Research Article **ISSN: 3065-5641**

Global Journal of Critical Care and Emergency Medicine

Anesthetic Considerations in Whipple Surgery "Pancreaticoduodenectomy" Case Report

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Received: 07 Feb 2026; **Accepted:** 13 Mar 2026; **Published:** 24 Mar 2026

Citation: Miguel Jovanny Jaimes Flores, Perla Violeta Rodríguez Robles, German Alonso Ramos, et al. Anesthetic Considerations in Whipple Surgery "Pancreaticoduodenectomy" Case Report. Glob J Emerg Crit Care Med. 2026; 3(1); 1-6.

ABSTRACT

Pancreatic cancer remains a significant challenge, with surgery being a cornerstone of curative treatment. In Mexico, it is one of the most aggressive tumors, ranking as the seventh leading cause of cancer death, with approximately 7,000 new cases annually and a mortality rate exceeding 90% five years after diagnosis. The incidence is 3.9 cases per 100,000 inhabitants, and it is most common in people aged 50 to 69.

Pancreatic surgery is complex and associated with higher rates of morbidity and mortality compared to other abdominal surgeries. Over the past decade, the introduction of new technologies, such as minimally invasive approaches, improvements in multimodal treatments, advances in anesthesia and perioperative care, and better management of complications, have collectively improved patient outcomes after pancreatic surgery.

In particular, the adoption of Enhanced Recovery After Surgery (ERAS) recommendations has reduced hospital stays and improved recovery times, as well as postoperative outcomes, in order to employ opioid-sparing multimodal anesthesia, as well as hemodynamic management, goal-guided fluids, optimal therapeutic central glucose levels after surgical injury, as well as blood gas values for adjusting mechanical ventilation, in order to assess early extubation.

Keywords

Pancreatic cancer, Enhanced Recovery After Surgery (ERAS), Multimodal anesthesia.

Introduction

Pancreatic cancer remains a significant challenge, with surgery being a fundamental pillar of curative treatment. In Mexico, it is one of the most aggressive tumors, ranking as the seventh leading cause of cancer death, with approximately 7,000 new cases annually and a mortality rate exceeding 90% five years after diagnosis. The incidence is 3.9 cases per 100,000 inhabitants, and it is most common in people aged 50 to 69 years [1].

Pancreatic tumors can originate from cells of the endocrine component (insulinoma, glucagonoma, VIPoma, etc.) or from cells of the exocrine component, with adenocarcinoma being the most common type [2].

Several surgical approaches exist for pancreatic tumors, depending on the tumor's location and extent.

Pancreatic surgery is complex and is associated with higher morbidity and mortality rates compared to other abdominal surgeries [3].

Distal pancreatectomy is performed for tumors of the distal half of the pancreas.

Subtotal pancreatectomy usually involves resection of the pancreas distal to the mesenteric vessels, leaving the pancreatic head and uncinate process intact.

Child's procedure (near total pancreatectomy): involves resecting the entire pancreas except for a ring along the lesser curvature of the duodenum.

The most common surgery for cancer of the head of the pancreas is the Whipple procedure, which consists of performing a pancreaticoduodenectomy, followed by a pancreaticojejunostomy, a hepaticojejunostomy, and a gastrojejunostomy.

There are certain contraindications for pancreatic adenocarcinoma resection using this technique, such as hepatic or peritoneal metastases, tumor infiltration of mesenteric vessels, and hepatic artery involvement. However, in endocrine tumors, the contraindication is more relative, and associated vascular resections can be performed [4,5].

Other surgical technique variations exist, such as total pancreatectomy or regional pancreatectomy [6].

The ERAS (Enhanced Recovery After Surgery) protocols for Whipple surgery (pancreatoduodenectomy) are multimodal perioperative strategies designed to reduce surgical stress, complications (by up to 50%), and hospital stay. They are based on preoperative nutrition, opioid-free pain management, and early mobilization [7].

Preoperative Phase

Counseling: Detailed education to reduce anxiety and improve patient cooperation.

Nutritional Optimization: Intervention in patients with severe weight loss or BMI < 18.5. Immunonutrition is common, but its recommendation varies.

Minimal Fasting: Allow solids up to 6 hours before anesthesia and clear liquids with carbohydrates up to 2 hours before anesthesia.

Selective Biliary Drainage: Not routinely recommended; only in cases of severe jaundice (>15 mg/dL) or colangitis [8].

Intraoperative Phase

Multimodal Anesthesia: Use of thoracic epidural analgesia (T4-T5) to reduce the stress response and the use of opioids.

Fluid Management: Goal-directed fluid therapy to avoid both dehydration and fluid overload, which can cause pancreatic fistula.

Normothermy: Maintaining body temperature >36°C to prevent infection and bleeding.

Minimally Invasive Surgery: Considered beneficial in high-volume centers to reduce pain and hospital stay [8,9].

CONSIDER IN THE PREOPERATIVE PERIOD
Assess comorbidities (diabetes mellitus, hypertension, COPD, heart failure, nutritional status).
Labs: CBC, electrolytes, liver function tests, renal function tests, coagulation studies, glucose.
VTE prophylaxis: compression stockings + LMWH if not contraindicated.
Antibiotic and antiemetic prophylaxis.
Explain analgesia (epidural/multimodal); consider ultrasound-guided spinal cord block.

Hemodynamic monitoring.
ECG, SpO2, capnography, non-invasive blood pressure, and temperature.
Arterial line (continuous blood pressure, blood gases, glucose).
Central venous catheter (vasopressors, fluids).
Hourly urine output.
Consider cardiac output monitoring if high risk.

Anesthetic Technique

Anesthetic Management
Balanced General Anesthesia
Analgesia multimodal • Epidural torácica (T6–T8): Bupivacaína 0.1–0.2% ± opioide. • Paracetamol 1 g IV c/6–8 h. • AINEs si no contraindicación. • Sulfato de magnesio: bolo 30–50 mg/kg → infusión 6–20 mg/kg/h.
Relajación muscular • Monitorizar TOF; ajustar si se usó magnesio. Cisatracurio • Inducción (intubación): 0.15–0.2 mg/kg IV (≈ 2 × DE95). • Mantenimiento: perfusion 1–3 µg/kg/min (0.06–0.18 mg/kg/h). Ajustar según TOF (ideal mantener 1–2 respuestas).
Fluid Therapy and Hemodynamics • Balanced crystalloids (Ringer's Lactate / Plasmalyte). • Target MAP: 65–75 mmHg. • Urine output ≥0.5 mL/kg/h. • Avoid fluid overload → use vasopressors (norepinephrine) if necessary. • Replace blood products as needed.
Metabolism and Electrolytes • Glucose: target 140–180 mg/dL, IV insulin via pump. • Temperature ≥36 °C (warm blankets, warmed fluids). • Correct electrolytes: first Mg, then Ca/K.

Postoperative Phase

Early Removal of Tubes:

Nasogastric Tube: Remove immediately or in the operating room

to prevent nausea and delayed gastric emptying.

Urinary Catheter: Remove preferably on day 1 or 2.

Abdominal Drains: Remove early (before 72 hours) if amylase levels are low to avoid infectious complications.

Nutrition and Mobility: Initiate oral diet and active ambulation from the first postoperative day.

Multimodal Analgesia: Prefer non-opioid drugs or adjuvants (such as paracetamol or NSAIDs), magnesium sulfate, lidocaine, dexmedetomidine, to promote intestinal transit.

Documented Benefits: Reduction of hospital stay by 2-4 days, decrease in complications such as delayed gastric emptying, and lower overall costs [10,11].

Postoperative period.
Immediate extubation if stable.
Admission to ICU for 24–48 hours.
Continue epidural or multimodal analgesia.
VTE prophylaxis (LMWH + mechanical).
Movilización temprana <24 h.
Early enteral/oral nutrition according to tolerance.

Case Description

A 63-year-old female patient scheduled for elective surgery:
Diagnosis: Malignant tumor of the ampulla of Vater.
Planned surgery: Tumor resection (Whipple procedure, pancreaticoduodenectomy).

The following relevant information is available

Non-pathological personal history: Native and resident of Acambay, State of Mexico, homemaker, lives in her own home, has all the resources to live, denies zoonotic diseases, denies food or drug allergies, denies smoking, occasional alcohol consumption without intoxication, denies drug addiction, SARS-CoV-2; 2020, received pharmacological treatment at home requiring supplemental oxygen for 7 days, reports 3 doses of the SARS-CoV-2 vaccine, no transfusions, Catholic, does not know blood type or Rh factor.

Pathological personal history

1. Newly diagnosed hypertension treated with losartan 50 mg every 24 hours.

Gynecological and Obstetric History

G5P5C0A0, last menstrual period at age 55.

Surgical and Anesthetic History

Cholecystectomy under neuraxial blockade, bilateral tubal ligation under neuraxial blockade, liver abscess drainage and biopsy under balanced general anesthesia.
Somatometry.

Weight.	Size.	TA.	FC	FR	SPO2	Tempera-tura.
73 KG.	150 Mts.	144/076 mmHg	68 Lpm.	18 Rpm.	92%	36.4°C.

On physical examination, the patient is active, responsive, and cooperative, with isocoric and normoreflexic pupils, good skin color and tegument, upper edentulism, and a mobile palate. The patient has a Class II MP, PA, PM, DII, and DEM occlusal structure, a cylindrical neck, a central and slightly mobile trachea, and no palpable lymphadenopathy. The chest is normal in shape with good air entry and exit, rhythmic and synchronous breath sounds, and a right costal scar in the abdomen, which is asymptomatic with normal peristalsis. The extremities are intact and symmetrical, with palpable pulses and negative bilateral radial pulses (Allec's maneuver). The right hand is dominant. The spine shows decreased intervertebral spaces (Chien class II).

18.07.2025 LEUC 5.2, HB 14.1 HCT 45.3, PLAO 323 MIL TP 10.1, INR 0.92 TPTP 36.6 GLUCOSA 98 CREATININA 0.52 UREA 47, TGO 28, TGP 27, FA 118, BUN 22, GGT 113.
Chest X-ray: Grade I cardiomegaly, without other abnormalities.

Electrocardiogram normal calibration, sinus rhythm, heart rate: 60 bpm, electrical axis 60 degrees, P wave 80 ms, short PR interval, QRS complex 60 ms, QTc 340 ms, no ST-segment elevation, no T-wave inversion, no necrosis, no chamber hypertrophy. Internal medicine consultation with no contraindications.

RAQ EIIIB ASA III Associated mortality 1.8-5.4% POSSUM SCORE Physiological status score 24 points Severity score 15 points Morbidity prediction 68.57% Mortality 15.95% Karnofsky 60 Occasional assistance for self-care, ECOG Class 2 Bedridden <50% of the day Minimal assistance IPID 10 points Discrete difficulty with intubation, El-Ganzouri Risk Index 6 points, LEE class III, Revised Cardiovascular Risk class II, New Heart Association functional class II, METS 5 points. John Hopkins category 4, CAPRINI 8 points VERY HIGH RISK. Pulmonary Ariscat 38 points Intermediate risk 13.3%, APFEL 2 points 40% RNVPO.

Plan: Thoracic epidural block + balanced general anesthesia + central venous catheter placement + (type 2 invasive monitoring) arterial line placement.

Prognosis: (LIFE-GUARDED). The patient is informed of the possible risks and complications of the anesthetic procedure, as well as its benefits, and accepts the procedure and signs the anesthetic consent form.

Instructions

1. Fasting: 2 hours (clear liquids: water, tea, coffee), 6 hours: Light or semi-solid meals, 8 hours: Solid and high-fat foods.
2. Patent double peripheral IV line with 3-way stopcock.
3. Have 3 units of pre-exposure prophylaxis (PEP) and perfusion

pressure (PPP) available.
4. Do not discontinue antihypertensive medication.
5. Have TCI or volumetric pumps available; 3 pump sets.
6. Forced air warming blankets for a heated bed at 36-37 degrees Celsius to prevent hypothermia; esophageal or standard thermometer.
7. Have tranexamic acid available in the ward.
8. Difficult airway management equipment (metal stylets, laryngeal masks, video laryngoscopy).
9. Have a triple-lumen central venous catheter available, and equipment for arterial line cannulation (3 units; ChloraPrep "2% chlorhexidine gluconate and alcohol"). 70% isopropyl alcohol).
10. Capillary blood glucose pre-, intra-, and post-surgical; target 110-180 mg/dL, have basal insulin available if above 200 mg/dL. Reassess every 1-2 hours.
11. Mild to medium compression elastic stockings (graduated to the knee) with a gradient of 18-20 mmHg, or mechanical compression due to the risk of venous thromboembolism.
12. Have a bed available in the ICU.
13. Personal and oral hygiene.
14. Transfer to the ward upon request.

Intra-anesthesia note: We are aware that Paula, 63 years old, has a diagnosis secondary to malignant tumor of the ampulla of Vater. She is scheduled for elective laparoscopic cholecystectomy (LCX) and Whipple procedure. RAQ EIIIB ASA III. Associated mortality 1.8-5.4%. POSSUM SCORE: physiological status score 24 points, severity score 15 points, morbidity prediction 68.57, mortality 15.95%. Karnofsky score 60 (occasional self-care assistance required), ECOG Class 2 (bedridden <50% of the day, minimal assistance), IPID 10 points (slight intubation difficulty), El-Ganzouri Risk Index 6 points, LEE Class III, Revised Cardiovascular Risk Class II, New Heart Association Functional Class II, METS 5 points, John Hopkins Category 4, CAPRINI 8 points (VERY HIGH RISK), Ariscat pulmonary score 38 points (intermediate risk 13.3%), APFEL 2 points (40% RNVPO).

The patient was admitted to room number 1 after verifying that the anesthesia machine was functioning, the heated bed was functional, and that the airway equipment, triple-lumen central catheter, and TCI pumps were functional and programmed with vasopressors and anesthetic adjuvants.

Non-invasive blood pressure monitoring was applied: BP 135/75 mmHg, HR 72 bpm, SpO2 98% with nasal cannula at 2 liters per minute, and sinus rhythm was detected via telemetry.

Sedation and analgesia: Fentanyl 100 mcg IV. Without losing automaticity, I placed the patient in the left lateral decubitus position. I performed asepsis and thoracic antisepsis with ChloraPrep (2% chlorhexidine gluconate and 70% isopropyl alcohol). I placed a sterile field and infiltrated 80 mg of 2% lidocaine into the skin and subcutaneous tissue at the T8-T9 level, providing pharmacological latency. I inserted a 17-gauge Tuohy needle using the Gutiérrez hanging drop technique to reach the epidural space. I performed a Moore test. I administered 22.5 mg of 0.75% ropivacaine epiduralally without incident or accident. I placed an epidural catheter 10 cm from the skin and secured it. I placed the patient in the supine position and performed preoxygenation and denitrogenation for 2 minutes at 100% FiO2.

Narcosis: Fentanyl 150 mcg IV.
Anxiolysis: Midazolam 3 mg IV.
Lidocaine 1%: 70 mg IV.
Induction: Propofol: 70 mg IV.
Neuromuscular blockade: Rocuronium 30 mg IV.

With a pharmacological latency of 5 minutes, the patient remained hemodynamically stable: SpO2 100%, HR 75 bpm, MAP 100/62 mmHg. MAP 68 mmHg. Atraumatic laryngoscopy was performed using MAC blade number 4. Cormack-Lehane class 2 anterior tracheostomy was observed. A size 7.5 Murphy-type endotracheal tube was placed 22 cm from the dental arch. Proper endotracheal tube placement was confirmed using capnography and auscultation. 5 cc of pneumothorax was administered. Mechanical ventilation was set: tidal volume (VT), peak pressure (pmax) 30, tidal volume (VT) 350, respiratory rate (RR) 10, inspiratory time (IT) 1:2, peak inspiratory pressure (PIP) 10, and peak endpoint (PEEP) 10. 5 CO2 35, SEVOFLURANE 1.5-2 VOL%. Fio2 30%.

Subsequently, I performed asepsis and antisepsis of the right neck with ChloraPrep (2% chlorhexidine gluconate and 70% isopropyl alcohol). I placed a sterile field, verified the Arrow 7 Fr triple-lumen 20 cm central venous catheter, primed the catheter with solution and heparin, visualized anatomical structures, and performed puncture at the level of the internal jugular vein on the first attempt using the Seldinger technique, placing a metallic guidewire and dilating the catheter entry. Subsequently, I placed a triple-lumen catheter 15 cm away, confirmed patency, and secured it with 2-0 Nailo without incident. I placed a Tegadrem, connected Hartmann's solution, and confirmed patency of the distal, medial, and proximal lumens.

I perform asepsis and antisepsis of the dorsum and palmar surface of the left hand and cannulate the radial artery. On the second attempt, I puncture 20 g without incident for blood gas sampling. An arterial line is placed, setting it to zero, and subsequently, the invasive blood pressure measurement is 65-70 mmHG, so a vasopressor is started at the appropriate dose to maintain perfusion targets.

Maintenance

1. Sevoflurane 1.5 to 2% by volume%.
2. Fentanyl via intravenous infusion (IVI) at 1-2 mcg/kg/hour. Total dose: 1 gram IV infusion (0.0045 mcg/ml).
3. Lidocianine 1% via IVI at 1.5 mg/kg/hour. Total dose: 1 gram. Therapeutic window: 3.5 mcg/ml.
4. Magnesium sulfate via IVI at 10 mg/kg/hour. Total dose: 5 g IV infusion.

5. Ropivacaine 0.3% via IVI at 10 mg/hour (5 ml/hour) epidural. Total dose: 40 mg.
6. Norepinephrine. Response dose: 0.02 mcg/kg/min. 6. Maintain hemodynamic stability (see log sheet 4-30-60/72), maintaining MAP targets of 65-70 mmHg.

Capillary blood glucose levels.

Entry.	148 mg/dl
On time.	178 mg/dl
At three hours.	191 mg/dl

Intraoperative arterial blood gas analysis:

Schedules.	0 hours.	2 hours.	5 hours.	7 hours. (end.
PH.	7.38	7.35	7.26	7.36
pCO2.	33	38	42	38
pO2.	81	85	72	95
Glucose.	103	186	200	165
Lactate.	1.2	1.2	1.3	1.3
Hemoglobin.	13.4	13.4	12.1	12.1
HCO3.	20.2	20.2	21.2	21.2
BE.	-1.8	-1.8	-2.0	-2.0

Water balance.

Type.	Total.
Income.	SH 1000 CC NACL 0.9% 250 (1250 CC)
Bleeding.	500 CC.
Urine output.	500 CC (0.9 ML/KG/H)
BALANCE.	-50 CC

Surgical procedure complete

- Anesthesia: epidural block + balanced general anesthesia + central venous catheter placement + arterial line placement.
- Time: 7 hours 30 minutes.
- Surgery: Laparoscopic endoscopic retrograde cholangiopancreatography (LRCP) + paracaval lymph node resection + endoscopic retrograde cholangiopancreatography (ERCP) + proximal pancreaticoduodenectomy + gastrojejunostomy + choledochojejunostomy + pancreaticojejunostomy + otectomy
- Time: 6 hours 20 minutes
- Complications: None.

Secretions were gently aspirated. The patient emerged from metabolic lysis and was extubated under pressure support adjusted for lung protection. Extubation was performed during inspiration, and a Venturi mask was placed at 2 LPM. Blood pressure was 115/75 mmHg without vasopressor support, mean arterial pressure (MAP) was 72 mmHg, SpO2 was 97%. The patient was transferred to the ICU. Richmond Murray score was 0, Ramsay score was 2, ENA score was 0-10, and Aldrete score was 9-10. A peridrual catheter loaded with 0.2% ropivacaine was left in place for postoperative pain management.

Discussion

Pancreatic surgery is complex and associated with higher morbidity and mortality rates compared to other abdominal surgeries. Therefore, today anesthesia has evolved by leaps and bounds and pre-, trans-, and post-surgical care has a better management of probable complications, collectively improving the results of patients after pancreatic surgery. In particular, the adoption of Enhanced Recovery After Surgery (ERAS) recommendations

Therefore, management becomes a challenge for the anesthesiologist in the operating room, both for intubation and early extubation, known in cardiovascular anesthesiology as (fast-track). This is a multidisciplinary strategy that seeks to remove the endotracheal tube early (before 6-8 hours postoperatively, or in the operating room if it is "ultra-fast-track") to accelerate recovery, reduce ICU stay, and minimize surgical stress. Rodríguez-Blanco et al. observed that arterial hypertension, a left ventricular ejection fraction ≥ 30%, off-pump coronary artery bypass grafting, and shorter surgical times increased the probability of extubation in the operating room. Borraci et al. stated that the age, creatinine, and left ventricular ejection fraction (LVEF) scale was the only independent variable associated with extubation in the operating room in elderly patients (≥ 70 years).

Conclusion

In summary, anesthetic management in these patients remains challenging, including airway management, hemodynamic management, fluid management, metabolism, and injury secondary to surgical trauma. Therefore, the ERAS protocol for the Whipple procedure maintains a multidisciplinary and multimodal approach that optimizes patient care before, during, and after surgery. The goal is to reduce surgical stress, decrease complications and the length of hospital stay, and accelerate the patient's functional recovery through evidence-based strategies, standard intraoperative monitoring (ECG, SpO2, NIBP, capnography, temperature) and advanced monitoring (arterial line monitoring; with the objective of maintaining MAP targets and arterial blood gas sampling), as well as central venous catheterization for vasopressor support if necessary, and a 14-16 gauge high-flow peripheral IV line. Given the complexity of the surgery, the type of anesthesia recommended by guidelines and protocols is multimodal anesthesia (combined thoracic epidural block and general anesthesia vs. TIVA). As previously mentioned, it is important to avoid fluid overload. In DGAI – NICE guidelines with (balanced) solutions: fluid control is a fundamental pillar which recommends avoiding fluid overload by maintaining MAP targets (65-75 mmhg) and diuresis 0.5ml/kg/hour. And the availability of tranexamic acid adjusted to doses of 10-15 mg/kg and blood concentrates as required in surgery, estimated metabolic goals: intraoperative blood glucose 140-180 mg/dl and adjusted with basal insulin, avoid intraoperative hypoglycemia, temperature above 36 degrees Celsius, electrolytes: potassium 3.5-4.5 mEq/L, intraoperative monitoring of calcium and magnesium, leading to multimodal analgesia (paracetamol, NSAIDs, opioids), and continuous perfusion with epidural catheter with 0.2% ropivacaine, favoring early extubation with Ultrafastrack within the first 6 postoperative hours, avoiding nosocomial infections. The patient is a candidate for ICU admission due to the complexity of

the surgery for at least 24 to 48 hours due to a high risk of bleeding, pancreatic leak, hypotension, and hemodynamic instability. Strict control of postoperative pain is also essential. Strict glucose and fluid balance monitoring. Initiation of enteral or parenteral nutrition according to postoperative tolerance, dual regimen for the management of PONV.

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