World Journal of Gastroenterology

Submit a Manuscript: http://www.wjgnet.com/esps/
Help Desk: http://www.wjgnet.com/esps/helpdesk.aspx
DOI: 10.3748/wjg.v20.i39.14237

World J Gastroenterol 2014 October 21; 20(39): 14237-14245
ISSN 1007-9327 (print) ISSN 2219-2840 (online)

TOPIC HIGHLIGHT

WJG 20th Anniversary Special Issues (14): Pancreatic cancer

Improving outcomes in pancreatic cancer: Key points in perioperative management

José M Álamo, Luis M Marín, Gonzalo Suarez, Carmen Bernal, Juan Serrano, Lydia Barrera, Miguel A Gómez, Jordi Muntané, Francisco J Padillo

José M Álamo, Miguel A Gómez, Jordi Muntané, Centro de Investigación Biomédica en Red de Enfermedades Hepáticas y Digestivas (CIBEREH o Ciberehd), Instituto de Salud Carlos Ⅲ, 28029 Madrid, Spain
Luis M Marín, Gonzalo Suarez, Carmen Bernal, Juan Serrano, Lydia Barrera, Francisco J Padillo, Department of General Surgery, Hospital Universitario Virgen del Rocío/CSIC/Universidad de Sevilla, 41013 Seville, Spain
Author contributions: Álamo JM, Marín LM, Suarez G, Bernal C, Serrano J and Barrera L substantially contributed to conception and design, acquisition of data, or analysis and interpretation of data; Gómez MA and Muntané J contributed to drafting the article or revising it critically for important intellectual content; Padillo FJ contributed to final approval of the version to be published.
Correspondence to: Francisco J Padillo, MD, PhD, Department of General Surgery, Hospital Universitario Virgen del Rocío/CSIC/Universidad de Sevilla, Av. Manuel Siurot s/n, 41013 Seville, Spain. javierpadilloruiz@gmail.com
Telephone: +34-955- 923122 Fax: +34-955-923002
Received: December 14, 2013 Revised: February 24, 2014
Accepted: June 20, 2014
Published online: October 21, 2014

Abstract

This review focused in the perioperative management of patients with pancreatic cancer in order to improve the outcome of the disease. We consider that the most controversial points in pancreatic cancer management are jaundice management, vascular resection and neo-adjuvant therapy. Preoperative biliary drainage is recommended only in patients with severe jaundice, as it can lead to infectious cholangitis, pancreatitis and delay in resection, which can lead to tumor progression. The development of a phase Ⅲ clinical trial is mandatory to clarify the role of neo-adjuvant radiochemotherapy in pancreatic adenocarcinoma. Venous resection does not adversely affect postoperative mortality and morbidity, therefore, the need for venous resection should not be a contraindication to surgical resection in selected patients. The data on arterial resection alone, or combined with vascular resection at the time of pancreatectomy are more heterogeneous, thus, patient age and comorbidity should be evaluated before a decision on operability is made. In patients undergoing R0 resection, arterial resection can also be performed.

Key words: Pancreatic cancer; Obstructive jaundice; Preoperative drainage; Neo-adjuvant therapy; Vascular resection

Core tip: The pancreatic cancer is one of the most virulent malignancies. The review is focused in the different perioperative management of the patients with pancreatic cancer in order to improve the outcome of the disease.

Álamo JM, Marín LM, Suarez G, Bernal C, Serrano J, Barrera L, Gómez MA, Muntané J, Padillo FJ. Improving outcomes in pancreatic cancer: Key points in perioperative management. *World J Gastroenterol* 2014; 20(39): 14237-14245 Available from: URL: http://www.wjgnet.com/1007-9327/full/v20/i39/14237.htm DOI: http://dx.doi.org/10.3748/wjg.v20.i39.14237

INTRODUCTION

Approximately 45000 people will develop exocrine pancreatic cancer in 2013 in the United States. A high percentage (85%) of diagnosed cases will die which shows the virulent nature of this malignancy[1]. Surgical resection offers the only chance of cure.

Unfortunately, the vast majority of patients are diagnosed with locally advanced unresectable or metastatic

disease. Up to 15%-20% of patients are eligible for initial resection[2]. Furthermore, even for those undergoing complete resection (R0) the prognosis is poor, because most of these patients will eventually relapse and die of their disease.

Reported five-year survival rates following pancreaticoduodenectomy for node-negative and node-positive disease are 25%-30% and 10%, respectively[3].

There are many interesting factors in the perioperative management of pancreatic cancer which could result in an improvement in the long-term outcome of this aggressive disease, such as intraoperative radiation therapy, standard or extended lymphadenectomy and adjuvant chemotherapy. However, we consider that the most controversial points nowadays are jaundice management, vascular resection and neo-adjuvant therapy.

PREOPERATIVE DRAINAGE IN JAUNDICED PATIENTS

The most frequent location of pancreatic cancer is the head of the pancreas; therefore, obstructive jaundice is a common presenting symptom. Pre-operative biliary drainage has been used to provisionally resolve the obstruction and may reverse the dysfunction resulting in obstruction of biliary flow. In recent years, this issue has been controversial. However, there is insufficient evidence on this therapeutic option. Several positive outcomes were observed after preoperative drainage in jaundiced patients: (1) higher postoperative morbi-mortality is associated with prolonged acute-phase response. More than 10 d of biliary tract obstruction was related to an increase in endotoxin levels, and a positive acute-phase response peak[4]. After biliary drainage a transitory improvement in these alterations was observed, although values remained high 1 wk post-drainage[5]; (2) malignant obstructive jaundice *per se* induces significant changes in food intake. Anorectic endocrine mediators, liver injury and biliary obstruction are related to protein-caloric malnutrition. This is a reversible situation. Nutritional markers improve after new bile flow into the duodenum[6]; (3) patients with biliary tract obstruction who require surgery often have protein calorie malnutrition, which is associated with increased peri-operative morbidity and mortality. Internal biliary drainage yields good results, and experimental studies have shown that it may improve nutritional status. The levels of pre-albumin and transferrin improved 10 d after internal biliary drainage for both benign and malignant obstruction[7,8] as nutritional alterations in patients with obstructive jaundice were determined by the intensity of the biliary obstruction[5]; (4) fluid administration expands the extracellular water compartment before drainage, but fails to improve renal function after drainage. Definitive improvement in endocrine and renal function requires the restoration of bile flow into the duodenum[9]; and (5) plasma levels of atrial natriuretic peptide increase due to obstruction of the biliary tree[10]. In these cases, this may reflect a subclinical myocardial dysfunction related to the severity of jaundice. There is a measurable improvement in cardiac function after internal biliary drainage[11].

The safety of routine pre-operative biliary drainage has not been established[12]. Pre-operative biliary drainage may increase the rate of serious adverse events, such as a significant increase on the rate of bile cultures positive for bacteria and significantly increase the probability of wound infection. In addition, bile cultures positive for bacteria seem to adversely impact mortality and morbidity after surgery in jaundiced patients[13]. In a large multicenter randomized trial comparing early surgery *vs* preoperative biliary drainage followed by surgery in patients with cancer of the pancreas head, the rates of serious complications were 39% (37 of 96 patients) in the early surgery group and 74% (75 of 106 patients) in the patients submitted to preoperative biliary drainage ($P \leqslant 0.001$)[14]. A follow-up report from the same trial showed that there was a significant delay in time to surgery (1 wk *vs* 5 wk), but no influence on survival rate[15]. While there was an increase in overall infectious complications following surgery in the stented group, the detrimental effects of pre-operative biliary stenting were likely limited to those with subsequent bacterial colonization of the biliary tree due to stent placement[16].

The rapid and direct scheduling for surgery may limit the number of interventions and thus decrease costs and potential procedure-related complications. Siddiqui *et al*[17] observed immediate complications such as post-operative endoscopic retrograde cholangiopancreatography pancreatitis (n = 14), stent migration (n = 3), and duodenal perforation (n = 3), as well as long-term complications included stent migration (n = 9) and hepatic abscess (n = 1). Fourteen patients (5.8%) experienced stent occlusion at an average of 6.6 mo (range 1 to 20 mo) after surgery. A total of 144 out of 174 patients (83%) deemed to have resectable cancer at the time of diagnosis subsequently underwent curative surgery. Due to disease progression or the discovery of metastasis after neo-adjuvant therapy, only 22 of 67 patients (33%) with borderline-resectable cancer underwent curative surgery.

The pre-operative placement of biliary stents in patients undergoing pancreatoduodenectomy significantly increases blood loss, with non-significant increases in operative time and peri-operative fluid resuscitation. In this cohort, these intra-operative considerations do not translate into increased peri-operative morbidity and mortality, with the data overall showing negligible differences in improved outcomes in stented patients. Consequently, pre-operative biliary stents may complicate intra-operative surgical management[18].

NEO-ADJUVANT THERAPY IN PANCREATIC CANCER

The low rate of resectability and the poor long-term outcomes following pancreatoduodenectomy have led to the investigation of pre-operative chemo-radiation therapy or a combination of pre-operative and post-operative

Table 1 Methods data of the three published meta-analyses on neo-adjuvant therapy in pancreatic carcinoma *n* (%)

	Year	*n*	Type study	Mean age (yr)		Chemotherapy Agents regimen		Radiotherapy Dose (Gy)	IORT	
Gillen *et al*[2]	80-09	111	78P-33R	62.5	107 (96.4)	5FU > GEM > Tax > Others	44S + 48C	104 (93.7)	24-63	13 (12.5)
Assifi *et al*[35]	93-10	14	14P-0R	N/P	14 (100)	GEM > 5FU	3S + 11C	12 (85)	30-50	0 (0)
Andriulli *et al*[36]	97-08	20	20P-0R	63.0	20 (100)	GEM > Cis	13S + 7C	17 (85)	30-40	N/P

P: Prospective; R: Retrospective; 5FU: 5-fluor-uracil; GEM: Gemcitabine; Cis: Cisplatine; Tax: Taxanes; S: Single; C: Combined; IORT: Intraoperative radiotherapy; N/P: Not provided.

Table 2 Results of the three published meta-analyses on neo-adjuvant therapy in pancreatic carcinoma in terms of safety (postoperative morbidity and toxicity) and efficacy (response and resection)

		Response (%)			Resection (%)				
	Toxicity (%)	Complete	Partial	Progression	Resected	R0	Mono	Combined	Postoperative morbidity (%)
Gillen *et al*[2]	01:26.3	3.6	30.6	20.9	73.6	60.4	80.9	66.2	26.7
	02:31.3	4.8	30.2	20.8	33.2	26.2	27.3	33.0	39.1
Assifi *et al*[35]	1:37	0.8	9.5	17.0	65.8	55.9	N/P	N/P	N/P
	02:46.2	4.0	31.8	21.8	31.6	19.6			N/P
Andriulli *et al*[36]	1:29	12		15.0	81.2	66.4	N/P	N/P	N/P
	2:33	27		32.0	26.4	16.0			N/P

1: Group of patients with potentially resectable pancreatic adenocarcinoma; 2: Group of patients with borderline resectable pancreatic adenocarcinoma. Toxicity: Only grade 3 and 4; Resection R0: Complete resection of the tumor; Resection Mono: Single chemotherapy drug; Resection Combined: Combined chemotherapy drugs; N/P: Not provided.

Table 3 Results of the three published meta-analyses on neo-adjuvant therapy in pancreatic carcinoma in terms of survival and mortality

	Mean Survival (mo)	Mortality (%)	Estimated survival (%)	
			1-yr	2-yr
Gillen *et al*[2]	01:23.3	3.9	77.9	47.4
	02:20.5	7.1	79.8	50.1
Assifi *et al*[35]	01:15.1	N/P	N/P	N/P
	02:11.2			
Andriulli *et al*[36]	01:18.8	N/P	91.7	86.3
	2:14		67.2	54.2

Referred only after surgical resection. 1: Group of patients with potentially resectable pancreatic adenocarcinoma; 2: Group of patients with borderline resectable pancreatic adenocarcinoma. N/P: Not provided.

therapies[19]. In this context, neo-adjuvant therapy is defined as any pre-operative therapy aiming to convert un-resectable to resectable tumors and/or to increase microscopic complete tumor resection rates[20]. Given this situation, the rationale for neo-adjuvant therapy in pancreatic cancer are as follows[21]: (1) the main objective is down-staging of the tumor to increase the probability of survival after an R0 resection; (2) a certain percentage of potentially un-resectable tumors may be down-staged to enable surgical resection; (3) radiation therapy is more effective on well-oxygenated cells that have not been de-vascularized by surgery; (4) pre-operative treatment may prevent implantation and dissemination of tumor cells at laparotomy; (5) patients with metastatic disease on restaging after neo-adjuvant therapy will not be subjected to unnecessary laparotomy; and (6) delayed post-operative recovery will not affect the delivery of neo-adjuvant therapy.

Candidates for neo-adjuvant therapy are those with radiographically resectable and biopsy-proven pancreatic adenocarcinoma[22]. Numerous phase Ⅱ trials have been performed with encouraging results[23-25]. Although median survival durations from some uncontrolled trials showed that neo-adjuvant therapy compared favorably with modern adjuvant therapy approaches[24,26,27], whether pre-operative therapy is better than post-operative therapy is uncertain. No phase Ⅲ trial comparing neo-adjuvant and post-operative adjuvant therapy has been performed, however, there are many retrospective comparisons using the borderline resectable pancreatic cancer criteria[28] which favor neo-adjuvant therapy for these cancers that almost certainly would have had a positive resection margin if surgery were performed first[29-31]. Moreover, such retrospective studies may have sample selection bias[32].

In this review we distinguish the results of neo-adjuvant therapy between patients with potentially resectable (Group 1) and borderline resectable pancreatic adenocarcinoma (Group 2). In fact, this is one of the main limitations of different meta-analyses, as the criteria for considering borderline carcinoma are heterogenous. The expert consensus statement was published in 2009[33]. The conclusions of the three published meta-analyses (level of evidence 1+ of the SIGN related to neo-adjuvant therapy in pancreatic cancer are shown in Tables 1, 2 and 3[34].

The methods data of the three published meta-analyses on neo-adjuvant therapy in pancreatic carcinoma (Table 1) are different. Gillen *et al*[2] included retrospective

and prospective phase I - II trials, as well as cohort studies and case series during an interval of 29 years (from 1980 to 2009) with an important variety of neo-adjuvant regimens.

The authors consider that the heterogeneity of the data is a limiting factor for extrapolation of the results. However, this first meta-analysis concluded that patients with locally advanced/un-resectable tumors should be included in neo-adjuvant protocols and subsequently be re-evaluated for resection, which is possible in a relevant number of patients. Moreover, in the group of patients with resectable tumors, resection and survival rates after neo-adjuvant therapy were similar to those observed in primary resected tumors treated with adjuvant therapy. Thus, in this group of patients, the current data do not demonstrate an obvious advantage of neo-adjuvant therapy. The study designs provided by Assifi *et al*[35] and Andriulli *et al*[36] are less heterogeneous. The data collection was limited only to prospective phase II trials investigating the effects of neo-adjuvant therapy on patients with pancreatic cancer during a similar time period. The last study included patients receiving gemcitabine alone or in combination with other drugs and/or radiotherapy. The problem of heterogeneity found in all meta-analyses was handled satisfactorily using the random effects model and a $P < 0.10$ in the Cochran Q test in the case of Assifi *et al*[35]. Despite a rigorous selection of studies, Andriulli *et al*[36] found significant heterogeneity which may indicate that the evidence was biased, confounded or inconsistent. Two factors which could, at least partly, explain the heterogeneity were identified. First, the patients' initial disease stage (resectable *vs* un-resectable) and, second, the study design. We think that one of the main limitations of the meta-analyses was the definition of unresectability and borderline resectability. These terms were not consistent between the studies, or clearly described in the manuscripts. Although the definitions have recently undergone standardization[33], the majority of studies analyzed preceded the adaption of such definitions or they were not utilized by the authors.

A recent meta-analysis of prospective studies published by Festa *et al*[37] involving patients who received chemotherapy with or without radiotherapy which was given before surgery to patients with borderline resectable cancer, estimated that the surgically explored and resection rate was higher in patients who received preoperative treatment with gemcitabine. Promising results in retrospective studies have been reported with neo-adjuvant FOLFIRINOX in borderline resectable pancreatic adenocarcinoma followed by radiation[25]. We have assessed the results of the meta-analyses in terms of safety (toxicity of the neo-adjuvant regimen and postoperative morbidity), efficacy (response and resection rate), survival and mortality (Tables 2 and 3). Toxicity data were not available in all the studies revised in the three meta-analyses.

However, these studies agree on the increasing incidence of grade 3-4 toxicity with the combined therapy (two or more chemotherapeutic agents or radiotherapy). In spite of the high estimated heterogeneity of these results, toxicity was higher in the group of patients who were borderline resectable than in those with potentially resectable pancreatic adenocarcinoma[2,35,36].

Postoperative morbidity was only reported by Gillen *et al*[2], and the results are comparable to others series[38,39]. In a systematic review reported by Laurence *et al*[40], neo-adjuvant chemoradiotherapy was not associated with a statistically significant increase in the rate of pancreatic fistula formation or total complications. One of the most important aspects of this review was the response and resection rate after neo-adjuvant therapy. A 30% response rate (complete and partial) in borderline resectable patients provides marginal support for the benefit of preoperative therapy.

The median survival of patients with locally advanced unresectable pancreatic cancer is approximately 10 to 12 mo. Interest in applying the principles of neo-adjuvant or induction therapy to such patients is due to their poor prognosis and the potential for longer term survival if the disease can be resected. Both Gillen *et al*[2] and Andriulli *et al*[36] calculated that the 1-year and 2-year estimated survival were 75% and 50%, respectively.

However, these data must be interpreted cautiously given the heterogeneous nature of this group of patients and their treatments. The influence of preoperative therapy on patient survival remains uncertain. Whether the improved median survival times in resected patients can be ascribed to the chemoradiotherapy administered before surgery or to a better selection of patients with non-progressive disease during the interval from diagnosis to completion of chemoradiotherapy and restaging remains to be addressed in a properly designed randomized trial[36].

It is probable that if pancreatic cancer can be completely resected, the best option is still surgical resection; neo-adjuvant therapy (chemotherapy or chemoradiotherapy) should be given in those patients with doubtful R0 resection, mostly locally advanced tumors, although this definition is not clearly defined.

VASCULAR RESECTION IN PANCREATODUODENECTOMY

The objective of vascular resection in case of vascular tumor invasion in pancreatic cancer is a potentially curative resection. Metastases must be the reference to performance a venous or arterial resection, so we must not practice it if there would be metastases in peritoneum or other organs. Venous invasion usually affects the superior mesenteric vein (SMV) or portal vein (PV), while hepatic artery (HA) the superior mesenteric artery (SMA) are the most affected arteries in pancreatic cancer. The indications and outcomes of vascular resections in pancreatic cancer are still in continuous study.

The purpose of vascular resection is, obviously, to increase the possibility of a curative R0 resection, because

a complete resection is the most important prognostic factor that influences long time survival. This is the reason why obtaining tumor-free resection margins must be the most important objective during vascular resection in pancreatitis ic cancer. In our experience, we have operated on 22 patients with pancreatic cancer including vascular resection:5 with arterial and 17 with venous resection (2005-2013). The mortality associated with the procedure was 36.4% (8 patients), and 6 surviving patients showed tumor recurrence (27.3%). The 5-year survival rate was 36.4% (range 1-96 mo, median 54 mo).

Arterial resection

The narrowing or vessel encasement of SMA, HA or celiac trunk (CT) observed on CT scan[41] or intraoperatively is usually due to a locally advanced tumor, but sometimes, this narrowing is secondary to a peri-tumour fibrosis, and this fact is most of times very difficult to define before or during surgical procedure. Furthermore, if we are sure that this arterial invasion indicates unresectability is in order to technical aspects and prognosis, highly debatable.

There are some doubts about arterial infiltration: (1) is arterial invasion result of an advanced carcinoma or is because of cancer location, near of these important vessels? (2) Is it supposed the finding of arterial infiltration the patient is in stage IV situation? (3) Do arterial resections influence in complications and mortality after pancreatic resection? Several articles show similar long-term survival in patients with arterial invasion compared with patients without vascular invasion. The fact that microscopy showed that vascular tumor invasion is an adverse factor has been changed by these studies[42-44]. This could be explained because the most important factor in survival in patients with pancreatic carcinoma is the presence of metastases in peritoneum or other organs. Yekebas *et al*[45] showed that arterial resection can be a safely procedure in cases with secure vascular invasion, being morbidity and mortality rates comparable to pancreatectomies without arterial resection. In this article, vascular resection did not influence in survival after surgery. When potentially curative pancreatectomy is performed, 2- and 5-year survival rates in patients with vascular invasion are 35% and 15%, respectively, the same rates that patients without arterial invasion. The median survival after pancreatectomy with arterial resection is 6 and 39 mo, much longer than pancreatic cancer treated with chemotherapy or palliative surgery. Although tumor arterial invasion of more than 180º is considered the most important criterion for unresectable cancer in persons with pancreatic tumors according to updated guidelines[46], there is still insufficient data to assert this fact.

The advances in pancreatic surgery together with the poor survival of patients who do not undergo surgical resection, have led to a debate regarding the importance of arterial resection in patients without distant metastasis. There are some studies on pancreatectomy with arterial resection in small series of patients. These articles showed that overall survival in patients with arterial resection is significantly worse when compared with operated patients without arterial resection. Vascular invasion should be considered an indicator of aggressive tumor biology, and it seems to be worse arterial than venous invasion: when simultaneous venous and arterial resection was performed in some studies, patients with arterial had a higher risk of R1 resection and more presence of affected nodes, so survival was reduced[47-49].

In the meta-analysis published by Mollberg *et al*[50] a significantly better survival was observed in patients with arterial resection compared with patients without tumor resection. The results of these analyses should be interpreted very cautiously, as it was an uncontrolled study: patients without resection with more advanced tumors had a worse prognosis compared to patients who underwent pancreatic and arterial resection. This meta-analysis found that patients with arterial resection had more postoperative complications and a worse long-term survival. The authors concluded that the need for arterial resection should be a contraindication to resectability. However, the survival benefit offered by pancreatectomy with arterial resection compared to palliative therapy without tumor resection could justify arterial resection in highly selected patients, only if performed at specialized institutions.

Bachellier *et al*[51] showed that pancreatic resection with arterial resection for locally advanced pancreatic cancer can be performed safely with survival rates similar to patients with locally advanced pancreatic adenocarcinoma without arterial resection (survival rates of 20% at 5 years). This study showed that perineural invasion, number of resected lymph nodes (< 15 *vs* > 15), and arterial wall invasion were independent prognostic factors for overall survival. The authors recommended the following: (1) radiological arterial invasion should not be considered a contraindication to pancreatic resection if the patient undergoes R0 resection; (2) the specificity of CT scanning to predict histological arterial wall invasion is still low; (3) in the case of radiological arterial invasion the patient should be a candidate for neo-adjuvant treatment; (4) after neo-adjuvant therapy in the absence of cancer progression an exploratory laparotomy should be performed to explore the resectability of the tumor; (5) arterial resection should be performed if the patient is undergoing R0 resection; and (6) pancreatic resection with arterial resection should be performed in specialized centers.

Bockhorn *et al*[52] reported a study of eighteen patients who required reconstruction of the HA, eight CT and three SMA. Fifteen patients also required resection of PV. Complications and mortality were significantly higher in patients with arterial resection than in patients without arterial resection ($P = 0.031$ and $P = 0.037$, respectively). Venous resection was an independent factor for morbidity ($P < 0.001$). Median overall survival was the same for both groups (14.0 *vs* 15.8 mo; $P = 0.152$). This article concluded than, in selected patients, overall survival following arterial resection was similar to standard resection and better than palliative treatment.

In conclusion, due to the doubtful data available, the operative and oncological results of these patients should be documented in centralized patient registries in prospective studies.

Venous resection

PV and SMV invasion is due to the location of the tumor, because this venous trunk is in the anatomic origin of pancreatic cancer. For a long time, venous invasion was regarded a contraindication to resection in pancreatic cancer. Today, there is controversy regarding arterial resection and whether pancreatic carcinoma with involvement of the PV/SMV should be resected.

The first resection and reconstruction of the PV/SMV during pancreatectomy were reported by Moore *et al*[53] (1951) and by Asada *et al*[54] (1963). In 1973, Fortner[55] proposed "regional pancreatectomy" which involved a systematic resection PV/SMV vessels and peripancreatic nodal and adipous tissue clearance, to increase the long-term survival rate. This procedure showed no survival benefit and was associated with high morbidity[56,57]; thus, most authors regard tumor invasion of the PV/SMV as a contraindication to curative pancreatic surgery.

However, several reports have confirmed that resection of the PV/SMV can be performed with acceptable mortality, complications and survival rates, comparable to those observed in pancreatic surgery without venous resection[43,44,58,59]. On the other hand, some author have reported poor survival results after this surgical procedure[60]. In general, the current opinion confirms the safety and feasibility of this surgical techniques, with mortality rates about 0 to 7.7%, which are similar to accepted mortality for pancreatectomy without venous resection reported in some studies[61-63]. Also, morbidity rates are similar to pancreatic resections performed without PV/SMV resections (16.7% to 54%)[64,65]. Reported 5-year survival rate in patients with venous resections is not different those without PV/SMV reconstruction (9%-18%)[66].

Many studies uphold PV/SMV resection during pancreatoduodenectomy, although some studies report a low 5-year survival rate because a venous infiltration leads to a more probability of nodal spread[67]. In a retrospective review of two prospective registers with 593 consecutive pancreatic resections for pancreatic cancer reported by Martin *et al*[68], 36 patients (18 men and 18 women, aged 42-82 years) (6.1%) underwent vascular resection at the time of pancreatectomy. Among them, 31 (88%) needed PV/SMV resection, 3 (8%) both arterial and venous resection; and 2 (6%) only arterial resection. The 90-d mortality was 0% and morbidity was 35%. In control group rates were 2% and 39% respectively ($P = 0.034$). Median survival was 18 mo in the venous or arterial resection group, and 19 mo in the control group.

The current literature suggests that PV/SMV resection while pancreatic resections, is a safe and feasible surgical technique, but this procedure must be made only in experienced centers with acceptable morbidity and mortality rates. Complication rates are similar to observed for pancreatic resections without venous reconstruction. Only venous resections can make R0 pancreatectomies in some cancer, and this is, today, the only curative therapy in these patients.

In conclusion, pancreatectomy combined with venous resection should always be considered in cases of suspected tumor infiltration of PV/SMV to obtain good resection margins, in the absence of distant metastasis. R0 resection continues to be the ultimate goal for patients with pancreatic carcinoma, because this is the most important technique in improving survival, thus, venous involvement should not contraindicate pancreatic resection, especially when R0 margins are possible and when reasonable reconstructions can be performed.

REFERENCES

1 **Siegel R**, Naishadham D, Jemal A. Cancer statistics, 2013. *CA Cancer J Clin* 2013; **63**: 11-30 [PMID: 23335087 DOI: 10.3322/caac.21166]

2 **Gillen S**, Schuster T, Meyer Zum Büschenfelde C, Friess H, Kleeff J. Preoperative/neoadjuvant therapy in pancreatic cancer: a systematic review and meta-analysis of response and resection percentages. *PLoS Med* 2010; **7**: e1000267 [PMID: 20422030 DOI: 10.1371/journal.pmed.1000267]

3 **Saif MW**. Controversies in the adjuvant treatment of pancreatic adenocarcinoma. *JOP* 2007; **8**: 545-552 [PMID: 17873458]

4 **Padillo FJ**, Andicoberry B, Muntane J, Lozano JM, Miño G, Sitges-Serra A, Solorzano G, Pera-Madrazo C. Cytokines and acute-phase response markers derangements in patients with obstructive jaundice. *Hepatogastroenterology* 2001; **48**: 378-381 [PMID: 11379313]

5 **Padillo FJ**, Andicoberry B, Muntane J, Lozano JM, Miño G, Sitges-Serra A, Pera-Madrazo C. Factors predicting nutritional derangements in patients with obstructive jaundice: multivariate analysis. *World J Surg* 2001; **25**: 413-418 [PMID: 11344390]

6 **Padillo FJ**, Andicoberry B, Pera-Madrazo C, Sitges-Serra A. Anorexia and malnutrition in patients with obstructive jaundice. *Nutrition* 2002; **18**: 987-990 [PMID: 12431722]

7 **Padillo FJ**, Rodriguez M, Gallardo JM, Andicoberry B, Naranjo A, Minõ G, Sitges-Serra A, Pera-Madrazo C. Changes in the pattern of visceral protein concentrations after internal biliary drainage in patients with obstructive jaundice. *Eur J Surg* 1999; **165**: 550-555 [PMID: 10433138 DOI: 10.1080/11024 1599750006442]

8 **Padillo FJ**, Andicoberry B, Naranjo A, Miño G, Pera C, Sitges-Serra A. Anorexia and the effect of internal biliary drainage on food intake in patients with obstructive jaundice. *J Am Coll Surg* 2001; **192**: 584-590 [PMID: 11333095]

9 **Padillo FJ**, Briceño J, Cruz A, Chicano M, Naranjo A, Vallejo J, Martín-Malo A, Pera-Madrazo C, Sitges-Serra A. Randomized clinical trial of the effect of intravenous fluid administration on hormonal and renal dysfunction in patients with obstructive jaundice undergoing endoscopic drainage. *Br J Surg* 2005; **92**: 39-43 [PMID: 15521079 DOI: 10.1002/bjs.4790]

10 **Valverde J**, Martínez-Ródenas F, Pereira JA, Carulla X, Jiménez W, Gubern JM, Sitges-Serra A. Rapid increase in plasma levels of atrial natriuretic peptide after common bile duct ligation in the rabbit. *Ann Surg* 1992; **216**: 554-559 [PMID: 1444646]

11 **Padillo J**, Puente J, Gómez M, Dios F, Naranjo A, Vallejo JA, Miño G, Pera C, Sitges-Serra A. Improved cardiac function in patients with obstructive jaundice after internal biliary drainage: hemodynamic and hormonal assessment. *Ann*

Surg 2001; **234**: 652-656 [PMID: 11685028]
12 **Fang Y**, Gurusamy KS, Wang Q, Davidson BR, Lin H, Xie X, Wang C. Pre-operative biliary drainage for obstructive jaundice. *Cochrane Database Syst Rev* 2012; **9**: CD005444 [PMID: 22972086 DOI: 10.1002/14651858.CD005444.pub3]
13 **Garcea G**, Chee W, Ong SL, Maddern GJ. Preoperative biliary drainage for distal obstruction: the case against revisited. *Pancreas* 2010; **39**: 119-126 [PMID: 19940799 DOI: 10.1097/MPA.0b013e3181bd65de]
14 **van der Gaag NA**, Rauws EA, van Eijck CH, Bruno MJ, van der Harst E, Kubben FJ, Gerritsen JJ, Greve JW, Gerhards MF, de Hingh IH, Klinkenbijl JH, Nio CY, de Castro SM, Busch OR, van Gulik TM, Bossuyt PM, Gouma DJ. Preoperative biliary drainage for cancer of the head of the pancreas. *N Engl J Med* 2010; **362**: 129-137 [PMID: 20071702 DOI: 10.1056/NEJMoa0903230]
15 **Eshuis WJ**, van der Gaag NA, Rauws EA, van Eijck CH, Bruno MJ, Kuipers EJ, Coene PP, Kubben FJ, Gerritsen JJ, Greve JW, Gerhards MF, de Hingh IH, Klinkenbijl JH, Nio CY, de Castro SM, Busch OR, van Gulik TM, Bossuyt PM, Gouma DJ. Therapeutic delay and survival after surgery for cancer of the pancreatic head with or without preoperative biliary drainage. *Ann Surg* 2010; **252**: 840-849 [PMID: 21037440 DOI: 10.1097/SLA.0b013e3181fd36a2]
16 **Jagannath P**, Dhir V, Shrikhande S, Shah RC, Mullerpatan P, Mohandas KM. Effect of preoperative biliary stenting on immediate outcome after pancreaticoduodenectomy. *Br J Surg* 2005; **92**: 356-361 [PMID: 15672425 DOI: 10.1002/bjs.4864]
17 **Siddiqui AA**, Mehendiratta V, Loren D, Kowalski T, Fang J, Hilden K, Adler DG. Self-expanding metal stents (SEMS) for preoperative biliary decompression in patients with resectable and borderline-resectable pancreatic cancer: outcomes in 241 patients. *Dig Dis Sci* 2013; **58**: 1744-1750 [PMID: 23179157 DOI: 10.1007/s10620-012-2482-z]
18 **Coates JM**, Beal SH, Russo JE, Vanderveen KA, Chen SL, Bold RJ, Canter RJ. Negligible effect of selective preoperative biliary drainage on perioperative resuscitation, morbidity, and mortality in patients undergoing pancreaticoduodenectomy. *Arch Surg* 2009; **144**: 841-847 [PMID: 19797109 DOI: 10.1001/archsurg.2009.152]
19 **Kleeff J**, Friess H, Büchler MW. Neoadjuvant therapy for pancreatic cancer. *Br J Surg* 2007; **94**: 261-262 [PMID: 17315287 DOI: 10.1002/bjs.5737]
20 **Adler G**, Seufferlein T, Bischoff SC, Brambs HJ, Feuerbach S, Grabenbauer G, Hahn S, Heinemann V, Hohenberger W, Langrehr JM, Lutz MP, Micke O, Neuhaus H, Neuhaus P, Oettle H, Schlag PM, Schmid R, Schmiegel W, Schlottmann K, Werner J, Wiedenmann B, Kopp I. [S3-Guidelines "Exocrine pancreatic cancer" 2007]. *Z Gastroenterol* 2007; **45**: 487-523 [PMID: 17607616 DOI: 10.1055/s-2007-963224]
21 **Wayne JD**, Abdalla EK, Wolff RA, Crane CH, Pisters PW, Evans DB. Localized adenocarcinoma of the pancreas: the rationale for preoperative chemoradiation. *Oncologist* 2002; **7**: 34-45 [PMID: 11854545]
22 **Wray CJ**, Ahmad SA, Matthews JB, Lowy AM. Surgery for pancreatic cancer: recent controversies and current practice. *Gastroenterology* 2005; **128**: 1626-1641 [PMID: 15887155]
23 **Staley CA**, Lee JE, Cleary KR, Abbruzzese JL, Fenoglio CJ, Rich TA, Evans DB. Preoperative chemoradiation, pancreaticoduodenectomy, and intraoperative radiation therapy for adenocarcinoma of the pancreatic head. *Am J Surg* 1996; **171**: 118-124; discussion 124-125 [PMID: 8554125 DOI: 10.1016/S0002-9610(99)80085-3]
24 **Talamonti MS**, Small W, Mulcahy MF, Wayne JD, Attaluri V, Colletti LM, Zalupski MM, Hoffman JP, Freedman GM, Kinsella TJ, Philip PA, McGinn CJ. A multi-institutional phase II trial of preoperative full-dose gemcitabine and concurrent radiation for patients with potentially resectable pancreatic carcinoma. *Ann Surg Oncol* 2006; **13**: 150-158 [PMID: 16418882 DOI: 10.1245/ASO.2006.03.039]
25 **Hosein PJ**, Macintyre J, Kawamura C, Maldonado JC, Ernani V, Loaiza-Bonilla A, Narayanan G, Ribeiro A, Portelance L, Merchan JR, Levi JU, Rocha-Lima CM. A retrospective study of neoadjuvant FOLFIRINOX in unresectable or borderline-resectable locally advanced pancreatic adenocarcinoma. *BMC Cancer* 2012; **12**: 199 [PMID: 22642850 DOI: 10.1186/1471-2407-12-199]
26 **Evans DB**, Varadhachary GR, Crane CH, Sun CC, Lee JE, Pisters PW, Vauthey JN, Wang H, Cleary KR, Staerkel GA, Charnsangavej C, Lano EA, Ho L, Lenzi R, Abbruzzese JL, Wolff RA. Preoperative gemcitabine-based chemoradiation for patients with resectable adenocarcinoma of the pancreatic head. *J Clin Oncol* 2008; **26**: 3496-3502 [PMID: 18640930 DOI: 10.1200/JCO.2007.15.8634]
27 **Meszoely IM**, Wang H, Hoffman JP. Preoperative chemoradiation therapy for adenocarcinoma of the pancreas: The Fox Chase Cancer Center experience, 1986-2003. *Surg Oncol Clin N Am* 2004; **13**: 685-696, x [PMID: 15350942 DOI: 10.1016/j.soc.2004.06.013]
28 **Tempero MA**, Behrman S, Ben-Josef E, Benson AB, Cameron JL, Casper ES, Hoffman JP, Karl RC, Kim P, Koh WJ, Kuvshinoff BW, Melvin WS, Muscarella P, Sasson AR, Shibata S, Shrieve DC, Talamonti MS, Tyler DS, Vickers SM, Warren RS, Willett C, Wolff RA. Pancreatic adenocarcinoma: Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw* 2005; **3**: 598-626 [PMID: 16194453]
29 **Stokes JB**, Nolan NJ, Stelow EB, Walters DM, Weiss GR, de Lange EE, Rich TA, Adams RB, Bauer TW. Preoperative capecitabine and concurrent radiation for borderline resectable pancreatic cancer. *Ann Surg Oncol* 2011; **18**: 619-627 [PMID: 21213060 DOI: 10.1245/s10434-010-1456-7]
30 **Sahora K**, Kuehrer I, Eisenhut A, Akan B, Koellblinger C, Goetzinger P, Teleky B, Jakesz R, Peck-Radosavljevic M, Ba' ssalamah A, Zielinski C, Gnant M. NeoGemOx: Gemcitabine and oxaliplatin as neoadjuvant treatment for locally advanced, nonmetastasized pancreatic cancer. *Surgery* 2011; **149**: 311-320 [PMID: 20817204 DOI: 10.1016/j.surg.2010.07.048]
31 **Barugola G**, Partelli S, Crippa S, Capelli P, D'Onofrio M, Pederzoli P, Falconi M. Outcomes after resection of locally advanced or borderline resectable pancreatic cancer after neoadjuvant therapy. *Am J Surg* 2012; **203**: 132-139 [PMID: 21824596 DOI: 10.1016/j.amjsurg.2011.03.008]
32 **Hartwig W**, Schneider L, Diener MK, Bergmann F, Büchler MW, Werner J. Preoperative tissue diagnosis for tumours of the pancreas. *Br J Surg* 2009; **96**: 5-20 [PMID: 19016272 DOI: 10.1002/bjs.6407]
33 **Callery MP**, Chang KJ, Fishman EK, Talamonti MS, William Traverso L, Linehan DC. Pretreatment assessment of resectable and borderline resectable pancreatic cancer: expert consensus statement. *Ann Surg Oncol* 2009; **16**: 1727-1733 [PMID: 19396496]
34 **Harbour R**, Miller J. A new system for grading recommendations in evidence based guidelines. *BMJ* 2001; **323**: 334-336 [PMID: 11498496]
35 **Assifi MM**, Lu X, Eibl G, Reber HA, Li G, Hines OJ. Neoadjuvant therapy in pancreatic adenocarcinoma: a meta-analysis of phase II trials. *Surgery* 2011; **150**: 466-473 [PMID: 21878232 DOI: 10.1016/j.surg.2011.07.006]
36 **Andriulli A**, Festa V, Botteri E, Valvano MR, Koch M, Bassi C, Maisonneuve P, Sebastiano PD. Neoadjuvant/preoperative gemcitabine for patients with localized pancreatic cancer: a meta-analysis of prospective studies. *Ann Surg Oncol* 2012; **19**: 1644-1662 [PMID: 22012027 DOI: 10.1245/s10434-]
37 **Festa V**, Andriulli A, Valvano MR, Uomo G, Perri F, Andriulli N, Corrao S, Koch M. Neoadjuvant chemo-radiotherapy for patients with borderline resectable pancreatic cancer: a meta-analytical evaluation of prospective studies. *JOP* 2013; **14**: 618-625 [PMID: 24216547 DOI: 10.6092/1590-8577/1724]

38 **Bhayani NH**, Miller JL, Ortenzi G, Kaifi JT, Kimchi ET, Staveley-O'Carroll KF, Gusani NJ. Perioperative outcomes of pancreaticoduodenectomy compared to total pancreatectomy for neoplasia. *J Gastrointest Surg* 2014; **18**: 549-554 [PMID: 24165872 DOI: 10.1007/s11605-013-2393-0]

39 **Tan WJ**, Kow AW, Liau KH. Moving towards the New International Study Group for Pancreatic Surgery (ISGPS) definitions in pancreaticoduodenectomy: a comparison between the old and new. *HPB* (Oxford) 2011; **13**: 566-572 [PMID: 21762300 DOI: 10.1111/j.1477-2574.2011.00336.x]

40 **Laurence JM**, Tran PD, Morarji K, Eslick GD, Lam VW, Sandroussi C. A systematic review and meta-analysis of survival and surgical outcomes following neoadjuvant chemoradiotherapy for pancreatic cancer. *J Gastrointest Surg* 2011; **15**: 2059-2069 [PMID: 21913045 DOI: 10.1007/s11605-011-1659-]

41 **Bluemke DA**, Fishman EK. CT and MR evaluation of pancreatic cancer. *Surg Oncol Clin N Am* 1998; **7**: 103-124 [PMID: 9443989]

42 **Allema JH**, Reinders ME, van Gulik TM, van Leeuwen DJ, de Wit LT, Verbeek PC, Gouma DJ. Portal vein resection in patients undergoing pancreatoduodenectomy for carcinoma of the pancreatic head. *Br J Surg* 1994; **81**: 1642-1646 [PMID: 7827892]

43 **Harrison LE**, Klimstra DS, Brennan MF. Isolated portal vein involvement in pancreatic adenocarcinoma. A contraindication for resection? *Ann Surg* 1996; **224**: 342-347; discussion 347-349 [PMID: 8813262]

44 **Leach SD**, Lee JE, Charnsangavej C, Cleary KR, Lowy AM, Fenoglio CJ, Pisters PW, Evans DB. Survival following pancreaticoduodenectomy with resection of the superior mesenteric-portal vein confluence for adenocarcinoma of the pancreatic head. *Br J Surg* 1998; **85**: 611-617 [PMID: 9635805 DOI: 10.1046/j.1365-2168.1998.00641.x]

45 **Yekebas EF**, Bogoevski D, Cataldegirmen G, Kunze C, Marx A, Vashist YK, Schurr PG, Liebl L, Thieltges S, Gawad KA, Schneider C, Izbicki JR. En bloc vascular resection for locally advanced pancreatic malignancies infiltrating major blood vessels: perioperative outcome and long-term survival in 136 patients. *Ann Surg* 2008; **247**: 300-309 [PMID: 18216537 DOI: 10.1097/SLA.0b013e31815aab22]

46 **National Comprehensive Cancer Network (NCCN)**. Guidelines in oncology: pancreatic adenocarcinoma 2008. Accessed May 5, 2011. Available from: URL: http://www.nccn.org/professionals/ physician_gls/PDF/pancreatic.pdf

47 **Wagner M**, Redaelli C, Lietz M, Seiler CA, Friess H, Büchler MW. Curative resection is the single most important factor determining outcome in patients with pancreatic adenocarcinoma. *Br J Surg* 2004; **91**: 586-594 [PMID: 15122610 DOI: 10.1002/bjs.4484]

48 **Cameron JL**, Riall TS, Coleman J, Belcher KA. One thousand consecutive pancreaticoduodenectomies. *Ann Surg* 2006; **244**: 10-15 [PMID: 16794383 DOI: 10.1097/01.sla.0000217673.04165.ea]

49 **Weitz J**, Rahbari N, Koch M, Büchler MW. The "artery first" approach for resection of pancreatic head cancer. *J Am Coll Surg* 2010; **210**: e1-e4 [PMID: 20113929 DOI: 10.1016/j.jamcollsurg.2009.10.019]

50 **Mollberg N**, Rahbari NN, Koch M, Hartwig W, Hoeger Y, Büchler MW, Weitz J. Arterial resection during pancreatectomy for pancreatic cancer: a systematic review and meta-analysis. *Ann Surg* 2011; **254**: 882-893 [PMID: 22064622 DOI: 10.1097/SLA.0b013e31823ac299]

51 **Bachellier P**, Rosso E, Lucescu I, Oussoultzoglou E, Tracey J, Pessaux P, Ferreira N, Jaeck D. Is the need for an arterial resection a contraindication to pancreatic resection for locally advanced pancreatic adenocarcinoma? A case-matched controlled study. *J Surg Oncol* 2011; **103**: 75-84 [PMID: 21105000 DOI: 10.1002/jso.21769]

52 **Bockhorn M**, Burdelski C, Bogoevski D, Sgourakis G, Yekebas EF, Izbicki JR. Arterial en bloc resection for pancreatic carcinoma. *Br J Surg* 2011; **98**: 86-92 [PMID: 21136564 DOI: 10.1002/bjs.7270]

53 **Moore GE**, Sako Y, Thomas LB. Radical pancreatoduodenectomy with resection and reanastomosis of the superior mesenteric vein. *Surgery* 1951; **30**: 550-553 [PMID: 14866700]

54 **Asada S**, Itaya H, Nakamura K, Isohashi T, Masuoka S. Radical Pancreatoduodenectomy and portal vein resection. Report of two successful cases with transplantation of portal vein. *Arch Surg* 1963; **87**: 609-613 [PMID: 14056238]

55 **Fortner JG**. Regional resection of cancer of the pancreas: a new surgical approach. *Surgery* 1973; **73**: 307-320 [PMID: 4265314]

56 **Sindelar WF**. Clinical experience with regional pancreatectomy for adenocarcinoma of the pancreas. *Arch Surg* 1989; **124**: 127-132 [PMID: 2910241]

57 **Yeo CJ**, Cameron JL, Lillemoe KD, Sohn TA, Campbell KA, Sauter PK, Coleman J, Abrams RA, Hruban RH. Pancreaticoduodenectomy with or without distal gastrectomy and extended retroperitoneal lymphadenectomy for periampullary adenocarcinoma, part 2: randomized controlled trial evaluating survival, morbidity, and mortality. *Ann Surg* 2002; **236**: 355-366; discussion 366-368 [PMID: 12192322 DOI: 10.1097/01.SLA.0000027272.08464.0B]

58 **Fuhrman GM**, Leach SD, Staley CA, Cusack JC, Charnsangavej C, Cleary KR, El-Naggar AK, Fenoglio CJ, Lee JE, Evans DB. Rationale for en bloc vein resection in the treatment of pancreatic adenocarcinoma adherent to the superior mesenteric-portal vein confluence. Pancreatic Tumor Study Group. *Ann Surg* 1996; **223**: 154-162 [PMID: 8597509]

59 **Roder JD**, Stein HJ, Siewert JR. Carcinoma of the periampullary region: who benefits from portal vein resection? *Am J Surg* 1996; **171**: 170-174; discussion 174-175 [PMID: 8554135 DOI: 10.1016/S0002-9610(99)80094-4]

60 **Winter JM**, Cameron JL, Campbell KA, Arnold MA, Chang DC, Coleman J, Hodgin MB, Sauter PK, Hruban RH, Riall TS, Schulick RD, Choti MA, Lillemoe KD, Yeo CJ. 1423 pancreaticoduodenectomies for pancreatic cancer: A single-institution experience. *J Gastrointest Surg* 2006; **10**: 1199-1210; discussion 1210-1211 [PMID: 17114007 DOI: 10.1016/j.gassur.2006.08.018]

61 **Richter A**, Niedergethmann M, Sturm JW, Lorenz D, Post S, Trede M. Long-term results of partial pancreaticoduodenectomy for ductal adenocarcinoma of the pancreatic head: 25-year experience. *World J Surg* 2003; **27**: 324-329 [PMID: 12607060 DOI: 10.1007/s00268-002-6659-z]

62 **Gouma DJ**, van Geenen RC, van Gulik TM, de Haan RJ, de Wit LT, Busch OR, Obertop H. Rates of complications and death after pancreaticoduodenectomy: risk factors and the impact of hospital volume. *Ann Surg* 2000; **232**: 786-795 [PMID: 11088073]

63 **McPhee JT**, Hill JS, Whalen GF, Zayaruzny M, Litwin DE, Sullivan ME, Anderson FA, Tseng JF. Perioperative mortality for pancreatectomy: a national perspective. *Ann Surg* 2007; **246**: 246-253 [PMID: 17667503 DOI: 10.1097/01.sla.0000259993.17350.3a]

64 **Howard TJ**, Villanustre N, Moore SA, DeWitt J, LeBlanc J, Maglinte D, McHenry L. Efficacy of venous reconstruction in patients with adenocarcinoma of the pancreatic head. *J Gastrointest Surg* 2003; **7**: 1089-1095 [PMID: 14675720]

65 **Bachellier P**, Nakano H, Oussoultzoglou PD, Weber JC, Boudjema K, Wolf PD, Jaeck D. Is pancreaticoduodenectomy with mesentericoportal venous resection safe and worthwhile? *Am J Surg* 2001; **182**: 120-129 [PMID: 11574081]

66 **Ramacciato G**, Mercantini P, Petrucciani N, Giaccaglia V, Nigri G, Ravaioli M, Cescon M, Cucchetti A, Del Gaudio M. Does portal-superior mesenteric vein invasion still indicate irresectability for pancreatic carcinoma? *Ann Surg Oncol* 2009; **16**: 817-825 [PMID: 19156463 DOI: 10.1245/s10434-008-0281-8]

67 **Siriwardana HP**, Siriwardena AK. Systematic review of

outcome of synchronous portal-superior mesenteric vein resection during pancreatectomy for cancer. *Br J Surg* 2006; **93**: 662-673 [PMID: 16703621 DOI: 10.1002/bjs.5368]
68 **Martin RC**, Scoggins CR, Egnatashvili V, Staley CA, McMasters KM, Kooby DA. Arterial and venous resection for pancreatic adenocarcinoma: operative and long-term outcomes. *Arch Surg* 2009; **144**: 154-159 [PMID: 19221327 DOI: 10.1001/archsurg.2008.547]

P- Reviewer: Borkakoti J, Milella M, Mizuno N, Olah A
S- Editor: Zhai HH **L- Editor**: Webster JR **E- Editor**: Wang CH

Published by **Baishideng Publishing Group Inc**
8226 Regency Drive, Pleasanton, CA 94588, USA
Telephone: +1-925-223-8242
Fax: +1-925-223-8243
E-mail: bpgoffice@wjgnet.com
Help Desk: http://www.wjgnet.com/esps/helpdesk.aspx
http://www.wjgnet.com

ISSN 1007-9327