric outlet obstruction.

	SGJ	ES	EUS-GE
Clinical success rates	85.8%	89.6%	90.2%
Reintervention rates	10.3%	25.3%	7.4%
Specifical complications	Delayed gastric emptying, wound infection, postoperative bleeding, and anastomotic leaks	Stent occlusion and migration	Perforation, stent migration
Strengths	Widely available, longer patency, less reintervention	Widely available, shorter length of stay	Longer stent patency, less reintervention
Weaknesses	Higher complication rate and mortality, longer length of stay	Higher reintervention rate	Safety issue, reimbursement issue
Limitations of the indication	Not suitable for patients in poor performance status	Unsuccessfully pass through the obstruction site	Technical complexity, difficulty in training, unsuccessfully pass through the obstruction site

Abbreviations: ES, endoscopic enteral stenting; EUS-GE, endoscopic ultrasound-guided gastroenterostomy; SGJ, surgical gastrojejunostomy.

covered SEMS has not significantly improved the reintervention rate or stent patency.[63]

Extensive comparative studies have thoroughly evaluated SGJ and ES. A meta-analysis of 31 studies with 2444 GOOs (SGJ: 1076, ES: 1368) demonstrated that SGJ was associated with higher technical success (OR, 4.30, $p=0.003$) and lower reintervention rates (OR, 0.28, $p<0.001$) but required a longer hospital stay (WMD, +7.95 days, $p=0.003$) than ES. No significant differences (SGJ vs. ES) were found in clinical success rates (OR, 1.26, $p=0.67$), adverse events (OR, 1.90, $p=0.15$), and overall survival (hazard ratio [HR], 0.55, $p=0.159$) in pancreatic cancer patients between the two groups.[64] Another recent systematic review and meta-analysis of 39 studies involving 5244 GOOs (SGJ: 2116, ES: 3128) revealed that ES resulted in a shorter length of stay (WMD, −8.43 days, $p<0.001$), shorter time to oral intake of liquids (WMD, −4.79 days, $p<0.001$) and solids (WMD, −4.36 days, $p<0.001$), and fewer surgical site infections (RR, 0.30, $p=0.01$), while the SGJ patients experienced longer overall survival (WMD, +24.77 days, $p=0.02$), lower reintervention rates (RR, 0.38, $p<0.001$), and were more likely to undergo palliative chemotherapy (RR, 1.23, $p=0.004$).[65] According to the American Society for Gastrointestinal Endoscopy guideline on the role of endoscopy in the management of GOO, ES is recommended in patients who are poor surgical candidates with a life expectancy of less than 6 months and who prioritize early resumption of oral diet and discharge from the facility. SGJ is preferentially recommended for patients with a life expectancy longer than 6 months and a good performance status.[66]

Recently, endoscopic ultrasound-guided gastroenterostomy (EUS-GE) has been introduced, benefiting from the rapid development of interventional endoscopic ultrasound. EUS-GE allows for the endoscopic placement of a fully covered, bi-flanged metal stent to create a transmural tract between the stomach and the jejunum. Since its introduction by Binmoeller and Shan in 2012, EUS-GE has been adopted rapidly with evolving techniques and reliable outcomes.[67] The overall clinical success, complications, 30-day mortality, and reintervention rates of EUS-GE were 90.2% (95%CI: 76.9–96.2), 13.3% (95%CI: 6.6–25.1), 0% (95%CI: 0.0–100.0), and 7.4% (95%CI: 3.2–16.1), respectively.[57] Adverse events with EUS-GE seem to decrease as operator experience increases.[68–70] Meanwhile, Jovani et al. found that proficiency and mastery were achieved after 25 and 40 cases, respectively.[71]

A large comparative study exploring long-term outcomes was conducted with 436 GOOs from two centers (EUS-GE: 232, ES: 131, SGJ: 73). Compared with ES and SGJ, EUS-GE demonstrated significantly higher clinical success rates (98.3% vs. 91.6%, 90.4%, $p<0.001$), and lower reintervention rates (0.9% vs. 12.2%, 13.7%, $p<0.001$).[70] Notably, the SGJ group had better performance status (ECOG: 0.4 vs. 1.2, 1.5, $p<0.001$), lower rates of symptomatic GOOs (90.4% vs. 99.6%, 99.2%, $p<0.001$) and peritoneal carcinomatosis (9.6% vs. 11.6%, 19.8%, $p=0.05$) than those of EUS-GE and ES groups.[70]

Another large multicenter retrospective study of 310 GOOs (EUS-GE: 187, SGJ: 123) set out to compare EUS-GE and SGJ. The two groups had no differences in mortality (48.1% vs. 50.4%, $p=0.78$), technical (97.9% vs. 100%, $p=0.15$), and clinical success (94.1% vs. 94.3%, $p=1.00$) rates. However, patients who underwent EUS-GE had lower rates of adverse events (11.9% vs. 17.9%, $p=0.003$), shorter time intervals to chemotherapy resumption (16.6 vs. 37.8 days, $p<0.001$), quicker oral intake recovery (1.4 vs. 4.1 days, $p<0.001$), and decreased length of stay (5.3 vs. 8.5 days, $p<0.001$), but higher reintervention rates (15.5% vs. 1.6%, $p<0.001$). Patients in the EUS-GE group were older (67.5 vs. 61.6 years, $p<0.001$), with lower albumin levels (2.95 vs. 3.33 g/dL, $p<0.001$), higher chances of having ascites (27.3% vs. 10.6%, $p<0.001$), and higher rates of using chemotherapy (47.1% vs. 26.0%, $p<0.001$) at the time of GOO diagnosis compared with the SGJ group.[72] EUS-GE also appears to have similar efficacy and superior clinical outcomes compared to laparoscopic SGJ and robotic SGJ for unresectable GOOs.[72,73]

In a comparison between EUS-GE and ES, a recent international multi-center RCT (97 GOOs, EUS-GE: 48, ES: 49) found that EUS-GE was associated with higher stent patency (median stent patency not reached in either group, $p<0.001$), lower reintervention rates within 6 months (4.2% vs. 28.6%, $p=0.002$), and shorter hospital stays (4.0 vs. 6.0 days, $p=0.013$). There were no significant differences between ES and EUS-GE in 30-day mortality (12.2% vs. 20.8%, $p=0.286$), technical success (100% vs. 95.8%, $p=0.242$), clinical success (91.8% vs. 100%, $p=0.117$), 30-day adverse events (24.4% vs. 22.9%, $p=1.00$), and quality of life scores at 1 month.[74]

These studies highlight the advantage of EUS-GE over SGJ and ES for GOO patients who are malnourished or in more advanced stages of their disease. However, an international practice survey from the European Pancreatic Club on the management of GOO due to pancreatic cancer found that ES (249/290, 85.9%) was the most commonly chosen treatment, followed by laparoscopic SGJ (220/290, 75.9%), open SGJ (195/290, 67.2%), and EUS-GE (162/290, 55.9%). The choice as a gold standard treatment was ES (76/168, 45.2%), EUS-GE (33/168, 19.6%), and SGJ (16/168, 9.5%) for gastroenterologists, while ES (24/98, 24.5%), EUS-GE (8/98, 8.2%), and SGJ (24/98, 24.5%) for surgeons.[75] The EUS-GE has a trend toward the primary treatment for GOO, notably among gastroenterologists and at high-volume centers. However, its availability remains limited, with the learning curve being a perceived barrier. Additionally, there is still some uncertainty about the feasibility and safety of EUS-GE. More RCTs are needed to validate its effectiveness and safety, especially compared to laparoscopic or robotic SGJ in resectable or borderline resectable pancreatic cancer patients with GOO before or during their neoadjuvant chemotherapy.[76]

2 | CONCLUSIONS

Advances in the palliative management of GOO and MBO in patients with pancreatic cancer have significantly improved symptom relief and enhanced quality of life. Treatment options now include surgical, interventional, or endoscopic approaches, often requiring a multidisciplinary team to determine the most appropriate strategy. This

decision is based on factors such as the balance of benefits and risks, the patient's performance status, disease stage, and life expectancy.

In patients with resectable or borderline resectable pancreatic cancer who are surgical candidates, current guidelines recommend biliary drainage primarily for MBO cases involving cholangitis, delayed surgery, or relief of jaundice in those scheduled to receive neoadjuvant chemotherapy. In these scenarios, ERCP or PTBD with internal stenting is generally preferred over EUS-BD. For GOO patients who are planning for surgical resection but need preoperative treatment, minimally invasive SGJ is advised for those with good performance status, while ES is suggested for those with poor performance status.

In unresectable pancreatic cancer with MBO, both ERCP and EUS-BD are viable options when experts in these procedures are available. EUS-BD, including EUS-CDS and EUS-HGS, may be preferable over ERCP in patients with surgically alerted anatomy, concurrent GOO, and when ERCP is unsuccessful or anticipated to be challenging. For unresectable GOO, ES remains the most widely used treatment, while EUS-GE has gained increasing attention as a durable and reliable modality, especially for patients with significant comorbidities or concurrent MBO. SGJ is now reserved for patients with recurrent GOO or unsuccessful stenting, particularly in patients with a life expectancy over 6 months and good performance status. For patients found to be unresectable during curative-intent surgery, surgical bypass should be reserved exclusively for patients who were symptomatic prior to surgery. It is widely recognized that each treatment approach has its own strengths and limitations, and the choice should be tailored to the patient's specific needs and the expertise available at the treating institution.

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Pengfei Wu: Writing – original draft; writing – review and editing. **Kai Chen:** Writing – review and editing. **Jin He:** Supervision; writing – review and editing.

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The authors declare no conflict of interest for this article.

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REFERENCES

1. Siegel RL, Giaquinto AN, Jemal A. Cancer statistics, 2024. CA Cancer J Clin. 2024;74:12–49.
2. American Cancer Society. Cancer Facts & Figures 2024. Atlanta: American Cancer Society; 2024.
3. Lillemoe KD, Cameron JL, Hardacre JM, Sohn TA, Sauter PK, Coleman JA, et al. Is prophylactic gastrojejunostomy indicated for unresectable periampullary cancer? A prospective randomized trial. Ann Surg. 1999;230:322–8.
4. Van Heek NT, De Castro SM, van Eijck CH, van Geenen RC, Hesselink EJ, Breslau RJ, et al. The need for a prophylactic gastrojejunostomy for unresectable periampullary cancer: a prospective randomized multicenter trial with special focus on assessment of quality of life. Ann Surg. 2003;238:894–902.
5. Rothlin MA, Schob O, Weber M. Laparoscopic gastro- and hepaticojejunostomy for palliation of pancreatic cancer: a case controlled study. Surg Endosc. 1999;13:1065–9.
6. Lai EC, Tang CN. Robot-assisted laparoscopic hepaticojejunostomy for advanced malignant biliary obstruction. Asian J Surg. 2015;38:210–3.
7. Hirata Y, Katz MHG, Ikoma N. Robotic duodenojejunostomy bypass for metastatic pancreatic body cancer. J Gastrointest Surg. 2022;26:1115–6.
8. Nehme F, Lee JH. Preoperative biliary drainage for pancreatic cancer. Dig Endosc. 2022;34:428–38.
9. Canakis A, Irani SS. Endoscopic treatment of gastric outlet obstruction. Gastrointest Endosc Clin N Am. 2024;34:111–25.
10. Lau KW, Rimbas M, Tripodi G, Larghi A. Endoscopic ultrasound biliary drainage in pancreatic cancer. J Gastrointestin Liver Dis. 2023;32:545–53.
11. Takeda T, Sasaki T, Okamoto T, Sasahira N. Endoscopic double stenting for the Management of Combined Malignant Biliary and Duodenal Obstruction. J Clin Med. 2021;10:10.
12. Rizzo GEM, Carrozza L, Rancatore G, Binda C, Fabbri C, Anderloni A, et al. The role of endoscopy in the palliation of Pancreaticobiliary cancers: biliary drainage, Management of Gastrointestinal Obstruction, and role in relief of oncologic pain. Cancers (Basel). 2023;15:5367.
13. Kang J, Lee SH, Choi JH, Paik WH, Ahn DW, Jeong JB, et al. Folfirinox chemotherapy prolongs stent patency in patients with malignant biliary obstruction due to unresectable pancreatic cancer. Hepatobiliary Pancreat Dis Int. 2020;19:590–5.
14. Eshmuminov D, Aminjonov B, Palm RF, Malleo G, Schmocker RK, Abdallah R, et al. FOLFIRINOX or gemcitabine-based chemotherapy for borderline Resectable and locally advanced pancreatic cancer: a multi-institutional, patient-level, meta-analysis and systematic review. Ann Surg Oncol. 2023;30:4417–28.
15. Wainberg ZA, Melisi D, Macarulla T, Pazo Cid R, Chandana SR, de la Fouchardière C, et al. NALIRIFOX versus nab-paclitaxel and gemcitabine in treatment-naive patients with metastatic pancreatic ductal adenocarcinoma (NAPOLI 3): a randomised, open-label, phase 3 trial. Lancet. 2023;402:1272–81.
16. Vanella G, Bronswijk M, van Wanrooij RL, Dell'Anna G, Laleman W, van Malenstein H, et al. Combined endoscopic mAnagement of BiliaRy and gastrIc OutLET obstruction (CABRIOLET study): a multicenter retrospective analysis. DEN Open. 2023;3:e132.
17. Strasberg SM, Gao F, Sanford D, Linehan DC, Hawkins WG, Fields R, et al. Jaundice: an important, poorly recognized risk factor for diminished survival in patients with adenocarcinoma of the head of the pancreas. HPB (Oxford). 2014;16:150–6.
18. Arshad SA, Phuoc VH. Surgical palliation of biliary obstruction: bypass in the era of drainage. J Surg Oncol. 2019;120:65–6.
19. Elmunzer BJ, Maranki JL, Gomez V, Tavakkoli A, Sauer BG, LimketKai BN, et al. ACG clinical guideline: diagnosis and Management of Biliary Strictures. Am J Gastroenterol. 2023;118:405–26.
20. Scheufele F, Schorn S, Demir IE, Sargut M, Tieftrunk E, Calavrezos L, et al. Preoperative biliary stenting versus operation first in jaundiced patients due to malignant lesions in the pancreatic head: a meta-analysis of current literature. Surgery. 2017;161:939–50.

21. Perinel J, Adham M. Palliative therapy in pancreatic cancer-palliative surgery. Transl Gastroenterol Hepatol. 2019;4:28.
22. Smith AC, Dowsett JF, Russell RC, Hatfield AR, Cotton PB. Randomised trial of endoscopic stenting versus surgical bypass in malignant low bileduct obstruction. Lancet. 1994;344:1655–60.
23. Shepherd HA, Royle G, Ross AP, Diba A, Arthur M, Colin-Jones D. Endoscopic biliary endoprosthesis in the palliation of malignant obstruction of the distal common bile duct: a randomized trial. Br J Surg. 1988;75:1166–8.
24. Andersen JR, Sorensen SM, Kruse A, Rokkjaer M, Matzen P. Randomised trial of endoscopic endoprosthesis versus operative bypass in malignant obstructive jaundice. Gut. 1989;30:1132–5.
25. Artifon EL, Sakai P, Cunha JE, Dupont A, Filho FM, Hondo FY, et al. Surgery or endoscopy for palliation of biliary obstruction due to metastatic pancreatic cancer. Am J Gastroenterol. 2006;101:2031–7.
26. Berti S, Ferrarese A, Feleppa C, Francone E, Martino V, Bianchi C, et al. Laparoscopic perspectives for distal biliary obstruction. Int J Surg. 2015;21(Suppl 1):S64–S67.
27. Kim EY, Lee SH, Hong TH. Palliative laparoscopic roux-en-Y choledochojejunostomy as a feasible treatment option for malignant distal biliary obstruction. Surg Today. 2022;52:1568–75.
28. Kozarek RA. The past, present, and future of endoscopic retrograde Cholangiopancreatography. Gastroenterol Hepatol (N Y). 2017;13:620–2.
29. Abraham NS, Barkun JS, Barkun AN. Palliation of malignant biliary obstruction: a prospective trial examining impact on quality of life. Gastrointest Endosc. 2002;56:835–41.
30. Barbosa EC, Santo P, Baraldo S, Nau AL, Meine GC. EUS- versus ERCP-guided biliary drainage for malignant biliary obstruction: a systematic review and meta-analysis of randomized controlled trials. Gastrointest Endosc. 2024;100:e398.
31. Gopakumar H, Singh RR, Revanur V, Kandula R, Puli SR. Endoscopic ultrasound-guided vs endoscopic retrograde Cholangiopancreatography-guided biliary drainage as primary approach to malignant distal biliary obstruction: a systematic review and meta-analysis of randomized controlled trials. Am J Gastroenterol. 2024;119:1607–15.
32. Vozzo CF, Sanaka MR. Endoscopic management of pancreaticobiliary disease. Surg Clin North Am. 2020;100:1151–68.
33. Alves de Lima SL, Bustamante FAC, Hourneaux de Moura EG, Bernardo WM, Artifon ELA, Chaves DM, et al. Endoscopic palliative treatment versus surgical bypass in malignant low bile duct obstruction: a systematic review and meta-analysis. Int J Hepatobiliary Pancreat Dis. 2015;5:35–45.
34. Almadi MA, Barkun A, Martel M. Plastic vs. Self-expandable metal stents for palliation in malignant biliary obstruction: a series of meta-analyses. Am J Gastroenterol. 2017;112:260–73.
35. Park CH, Park SW, Jung JH, Jung ES, Kim JH, Park DH. Comparative efficacy of various stents for palliation in patients with malignant extrahepatic biliary obstruction: a systematic review and network meta-analysis. J Pers Med. 2021;11:11.
36. Swan MP, Bourke MJ, Williams SJ, Alexander S, Moss A, Hope R, et al. Failed biliary cannulation: clinical and technical outcomes after tertiary referral endoscopic retrograde cholangiopancreatography. World J Gastroenterol. 2011;17:4993–8.
37. Giri S, Seth V, Afzalpurkar S, Angadi S, Jearth V, Sundaram S. Endoscopic ultrasound-guided versus percutaneous Transhepatic biliary drainage after failed ERCP: a systematic review and meta-analysis. Surg Laparosc Endosc Percutan Tech. 2023;33:411–9.
38. Wang L, Lin N, Xin F, Ke Q, Zeng Y, Liu J. A systematic review of the comparison of the incidence of seeding metastasis between endoscopic biliary drainage and percutaneous transhepatic biliary drainage for resectable malignant biliary obstruction. World J Surg Oncol. 2019;17:116.
39. Inamdar S, Slattery E, Bhalla R, Sejpal DV, Trindade AJ. Comparison of adverse events for endoscopic vs percutaneous biliary drainage in the treatment of malignant biliary tract obstruction in an inpatient National Cohort. JAMA Oncol. 2016;2:112–7.
40. Strom TJ, Klapman JB, Springett GM, Meredith KL, Hoffe SE, Choi J, et al. Comparative long-term outcomes of upfront resected pancreatic cancer after preoperative biliary drainage. Surg Endosc. 2015;29:3273–81.
41. Yamamoto Y, Sugiura T, Esaki M, Takahashi Y, Arita J, Hashimoto M, et al. Impact of biliary drainage method before pancreaticoduodenectomy on short- and long-term outcomes in patients with periampullary carcinoma and obstructive jaundice: a multicenter retrospective analysis. Surgery. 2024;176:616–25.
42. Giovannini M, Moutardier V, Pesenti C, Bories E, Lelong B, Delpero J. Endoscopic ultrasound-guided bilioduodenal anastomosis: a new technique for biliary drainage. Endoscopy. 2001;33:898–900.
43. Han SY, Kim SO, So H, Shin E, Kim DU, Park DH. EUS-guided biliary drainage versus ERCP for first-line palliation of malignant distal biliary obstruction: a systematic review and meta-analysis. Sci Rep. 2019;9:16551.
44. Mazur R, Trna J. Principles of palliative and supportive care in pancreatic cancer: a review. Biomedicine. 2023;11:11.
45. Eisenberg I, Gaidhane M, Kahaleh M, Tyberg A. Drainage approach for malignant biliary obstruction: a changing paradigm. J Clin Gastroenterol. 2023;57:546–52.
46. van der Merwe SW, van Wanrooij RLJ, Bronswijk M, Everett S, Lakhtakia S, Rimbas M, et al. Therapeutic endoscopic ultrasound: European Society of Gastrointestinal Endoscopy (ESGE) guideline. Endoscopy. 2022;54:185–205.
47. Paik WH, Lee TH, Park DH, Choi JH, Kim SO, Jang S, et al. EUS-guided biliary drainage versus ERCP for the primary palliation of malignant biliary obstruction: a multicenter randomized clinical trial. Am J Gastroenterol. 2018;113:987–97.
48. Bang JY, Navaneethan U, Hasan M, Hawes R, Varadarajulu S. Stent placement by EUS or ERCP for primary biliary decompression in pancreatic cancer: a randomized trial (with videos). Gastrointest Endosc. 2018;88:9–17.
49. Zhao X, Shi L, Wang J, Guo S, Zhu S. Clinical value of preferred endoscopic ultrasound-guided antegrade surgery in the treatment of extrahepatic bile duct malignant obstruction. Clinics (Sao Paulo). 2022;77:100017.
50. Chen YI, Sahai A, Donatelli G, Lam E, Forbes N, Mosko J, et al. Endoscopic ultrasound-guided biliary drainage of first intent with a lumen-apposing metal stent vs endoscopic retrograde cholangiopancreatography in malignant distal biliary obstruction: a multicenter randomized controlled study (ELEMENT trial). Gastroenterology. 2023;165(5):e1245.
51. Teoh AYB, Napoleon B, Kunda R, Arcidiacono PG, Kongkam P, Larghi A, et al. EUS-guided Choledocho-duodenostomy using lumen apposing stent versus ERCP with covered metallic stents in patients with unresectable malignant distal biliary obstruction: a multicenter randomized controlled trial (DRA-MBO trial). Gastroenterology. 2023;165(2):e472.
52. Lyu Y, Li T, Cheng Y, Wang B, Cao Y, Wang Y. Endoscopic ultrasound-guided vs ERCP-guided biliary drainage for malignant biliary obstruction: a up-to-date meta-analysis and systematic review. Dig Liver Dis. 2021;53:1247–53.
53. Janet J, Albouys J, Napoleon B, Jacques J, Mathonnet M, Magne J, et al. Pancreatoduodenectomy following preoperative biliary drainage using endoscopic ultrasound-guided choledochoduodenostomy versus a Transpapillary stent: a multicenter comparative cohort study of the ACHBT-FRENCH-SFED intergroup. Ann Surg Oncol. 2023;30:5036–46.
54. Marzioni M, Crino SF, Lisotti A, Fuccio L, Vanella G, Amato A, et al. Biliary drainage in patients with malignant distal

biliary obstruction: results of an Italian consensus conference. Surg Endosc. 2024;38:6207–26.
55. Williamsson C, Wennerblom J, Tingstedt B, Jonsson C. A wait-and-see strategy with subsequent self-expanding metal stent on demand is superior to prophylactic bypass surgery for unresectable periampullary cancer. HPB (Oxford). 2016;18:107–12.
56. Insulander J, Sanjeevi S, Haghighi M, Ivanics T, Analatos A, Lundell L, et al. Prognosis following surgical bypass compared with laparotomy alone in unresectable pancreatic adenocarcinoma. Br J Surg. 2016;103:1200–8.
57. Tran KV, Vo NP, Nguyen HS, Vo NT, Thai TBT, Pham VA, et al. Palliative procedures for malignant gastric outlet obstruction: a network meta-analysis. Endoscopy. 2024;56:780–9.
58. Al-Rashedy M, Dadibhai M, Shareif A, Khandelwal MI, Ballester P, Abid G, et al. Laparoscopic gastric bypass for gastric outlet obstruction is associated with smoother, faster recovery and shorter hospital stay compared with open surgery. J Hepato-Biliary-Pancreat Surg. 2005;12:474–8.
59. Navarra G, Musolino C, Venneri A, de Marco ML, Bartolotta M. Palliative antecolic isoperistaltic gastrojejunostomy: a randomized controlled trial comparing open and laparoscopic approaches. Surg Endosc. 2006;20:1831–4.
60. Kaminishi M, Yamaguchi H, Shimizu N, Nomura S, Yoshikawa A, Hashimoto M, et al. Stomach-partitioning gastrojejunostomy for unresectable gastric carcinoma. Arch Surg. 1997;132:184–7.
61. Lorusso D, Giliberti A, Bianco M, Lantone G, Leandro G. Stomach-partitioning gastrojejunostomy is better than conventional gastrojejunostomy in palliative care of gastric outlet obstruction for gastric or pancreatic cancer: a meta-analysis. J Gastrointest Oncol. 2019;10:283–91.
62. Yamao K, Kitano M, Chiba Y, Ogura T, Eguchi T, Moriyama I, et al. Endoscopic placement of covered versus uncovered self-expandable metal stents for palliation of malignant gastric outlet obstruction. Gut. 2021;70:1244–52.
63. Teoh AYB, Lakhtakia S, Tan DMY, Crinò SF, Dhir V, Kunda R, et al. Partially covered versus uncovered pyloro-duodenal stents for unresectable malignant gastric outlet obstruction: randomized controlled study. Dig Endosc. 2024;36:428–36.
64. Hong J, Chen Y, Li J, Hu P, Chen P, du N, et al. Comparison of gastrojejunostomy to endoscopic stenting for gastric outlet obstruction: an updated systematic review and meta-analysis. Am J Surg. 2022;223:1067–78.
65. Khamar J, Lee Y, Sachdeva A, Anpalagan T, McKechnie T, Eskicioglu C, et al. Gastrojejunostomy versus endoscopic stenting for the palliation of malignant gastric outlet obstruction: a systematic review and meta-analysis. Surg Endosc. 2023;37:4834–68.
66. ASGE Standards of Practice Committee, Jue TL, Storm AC, Naveed M, Fishman DS, Qumseya BJ, et al. ASGE guideline on the role of endoscopy in the management of benign and malignant gastroduodenal obstruction. Gastrointest Endosc. 2021;93(2):e304.
67. Binmoeller KF, Shah JN. Endoscopic ultrasound-guided gastroenterostomy using novel tools designed for transluminal therapy: a porcine study. Endoscopy. 2012;44:499–503.
68. Tyberg A, Perez-Miranda M, Sanchez-Ocana R, Penas I, de la Serna C, Shah J, et al. Endoscopic ultrasound-guided gastrojejunostomy with a lumen-apposing metal stent: a multicenter, international experience. Endosc Int Open. 2016;4:E276–E281.
69. Kerdsirichairat T, Irani S, Yang J, Brewer Gutierrez OI, Moran R, Sanaei O, et al. Durability and long-term outcomes of direct EUS-guided gastroenterostomy using lumen-apposing metal stents for gastric outlet obstruction. Endosc Int Open. 2019;7:E144–E150.
70. Jaruvongvanich V, Mahmoud T, Abu Dayyeh BK, Chandrasekhara V, Law R, Storm AC, et al. Endoscopic ultrasound-guided gastroenterostomy for the management of gastric outlet obstruction: a large comparative study with long-term follow-up. Endosc Int Open. 2023;11:E60–E66.
71. Jovani M, Ichkhanian Y, Parsa N, Singh S, Brewer Gutierrez OI, Keane MG, et al. Assessment of the learning curve for EUS-guided gastroenterostomy for a single operator. Gastrointest Endosc. 2021;93:1088–93.
72. Canakis A, Bomman S, Lee DU, Ross A, Larsen M, Krishnamoorthi R, et al. Benefits of EUS-guided gastroenterostomy over surgical gastrojejunostomy in the palliation of malignant gastric outlet obstruction: a large multicenter experience. Gastrointest Endosc. 2023;98(3):e330.
73. Pawa R, Koutlas NJ, Russell G, Shen P, Pawa S. Endoscopic ultrasound-guided gastrojejunostomy versus robotic gastrojejunostomy for unresectable malignant gastric outlet obstruction. DEN Open. 2024;4:e248.
74. Teoh AYB, Lakhtakia S, Tarantino I, Perez-Miranda M, Kunda R, Maluf-Filho F, et al. Endoscopic ultrasonography-guided gastroenterostomy versus uncovered duodenal metal stenting for unresectable malignant gastric outlet obstruction (DRA-GOO): a multicentre randomised controlled trial. Lancet Gastroenterol Hepatol. 2024;9:124–32.
75. De Ponthaud C, Bozkirli B, Rizzo GEM, Robinson S, Vilas-Boas F, Capurso G, et al. Management of malignant gastric outlet obstruction (mGOO) due to pancreatic cancer in the era of EUS-Gastrojejunostomy: an international practice survey and case vignette study by pancreas 2000 from the European pancreatic Club. Surg Endosc. 2024;38:3231–40.
76. Lim SG, Kim CG. Endoscopic stenting for malignant gastric outlet obstruction: focusing on comparison of endoscopic stenting and surgical gastrojejunostomy. Clin Endosc. 2024;57:571–80.

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