

Whipple surgery learning curve for tumors resection of the duodenal bilio-pancreatic complex in a tertiary care hospital

Abstract

Whipple surgery for tumor resection of pancreas head, duodenum and biliary tract, involves high morbidity and perioperative mortality, for this, centers specialized in oncology, recommend surgical thoroughness by the surgeon oncologist expert in biliary-pancreatic surgery and attachment by the medical-surgical staff which provides postoperative care, and so, improve the learning curve with reduction of morbidity, mortality and survival to long term. We present the experience and learning curve of a Surgeon Oncologist specialized in Whipple's surgery in a third-level medical school hospital.

Method: We include patients undergoing the Whipple procedure performed by a single surgeon in the Surgical Oncology service of a third level hospital of medical attention between 2000 to 2017, divided in periods of 5 years (2000-2005, 2006-2011 and 2012-2017). From the clinical record was recorded the following variables: Age, sex, location and dimensions tumor, histological type and differentiation degree, TNM staging, complications, mortality and survival.

Results: We analyze 38 patients with 58 ± 8 years age, female were 16 (45%) and male 18 (55%). The morbidity was 34% (n=13) and mortality was 23% (n=8). All cases were in stage I (61%) and II (39%), highlighting the adenocarcinoma histological type (72%) above neuroendocrine tumor (19%) and pseudopapillary tumor (9%), of these, 61% were moderately differentiated and the main location was Vater's ampulla (64%). Survival and relapse-free period at five years were 82% and 81% respectively, unchanged after the fifth year during 17-year follow-up. The regression analysis showed that the histological type and the stage had an independent effect on the survival and relapse-free period without relevant changes after the fifth year until the total follow-up. The learning curve showed a tendency towards reduction in morbidity, standardizing during the 8 procedures performed in 2006- 2011 period. Perioperative and 30 days postoperative mortality showed a tendency to reduce during all study period (200-2017).

Conclusion: The participation of a surgeon oncologist expert in biliopancreatic surgery for tumor resection of duodenal biliopancreatic complex with Whipple surgery, improves the learning curve for the reduction of morbidity and mortality peri and postoperative to 30 days as well as survival and relapsed-free period at 5 years.

Keywords: bilio-pancreatic duodenal tumors, whipple surgery, learning curve

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Introduction

The Vater's ampulla neoplasms can originate in the pancreas head, duodenum and distal bile duct or in ampulla itself, with 5-year survival less than 5%. Jaundice and epigastric pain accompanied by disorders in liver function and weight loss are usually the first clinical manifestations, but unfortunately in advanced stages, so their diagnosis and early treatment represent better survival.¹⁻⁷ Because the invasive capacity of this type of neoplasms, aggressive surgical resection of the anatomical structures involved in the anatomical complex that considers the duodenum, bile duct and head of the pancreas is necessary. This procedure initially described by Kausch in 1909 and popularized by Allen Whipple in 1935 has shown great efficacy, providing better survival and even cure of this disease, but because the clinical manifestations occur when the neoplasia is in advanced stages, only between 15 and 20% of patients are candidates to this surgical treatment.^{8,9} Whipple surgery consider resection of pancreas head, duodenum, proximal jejunum, gallbladder and distal

gastric chamber, which involving high morbidity and perioperative mortality, even in high-tech specialized hospital centers. For this, it is advisable a supervised surgical training should be enough before a new surgeon begins his own experience,⁹ we present the experience and learning curve of a Surgeon Oncologist specialized in Whipple surgery in a tertiary care hospital.

Methods

To avoid bias among operators, we include patients undergoing the Whipple procedure performed by a single surgeon in the Surgical Oncology service of a third level hospital of medical attention between 2000 to 2017, divided in periods of 5 years (2000-2005, 2006-2011 and 2012-2017). From the clinical record was recorded the following variables: Age, sex, location and dimensions tumor, histological type and differentiation degree, TNM staging, complications, mortality and survival.¹⁰⁻¹³

Results

From 2000 to 2017, thirty-eight patients with 58 ± 8 age years were undergoing Whipple surgery. Females were 16 (45%) and male 18 (55%). The morbidity was 34% (n=13) characterized by pancreatic-duodenal fistula (n=6), biliary fistula (n=4), postoperative bleeding (n=2) and acute renal failure (n=1). The mortality was 23% (n=8) secondary to septic shock due to abdominal sepsis. All cases were in stage I (61%) and II (39%), highlighting the adenocarcinoma histological type (72%) above the neuroendocrine tumor (19%) and pseudopapillary tumor (9%). Moderately differentiated were 61% and well differentiated 39%. The main location was in Vater's ampulla (64%) followed by pancreas head (36%). Table 1 Survival and relapse-free period to 5 years were 82% and 81% respectively, unchanged after the fifth year to 17-year follow-up. The multivariate analysis showed to histological type and disease stage had an independent effect on the survival and relapse-free period to 5 year. Figure 1 The amount of surgeries showed a gradual increase, rising to 65% from 2012 to 2017. The learning curve showed improvement with a significant reduction in morbidity and surgical time after the sixth procedure, standardizing in the 8 procedures performed in 2006-2011, without showing changes in following 23 procedures performed in 2012-2017. Perioperative and postoperative mortality to 30 days showed a tendency to reduce during the study period (200-2017). Table 2 & Figure 2 In all cases, was performed a radiological contrasted study before and after surgical procedure. The conventional surgical technique used consisted in the resection of the head of the pancreas, gastric antrum, duodenum, proximal ileum, gallbladder and bile duct. The reconstruction was performed with pancreato-jejunum, gastro-jejunum and bilio-jejunum anastomoses, as shown in Figure 3.¹⁴⁻¹⁷

Table 1 Pancreas cancer characteristics

	n	%
Tumor location		
Pancreas Head	13	36
Vater's Ampulla	23	64
Histological type		
Adenocarcinoma	26	72
Neuroendocrine tumor	7	19
Pseudopapilar tumor	3	9
Diferenciación		
Well diferenciaded	14	39
Moderately diferenciaded	22	61
Stage TNM		
I	22	61
II	14	39

Table 2 Learning curve by morbidity and mortality

Years	Surgery (n)	Complications(n) %	Mortality*(n) %	Surgical time (hours)
2000-2005	5	3 60	3 60	10
2006-2011	8	3 37	3 37	7
2012-2017	23	8 36	6 26	6.5

*Perioperative and 30 days postoperative mortality

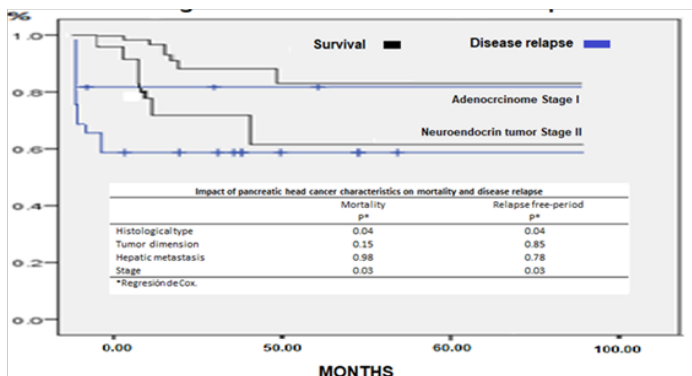


Figure 1 Survival and disease relapse.

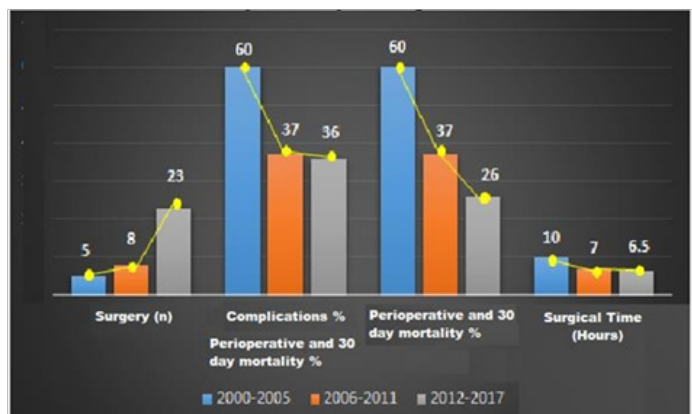


Figure 2 Number of surgeries, complications, Perioperative and 30 days mortality and surgical time.

Discussion

Pancreatoduodenectomy is the choice surgical procedure for periampullar carcinoma and pancreas head, but only when the location tumor and size allow it, although with low survival at 5 years (5%). Hospital centers specialized in oncology, assume that survival could improve significantly when surgical resection is accurate, especially in low stages (I and II). Our findings coincide with this hypothesis, with a very high survival and free period of relapse at 5 years (82 and 81% respectively), under experience of a surgeon specialist in bilio-pancreatic surgery. This findings contrasting significantly with the survival reported in the international medical literature of 61 and 52% respectively.^{18,19} It is logical to expect that survival is high in non-advanced cancer stages, since tumor dimensions and low lymph node invasion, facilitate complete resection of the neoplasm. In this study,

multivariate analysis showed an independent effect of the histological kind (Adenocarcinoma and neuroendocrine tumor) and disease stage on the survival and in relapse free-period to 5 years ($p=0.04$ and 0.03 respectively). These findings, not differ from those reported in some studies,^{10–13,16,18,19} However, we believe that the surgical thoroughness developed by an expert surgeon in bilio-pancreatic surgery, was

manifested in perioperative and postsurgical results observed to long term in this study. To reduce bias in surgical criteria to pancreatic-biliary and duodenal tissue resection affected by cancer, as well as in the variability of results, we evaluated the learning curve of a single oncologist surgeon to perform this complex surgical procedure in relation to morbidity and mortality reduction.

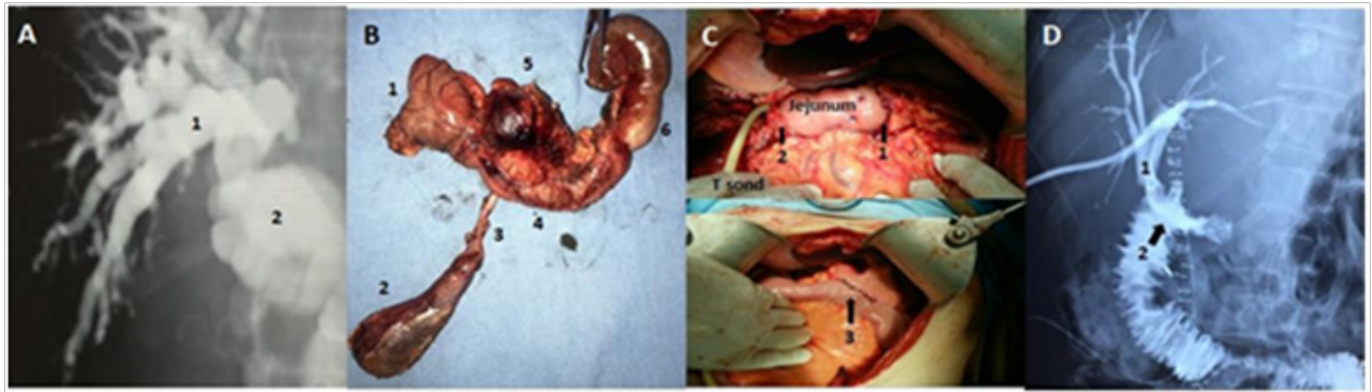


Figure 3 A) Preoperative contrasted radiological image showing dilated intrahepatic bile ducts (1) and common bile duct (2) by head pancreas tumor; B) Resected anatomical structures: Gastric antrum (1), gallbladder (2), Common bile duct (3), duodenum (4), pancreas head tumor (5) and proximal jejunum (6); C) Bilio-digestive reconstruction with following anastomosis: jejunum-pancreatic (1), biliopancreatic splinted with T tube (2), and gastro-jejunum (3); D) Postoperative contrasted radiological image showing normal intrahepatic bile duct (1) and permeability of bilio-jejunum anastomosis (2).

The standardization of results on morbidity was reaching after the sixth procedure, trough of 2006- 2011 period, without observing relevant changes in the next evaluation (2012-2017). Regarding to perioperative and postsurgical mortality at 30 days, findings showed a trend to mortality reduction as the number of surgical procedures increased through the study. Figure 2 We consider that the standardization of results achieved in the second period (2006-2011) with 8 surgical procedures and the thoroughness in the surgical technique for tumor resection developed by the leading surgeon with training in biliopancreatic surgery, was transmitted to surgeons in training process in oncological surgery, since the permanent supervision by the expert surgeon was maintained during the next evaluation period (2012-2017), where post-surgical bleeding was observed only in 2 patients, biliary fistulas in 4 patients and bilio-pancreatic fistula in 6 patients. This consideration contrasts with medic centers which perform a greater amount of Whipple procedure, where they consider that at least 20 procedures are required to standardize the criteria of tumor resection and the learning curve to reduce surgical morbidity and mortality.^{21–24} Although surgical time used to perform the surgery was reduced to 6-7 hours after the first evaluation period (2000-2005), it is still longer than the time reported in other studies (4 and 5 hours),^{18–26} however we consider which this contrast due to thoroughness of the expert surgeon and surgical team for affected tissue resection, as well as at refined surgical technique applied, which was finally reflected in the best results observed in our study compared with it reported in other studies. In sum, whipple surgery for the resection of biliopancreatic and duodenal tumors represents a serious surgical complexity that requires of an oncologist surgeon skilled in biliopancreatic surgery, who must maintains surgical thoroughness and close supervision of the medical-surgical team. In this way, it is possible to improve and standardizing perioperative and long-term results with a lower learning curve.

Conclusion

The presence of a surgeon oncologist expert in biliopancreatic surgery for the resection of duodenal and bilio-pancreatic tumors with Whipple surgery reduce the amount of procedures to standarization of morbidity and mortality perioperative and postsurgical at 30 days, as well as survival to 5 years.

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Conflict of interest

The author declares there is no conflict of interest.

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