

Laparoscopic pancreatoduodenectomy

Pancreatoduodenectomía laparoscópica

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Abstract

Background: Pancreatoduodenectomy or Whipple's operation is the elective surgical procedure to treat different periampullary diseases. Through the years, this surgery has been doing open, but in the last decades thanks to the improve technology and trained surgeons, today is feasible doing it laparoscopic with good results. **Objective:** The aim of the study was to present the initial experience and results in totally laparoscopic pancreatoduodenectomy in Hospital Regional ISSSTE Puebla, reporting the second number of cases in México. **Methods:** Since July 2014-July 2018, eight patients have been operated by totally laparoscopic pancreatoduodenectomy, seven in Hospital Regional ISSSTE Puebla and 1 in a private Hospital. **Results:** Evaluating all the patients, not one had mortality during operation, no morbidity, or immediate reoperation, so the results are favorable. **Conclusion:** Laparoscopic pancreatoduodenectomy is a very complex procedure but feasible, and good results depend on various factors, like the appropriate patient selection.

Keywords: Laparoscopic pancreatoduodenectomy. Whipple procedure. Pancreatic surgery.

Resumen

Antecedentes: La pancreatoduodenectomía o cirugía de Whipple es el procedimiento de elección en el tratamiento de las enfermedades periampulares. A través de los años se ha realizado de manera abierta, y actualmente, gracias a la mejora de los recursos humanos y tecnológicos, se realiza este procedimiento por mínima invasión con buenos resultados. **Objetivo:** Presentar la experiencia inicial en la pancreatoduodenectomía totalmente laparoscópica en el Hospital de Alta Especialidad del Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE) de Puebla, dando a conocer la segunda serie de casos reportada en México. **Método:** De julio de 2014 a julio de 2018 se han realizado ocho pancreatoduodenectomías totalmente laparoscópicas, siete en el hospital de alta especialidad ISSSTE Puebla y una en un hospital privado. **Resultados:** En todos los pacientes intervenidos los resultados son favorables, sin mortalidad transoperatoria y sin presentar complicaciones graves ni reintervención. **Conclusión:** La pancreatoduodenectomía laparoscópica es un procedimiento de alta complejidad que, teniendo una adecuada selección de pacientes y un manejo multidisciplinario, se puede llevar a cabo con excelentes resultados.

Palabras clave: Pancreatoduodenectomía laparoscópica. Procedimiento de Whipple. Cirugía pancreática.

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Introduction

Periampullary tumors are characterized for being a heterogeneous group of neoplasms of different histological lineage, and include all those tumors confined to this anatomical region, that is, tumors of the head of the pancreas (the most common), ampulla of Vater, distal common bile duct, and duodenum¹. Due to their anatomical location, they compromise the biliopancreatic confluence area and produce a similar and ominous condition; in addition, they involve numerous visceral and vascular structures for their resection.

Pancreaticoduodenectomy is the surgical procedure of choice for the treatment of periampullary malignant tumors, cystic pancreatic neoplasms located on the head of the pancreas and, on some occasions, patients with abdominal trauma. This procedure is also known as the Whipple procedure, first described in 1934 by Allan Whipple², and has been performed in numerous hospitals all over the world. However, this type of minimally-invasive surgery (laparoscopy) is being used with increasing frequency. In Mexico, in very few centers have it been performed using this route with good results.

In the United States, it was predicted that by 2015 more than 48,000 people would be diagnosed with pancreatic cancer³, and that slightly over 80% would die from this disease. In Mexico, in the last study that was carried out, an increase in the number of cases and a mortality higher than 90% was reported⁴; pancreatic cancer has a high morbidity and mortality and ranks 4th in the world and 8th in our country as a cause of death from cancer-related disease¹.

As previously mentioned, surgery is the only potentially curative option for this type of diseases, and in the case of pancreatic head cancer, only 15-20% of patients are candidates for surgical resection; still, 5-year survival after pancreaticoduodenectomy with R0 and R1 resection is 25-30% and 10%, respectively².

Adenocarcinoma of the ampulla of Vater accounts for 10-36% of all resectable periampullary malignancies, with 76-78% resectability likelihood, in contrast to 22% of patients with pancreatic head tumors. Five-year survival in patients after pancreaticoduodenectomy for ampulloma is 32-58%^{1,4}.

Methods

At ISSSTE Puebla High Specialty Regional Hospital, from October 2009 to November 2017, 17 open

pancreaticoduodenectomies were carried out for various pathologies, mainly malignant and mostly adenocarcinoma of the head of the pancreas (70%). As of 2014, the hospital started performing the procedure completely through laparoscopy. All patients selected for this procedure were evaluated by the departments of general surgery and laparoscopy, hepato-pancreato-biliary surgery, and surgical oncology, taking into account the different criteria for proposing surgical resection. Patients who did not meet the conditions for being offered curative treatment were managed with palliative treatment or biopsy and neoadjuvant therapy. Only patients who initially underwent surgical resection were included in this study.

From July 2014 to July 2018, eight patients underwent fully laparoscopic pancreaticoduodenectomy by the same surgeon and surgical team. Patient age range was 36-79 years. The pathologies that they were operated on for were adenocarcinoma of the ampulla of Vater (three patients) and pancreatic head adenocarcinoma (five patients) (Table 1). The hospital has all the human and technological resources available, such as endoscopy, ultrasound, tomography, magnetic resonance imaging, and endoscopic ultrasound, and the departments of endoscopic surgery, hepato-pancreato-biliary surgery, intensive care unit, pathological anatomy, and surgical and medical oncology are involved, for adequate evaluation, selection, post-operative management, and follow-up of patients who are candidates for this type of procedure, to offer better results, always adhering to national and international guidelines (Figs. 1-3).

Surgical technique

Patients were placed in the Trendelenburg position, with both arms close to the body, the surgeon between the legs and the assistants on the sides. Pneumoperitoneum was performed at 12 mmHg with the Hasson technique and four working ports were placed under direct vision (Fig. 4). The procedure starts with

Table 1. Surgical procedures carried out with laparoscopy

Performed surgery	
Choledochoduodenostomy	12
Roux-en-Y hepaticojejunostomy	10
Distal pancreatectomy with splenic preservation	1
Pancreaticoduodenectomy	8



Figure 1. Double contrast CT scan showing intrahepatic and extrahepatic bile duct dilation secondary to a malignant tumor of the ampulla of Vater.



Figure 3. Tumor of the ampulla of Vater observed by endoscopy.



Figure 2. Double contrast CT scan of a patient with a pancreatic head tumor.



Figure 4. Trocars' position.

inspection of the cavity in search of ascites or tumor implants, extended Kocher maneuver until exposure of the vena cava and right lateral border of aorta, opening of the gastrocolic omentum and control of

gastroepiploic vessels with a harmonic scalpel, and exposure of the pancreatic gland. The superior mesenteric vessels are located, a retropancreatic window is performed at the level of the pancreatic neck



Figure 5. Laparoscopic pancreaticoduodenectomy product.



Figure 6. Post-pancreaticoduodenectomy surgical bed.

between the gland and the portal vein, and the pancreas is suspended with Penrose-type drainage. Next, section of the stomach at the portion of the antrum with Echelon Flex® stapler and blue reloads, opening of the hepatoduodenal ligament exposing the hepatic pedicle and locating the gastroduodenal artery, vascular control with Hemo-lock® and section of the artery, and sectioning of the common bile duct. The procedure continues with section of the pancreas with bipolar energy at the level of the neck, section of the duodenum-jejunum at a 10 cm of the angle of Treitz and complete release of the duodenum, detachment of the cephalic portion of the pancreas from the retroportal lamina with Enseal®, and/or harmonic scalpel until complete release (Figs. 5 and 6). Antecolic reconstruction is performed, with seromuscular stitches from the jejunum to the pancreatic parenchyma posterior line with Prolene 2-0, opening of the jejunum

Table 2: Distribution by age, gender, histopathological type, and days of intensive care unit stay in patients undergoing laparoscopic pancreaticoduodenectomy

Gender	Age	Histopathological diagnosis	Hospital stay	ICU stay
Female	68	Ampulla of Vater adenocarcinoma	19 days	13 days
Male	62	Pancreatic head adenocarcinoma	9 days	0
Female	57	Pancreatic head adenocarcinoma	10 days	1 day
Male	36	Pancreatic head adenocarcinoma	9 days	2 days
Female	64	Ampulla of Vater adenocarcinoma	10 days	0 days
Female	79	Pancreatic head adenocarcinoma	10 days	0 days
Male	43	Pancreatic head adenocarcinoma	10 days	0 days
Female	66	Ampulla of Vater adenocarcinoma	10 days	0 days

ICU: intensive care unit.

Table 3: Surgically resolved pathologies at ISSSTE Puebla High Specialty Regional Hospital

Pathology	Patients
Choledocholithiasis	11
Choledochal cyst	2
Mirizzi's syndrome	1
Bile duct lesion	3
Ampulla of Vater malignant neoplasm	3
Solid pseudopapillary tumor of the pancreas (head and tail)	2
Pancreatic head adenocarcinoma	5
Lemmel syndrome	1

with monopolar energy, ductal-mucosal Wirsung-jejunum anastomosis with Monocryl 4-0 with trans-anastomotic stent (in all cases), stitches on the jejunum-to-pancreas anastomosis seromuscular anterior line with 2-0 Prolene, biliodigestive anastomosis with 3-0 Monocryl, and gastrojejunal anastomosis in the posterior aspect of the stomach with 65-mm blue reload Echelon Flex® stapler. Two suction drains are left in the abdominal cavity. All patients were started on enteral diet 4 days after surgery, and the evaluation visit was at day 10 of the post-operative period.

Results

Of the eight patients who underwent laparoscopic pancreaticoduodenectomy, five were females and three were males. In six cases were pre-operative

enteral nutritional support provided. In seven patients, resection and reconstruction were fully laparoscopic, with no transoperative mortality or complications in the immediate post-operative period related to the surgical procedure (fistulae, collections, post-operative bleeding, etc.). Conversion to traditional surgery was necessary in one patient due to intraoperative bleeding that could not be controlled with minimal invasion; however, he had a favorable post-operative evolution. Three patients required admission to the intensive care unit and the rest continued the post-operative period at the surgery department hospitalization area. Surgical time, bleeding, morbidity, and hospital stay results were favorable and very similar to those of other national and international reports (Tables 2 and 3).

Discussion

Pancreatic surgery has always been considered difficult to manage. In 1886, Nicolas Senn wrote: "The most favorable conditions for pancreatic resection are when the disease is localized on the tail of the pancreas". It was in 1912 when Walter Kausch, with contributions of Theodor Kocher, among others, carried out the first successful pancreaticoduodenectomy, and later, in 1935, Allen Whipple was credited with the greatest contribution to periampullary tumors surgical treatment, especially in pancreatic cancer⁴⁻⁷.

Diseases of the bile ducts and pancreas are highly diverse and involve both benign and malignant, inflammatory and obstructive diseases, which in most cases, due to the complexity of their management and treatment, either curative or palliative, require intervention of different specialists for adequate resolution⁸. Minimally-invasive pancreatic surgery started in the 1990s, mainly in benign diseases, such as complications in patients with acute and chronic pancreatitis⁹; in cases of malignant disease, only for taking biopsies, palliative surgery, and staging laparoscopy¹⁰⁻¹².

At present, major laparoscopic resections have been reported with highly encouraging results, and even distal pancreatectomy with or without splenic preservation is positioning itself as the procedure of choice for benign or malignant diseases of the distal pancreas¹³⁻¹⁶. In the specific case of the Whipple procedure, in 1994, Gagner and Pomp first described laparoscopic pancreaticoduodenectomy in a patient with chronic pancreatitis³. In Mexico, there are currently reports from two centers where this procedure has been performed: General Hospital of Mexico,

which in 2015 published the first case of laparoscopic pancreaticoduodenectomy, and the "Manuel Gea González" Hospital, with the largest series that has been reported, with six cases.

After the first laparoscopic pancreaticoduodenectomy, several studies have been carried out comparing traditional pancreaticoduodenectomy with laparoscopic surgery, with very similar results^{17,18}. After 10 years, numerous studies claim that, in terms of safety, costs, feasibility, and oncological results, laparoscopic pancreaticoduodenectomy has more advantages than open pancreaticoduodenectomy¹⁹. On the other hand, in addition to earlier initiation of the oral route, less bleeding, less pain, faster recovery, and shorter hospital stay, the benefits provided by minimally-invasive surgery stand out. All this, always emphasizing the importance of adequate and rigorous patient selection, allows better results to be offered^{18,20}.

In all published reports, the limitation, as mentioned by most series, is the high degree of technical complexity, since it involves two or more organs partial or total resection, vascular dissection, and complex digestive anastomoses, which requires a certain number of cases (in some reports, the learning curve is established in at least 30 procedures to master the technique)^{16,18}.

The results that have been obtained have been compared with traditional surgery and similar intra-operative mortality and post-operative morbidity have been reported (5% and 30-40%, respectively)^{16,18}.

Conclusion

ISSSTE Puebla High Specialty Regional Hospital is a regional hospital that concentrates population from all municipalities of the State. In addition, it is a referral center for other states of the Republic, and therefore, the number of patients treated annually is rather high. From July 2014 to July 2018, various procedures were performed in the hospital, such as biliodigestive diversions for benign and malignant disease of the bile ducts and pancreas (Tables 2 and 3), partial pancreatic resections, and eight fully laparoscopic pancreaticoduodenectomies (seven at ISSSTE Puebla High Specialty Regional Hospital and one in a private hospital in the same city). In all cases, good results have been obtained in the variants that were evaluated, without transoperative mortality or reoperation in any patient.

It is highly important mentioning that, so far, there are only two centers in Mexico where series of cases of pancreaticoduodenectomy and fully laparoscopic reconstruction have been reported: “Manuel Gea González” General Hospital and ISSSTE Puebla High Specialty Regional Hospital, fortunately with excellent results. This shows that performing this type of procedure is feasible, provided that infrastructure and trained personnel to perform highly complex surgeries are available, with the results herein published being a parameter.

We are fully convinced that increasing the number of cases is necessary for the sample to be significant, but the results so far obtained are encouraging.

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Conflict of interests

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Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this research.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained informed consent from the patients and/or subjects referred to in the article. This document is in the possession of the corresponding author.

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