DOI:10.1111/j.1477-2574.2009.00105.x

HPB

ORIGINAL ARTICLE

Peri-operative outcomes for pancreatoduodenectomy in India: a multi-centric study

Parul J. Shukla[1], Savio G. Barreto[1], M.M.S. Bedi[2], N. Bheerappa[3], Adarsh Chaudhary[4], M.D. Gandhi[2], M. Jacob[2], S. Jesvanth[5], D.G. Kannan[5], Vinay K. Kapoor[6], A. Kumar[6], K.K. Maudar[7], Hariharan Ramesh[2], R.A. Sastry[3], Rajan Saxena[6], Ajit Sewkani[7], S. Sharma[7], Shailesh V. Shrikhande[1], A. Singh[4], Rajneesh K. Singh[6], R. Surendran[5], Subodh Varshney[7], V. Verma[3] & V. Vimalraj[5]

[1]Department of Gastrointestinal and Hepatopancreatobiliary Surgery, Tata Memorial Hospital, Mumbai, [2]Department of Gastrointestinal and Hepatopancreatobiliary Surgery, Lakeshore Hospital, Cochin, [3]Department of Gastrointestinal and Hepatopancreatobiliary Surgery, Nizam's Institute, Hyderabad, [4]Department of Gastrointestinal and Hepatopancreatobiliary Surgery, Sir Ganga Ram Hospital, New Delhi, [5]Department of Gastrointestinal and Hepatopancreatobiliary Surgery, Stanley Medical College, Chennai, [6]Department of Gastrointestinal and Hepatopancreatobiliary Surgery, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, and [7]Department of Gastrointestinal and Hepatopancreatobiliary Surgery, Bhopal Memorial Hospital and Research Center, Bhopal, India

Abstract

Background: There have been an increasing number of reports world-wide relating improved outcomes after pancreatic resections to high volumes thereby supporting the idea of centralization of pancreatic resectional surgery. To date there has been no collective attempt from India at addressing this issue. This cohort study analysed peri-operative outcomes after pancreatoduodenectomy (PD) at seven major Indian centres.

Materials and Methods: Between January 2005 and December 2007, retrospective data on PDs, including intra-operative and post-operative factors, were obtained from seven major centres for pancreatic surgery in India.

Results: Between January 2005 and December 2007, a total of 718 PDs were performed in India at the seven centres. The median number of PDs performed per year was 34 (range 9–54). The median number of PDs per surgeon per year was 16 (range 7–38). Ninety-four per cent of surgeries were performed for suspected malignancy in the pancreatic head and periampullary region. The median mortality rate per centre was four (range 2–5%). Wound infections were the commonest complication with a median incidence per centre of 18% (range 9.3–32.2%), and the median post-operative duration of hospital stay was 16 days (range 4–100 days).

Conclusions: This is the first multi-centric report of peri-operative outcomes of PD from India. The results from these specialist centers are very acceptable, and appear to support the thrust towards centralization.

Keywords

pancreatoduodenectomy, outcomes, India

Received 9 March 2009; accepted 16 June 2009

Correspondence

Parul J. Shukla, Gastrointestinal Surgical Oncology, Tata Memorial Hospital, Parel, Mumbai 400 012, India. Tel: 91 22 2414 7172. Fax: 91 22 2414 6937. E-mail: pjshukla@doctors.org.uk

Introduction

There have been an increasing number of reports from around the world relating improved outcomes after pancreatic resections to high volumes of patients.[1–8] This has led to an increased emphasis on centralization of pancreatic resectional surgery, especially pancreatoduodenectomy (PD). PD remains a complex surgery with an attendant high morbidity rate.[9–11] The reduction in operative mortality rates across the world, to less than 5%,[12–14] has largely been attributed to a vast variety of factors including specialized surgery being performed in specialized centres,[1–8] interventional radiology support for management of complications[15,16] and better critical care support. In fact, Kotwall *et al.*,[17] using the Nationwide Inpatient Sample Database, showed a 50% excess

mortality after PD in low-volume centres in the United States of America. While there have been many Indian publications on PDs,[18–28] there are no studies reporting collated results from a number of centres. This cohort study was carried out to determine the peri-operative outcomes of PD from seven high-volume centres in India.

Materials and methods

Between 1st January 2005 to 31st December 2007, retrospective data of patients undergoing PDs in seven Indian high-volume (more than five PDs per year[1,29,30]) Gastrointestinal and Hepato-Pancreato-Biliary centres were reviewed. The participating centres included Bhopal Memorial Hospital and Research Center (BMHRC – Bhopal), Lakeshore Hospital (Cochin), Nizam's Institute, Hyderabad, Sanjay Gandhi Post Graduate Institute of Medical Sciences (SGPGI – Lucknow), Sir Ganga Ram Hospital (SGRH – New Delhi), Stanley Medical College (Chennai) and Tata Memorial Hospital (TMH – Mumbai).

All the seven centres included in the study are renowned super-speciality teaching institutions located in different parts of India and offer advanced training programmes in the field of Surgical Gastroenterology. Moreover, all authors in the study are recognized nationally as leaders in the field with publications to their credit.

In India, there are many other centres performing PDs, and we have not attempted to represent all PDs being performed in the country. This study has been possible because of good personal relations between the authors from the seven centres, and hopefully will set a precedent towards multi-centric data sharing within India.

The data of the patients from each institute were collated by the participating institute and a common proforma was filled out by each individual institute and sent to the analysing centre (Tata Memorial Hospital). Data of PDs performed at all the centers were then collected in a proforma (See Table 1) and analysed.

Standard definitions were used for the classification of complications (See Table 1). Peri-operative mortality was defined as deaths taking place during surgery, immediate post-operative (irrespective of whether they arose as a result of the surgery or other causes), up to 30 days post-operative or any death in a patient outside these criteria that was directly related to a complication of the procedure.

Statistical analysis

All statistical analyses were performed using the Statistical Product and Service Solutions, SPSS 14.0 for Windows (SPSS Inc., Chicago, IL, USA). Nominal data are provided as number (%) and continuous data as median (range) and $P \leq 0.05$ was regarded as significance.

Pearson's χ^2-test was used for testing associations between surgical site and mortality rates.

Results

During the study period, 718 patients underwent PDs at these seven centres. The median number of PDs performed per year was 34 (range 9–54). The median number of PDs per surgeon per year was 16 (range 7–38). The demographics, indications for surgery, pre- and intra-operative factors are summarized in Table 2.

Drug protocols

In the seven centres, all patients received peri-operative intravenous third generation Cephalosporins which were continued for 3–7 days post-operatively. The preferred antibiotic combination of cefoparazon-sulbactam was the preferred choice in four centres, whereas cefotaxime (two centres) and ceftriaxone (1 centre) were also used. In patients who developed intraabdominal complications including haemorrhage and post-operative pancreatic fistula (POPF), Meropenem was used.

The use of octreotide varied between institutes. While in three centres octreotide was routinely used for 3–7 days post-operative, in two other centers, the choice for octreotide was reserved only in case of a soft pancreas and undilated pancreatic duct in which case it was used for 5 and 7 days. In the 6th centre, in addition to the previous two indications, octreotide was also used in case of a technically unsatisfactory pancreaticoenterostomy. In the 7th centre, octreotide was never used.

Drains

In all centres, surgical tube drains were routinely placed intra-operatively. The number of drains used routinely varied from 2 in 3 centres to 1 in 2 centers. In the remaining 2 centres, the number of drains used, 1 or 2, depended on the operating surgeon's preference. In 5 centres the drains used were non-suction drains, in the 6th centre closed suction drains were routinely used, whereas in the 7th centre, the choice was dependant on the operating surgeon.

Histopathology

Final histology confirmed 643 (89.5%) patients with adenocarcinoma, 35 (4.8%) chronic pancreatitis, 21 (2.9%) neuroendocrine tumours, 8 (1.1%) solid pseudopapillary tumours and 15 (2%) other pathology.

Post-operative morbidity and mortality

The median (range) individual complication rate per centre is described in Table 3. Wound infections were the commonest complication with a median incidence per centre of 18% (range 9–32%). Post-operative pancreatic fistulae were the second most common complication with a median incidence per centre of 12% (6–38%). As per the International study Group on Pancreatic Fistula (ISGPF) definition,[32] the post-operative pancreatic fistulae (n = 135) were of the following grades: Grade A = 85 (62.9%), Grade B = 19 (14%) and Grade C = 31

Table 1 Definition of complications

Factors studied	Definitions used
Demographic data	• Age
	• Gender
Preoperative variables	Number of patients undergoing preoperative biliary drainage (PTBD or ERCP with stenting, or cholecystostomy)
Indications for PD	
Intra-operative factors	• Type of resection – classicor pylorus-preserving
	• Type of pancreaticoenteric anastomosis – PG or PJ
	• Extent of lymph node dissection[31] Standard – defined as regional lymphadenectomy around the duodenum and pancreasRadical – regional lymphadenectomy plus skeletonisation hepatic arteries, superior mesenteric artery between aorta and inferior pancreaticoduodenal, and celiac trunk, dissection of the anterolateral aspect of aorta and vena cava including Gerota's fascia
	• Use of pancreatic ductal stent and the indications
	• Type of GJ / DJ – ante- or retro-colic
	• Duration of surgery
	• Blood loss
	• Number of transfusions per patient
Peri-operative variables	• Antibiotic protocol
	• Use of octreotide
	• Morbidity
	I. Pancreatic fistula was defined as per the ISGPF[32]
	II. Delayed gastric emptying – defined as either 1) nasogastric tube decompression for ≥10 days and one of the following criteria: a) emesis after nasogastric tube removal, b) post-operative use of prokinetic agents after post-operative day 10, c) reinsertion of a nasogastric tube, or d) failure to progress with diet, or 2) nasogastric tube decompression for <10 days and two out of the four criteria.
	III. Biliary leak – persistent biliary drainage form the drain placed in the right upper quadrant.
	IV. Haemorrhage – bleeding as evidenced by the presence of fresh blood in the drains/nasogastric tube and/or malaena, with or without the further need for intervention – radiological or surgical.
	V. Acute pancreatitis – at least a threefold increase in the normal amylase or lipase serum value within the 4th post-operative day, confirmed clinically and radiologically (CT)
	VI. Fluid collection (Abscess) – fluid collection diagnosed on US or CT associated with presence of pus on guided aspiration performed for clinical with leucocytosis/leucopenia (patients in septicemia), tachycardia and local abdominal tenderness with or without prior evidence of acute pancreatitis and after removal of drains.
	VII. Chyle leak – was defined as drainage of copious milky white fluid from the intra-operatively placed drains with a normal drain amylase (<three times normal at any time post-operative)
	VIII. Persistently high drain output – high volume (>50 cc/day) serous drain effluent with normal drain amylase and non-chylous persisting after the first postoperative week.
	• Mortality
Post-operative factors	• Duration of hospital stay defined as the entire period of hospitalization until the patient was discharged
	• Histopathology

PD, pancreatoduodenectomy; PTBD, percutaneous transhepatic biliary drainage; ERCP, endoscopic retrograde cholangiopancreatography; PG, pancreaticogastrostomy; PJ, pancreaticojeunostomy; GJ, gastrojejunostomy; DJ, duodenojejunostomy; ISGPF, International study Group on Pancreatic Fistula definition; US, ultrasonography; CT, computed tomography.

(22.9%). Forty four (6.1%) patients developed post-operative bleeding. These included 13 patients with an early bleed (<24 h) and 31 patients with a late bleed (>24 h). Nineteen out of the 44 patients required re-surgery to control the bleeding.

The median post-operative hospital stay was 16 days (range 4–100). Applying Pearson's χ^2-test for association between surgical site and mortality rates, we found no significant association ($P < 0.796$) between surgical site and mortality.

Discussion

The concept of improved outcomes for patients undergoing pancreatic resections at high volume centres is not new. Birkmeyer *et al.*[1] were the first to put forth this idea that was later ratified by large studies from Europe and the United States.[2–8]

The current study was performed to analyse the pattern of peri-operative outcomes for patients undergoing PDs in seven Gastrointestinal and Hepato-Pancreato-Biliary Surgical Speciality

Table 2 Patient-related factors including demography, indications for PD and intra-operative factors

Demography	
Median age (range)	53 years (13–88)
Male gender	435 (60.5%)
Pre-operative biliary tent	232 (32.3%)
Indications for PD	
Neoplasms	668 (93.0%)
Lower CBD	108
Pancreatic head	180
Ampulla	299
Duodenum	81
Chronic pancreatitis	35 (4.8%)
Others	15 (2.0%)
Type of PD	
Pylorus-preserving	321 (44.7%)
Classic	397 (55.3%)
Median (range) blood loss (mls)	400 (60–4000) ml
Median (range) duration of surgery (minutes)	245 (120–770) min
Type of pancreatic reconstruction	
PJ	491 (68.3%)
PG	227 (31.7%)
Extent of lymph node dissection[a]	
Standard	652 (90.8%)
Radical	57 (7.9%)
Type of GJ /DJ	
Antecolic	334 (46.5%)
Retrocolic	384 (53.5%)

[a]In nine patients, a lymphadenectomy was not performed as per the Institute's policy not to perform a lymphadenectomy for patients with chronic pancreatitis.
PD, pancreatoduodenectomy; CBD, common bile duct; PG, pancreaticogastrostomy; PJ, pancreaticojeunostomy; GJ, gastrojejunostomy; DJ, duodenojejunostomy.

Table 3 Outcomes and complications (n = 718)

	Median incidence rates (range)
Surgical complications	
Wound infections	18 (9–32%)
Post-operative pancreatic fistula (n = 135)	12 (6–38%)
Delayed gastric emptying	10 (0–31%)
Haemorrhage	6 (3–13%)
Persistent high drain output	7 (0–13%)
Biliary leak	1 (0–17%)
Acute pancreatitis	6 (0–6%)
Chyle leak	4 (0–4%)
Mortality	3.57% (2–5%)

and Teaching Hospitals across India. We used a cut-off value of more than five PDs a year to define 'high volume' as has been described by Birkmeyer and Kingsnorth.[1,29,30]

Unlike the recently published articles from Belgium and Italy[7,8] addressing the issue of centralization, our study did not rely on any central data-gathering agency. There is no systematic collection of the total number of surgical procedures performed in the country, and it would be very difficult to quote any reliable peri-operative outcome for the country as a whole. It is usually left to individual centres or units to establish their own data-bases, and maintain meticulous data capture and analysis.

From the data analysed, together, the centres performed a median of 34 PDs a year (range 9–54) with a median individual surgeon-volume of 16 surgeries per year over the 3-year study period.

The antibiotic protocols were quite similar in all the seven centres, with the cephalosporin group of antibiotics being the most commonly used. While routine antibiotic prophylaxis is recommended in PD,[33,34] the continued use of antibiotics up to the 7th post-operative day in our study possibly reflects an over-cautious approach. There are reports from India regarding the use of prophylactic antibiotics being inconsistent with published guidelines.[35]

An earlier study from India[36] had demonstrated the increased risk of septic complications in patients undergoing PD in whom the pre-operative endoscopic drainage was complicated. The centres included in our study constitute referral centres, and 32.3% of patients had undergone pre-operative endoscopic drainage, which may not necessarily have been undertaken at the institute *per se*. Clearly, there appears a need to further rationalize and develop evidence-based antibiotic prophylaxis policies which would be applicable nationally.[37]

Use of Octreotide between centres was also variable. This is probably a reflection of the lack of clear benefit of octreotide in PD. Since 1992, five randomized controlled trials (RCT) have been performed in Europe[38–42] and one RCT in the US.[43] While four out of the five European studies[38–41] did show a trend towards improved peri-operative outcomes with the use of octreotide, the 5th study[42] did not actually report any benefit in the entire patient cohort. What was found though, on sub-group analysis, was that Octreotide was useful in patients with a duct diameter of <3mm. The lone RCT from the US[43] failed to demonstrate any advantage of Octreotide use in this setting.

The type of resection and reconstruction performed varied between the centres with pylorus-preserving PDs being performed in 321 patients (44.7%) and classic PDs being performed in 397 patients (55.3%). This often appeared to be a protocol of the centre although some units did appear to have specific indications for performing classic PDs (in patients with duodenal malignancies or pancreatic head lesions infiltrating the duodenum).

Most patients underwent a standard lymphadenectomy, with only 7.9% of patients being subjected to a radical lymphadenec-

tomy. A recent meta-analysis[44] comparing standard PD versus extended PD, that included three randomized controlled trials, found that while extended PD increased lymph node yield and reduced positive resection margins, it conferred no survival advantage and was associated with a significantly increased risk of delayed gastric emptying (DGE).

The choice of pancreatic anastomosis showed a trend towards preference of pancreaticojejunostomy (PJ). PJ was performed in 491 patients (68.3%) as compared with a pancreaticogastrostomy (PG) which was performed in 227 patients (31.7%). While two meta-analyses[45,46] covering three, randomized, controlled trials[47–49] comparing PG versus PJ failed to show any statistically significant benefit of one technique of anastomosis over the other in terms of anastomotic leak rate, there is an increasing trend amongst surgeons towards performing a PJ.[50] This appears to be reflected in our study, as well.

The choice of the ante- versus retro-colic approach for gastrojejunostomy was evenly spread (46.5% vs. 53.5% respectively). While studies have reported a higher incidence of post-operative DGE[51–53] after the performance of a retrocolic GJ, a recent review of literature by Traverso and Hashimoto[54] found that conclusive evidence as to the benefit of one technique over the other could not be derived from the available literature owing to lack of homogeneity of definition and design and also because of the fact that the studies were underpowered.

Abdominal drains were routinely used in all seven centres. However, the number and type of drains used varied between the centres. This is possibly a reflection of the lack of consensus on the use of drains reported from around the world. While some studies have reported the lack of benefit of intraabdominal drains,[55,56] others recommend drainage[27,57] although the duration of drainage varies.

Despite the variance in the peri- and intra-operative management, the morbidity and mortality rates were within the observed world standards.[4–8,12–14] Post-operative pancreatic fistulae accounted for 17% of the complications in the entire series of which 77.0% were grade A and B. There appeared to be no significant association between the surgical site and mortality rates.

This study, which represents data from seven leading pancreatic surgery centres from India over a defined 3-year period, confirms the acceptable outcomes after PDs in high-volume centres that have been reported across the world.

And while there are no studies/literature available reporting or comparing outcomes from small volume centres in India, it is reasonable to expect that the world-wide experience of the advantages of centralization of major pancreatic resectional surgery would also be applicable in India.

Besides reporting good peri-operative outcomes after PD at the high-volume centres in India, our study has also detected certain variations in practice in different parts of the country. We hope that this study will bring together pancreatic surgeons from across the country for a collaborative effort towards formulating evidence-based pathways for standards of care. This study should, hopefully, encourage similar pooling and sharing of data from various centres around the country, and serve as a starting point in the long-term goal of establishing a credible central data-gathering agency for the country.

Conclusions

This multi-centric study confirms the coming of age of pancreatic resectional surgery in India. The peri-operative results from the seven high-volume and specialist centres are encouraging. It also guides surgeons who would like to be trained in these procedures, in finding the appropriate centres for training.

Acknowledgements

We sincerely thank and acknowledge Professor R. A. Badwe – Professor and Head, Department of Surgical Oncology, Tata Memorial Hospital, Mumbai for his help and inputs towards the preparation of this manuscript.

Conflicts of interest

None.

References

1. Birkmeyer JD, Finlayson SR, Tosteson AA, Sharp SM, Warshaw AL, Fisher ES. (1999) Effect of hospital volume on in-hospital mortality with pancreaticoduodenectomy. *Surgery* 125:250–256.
2. Lieberman KD, Kilburn H, Lindsey M, Brennan MF. (1995) Relation of perioperative deaths to hospital volume among patients undergoing pancreatic resection for malignancy. *Ann Surg* 222:638–645.
3. Gordon TA, Bowman HM, Tielsch JM, Bass EB, Burleyson GP, Cameron JL. (1998) Statewide regionalisation of pancreaticoduodenectomy and its effect on in-hospital mortality. *Ann Surg* 228:71–78.
4. Gouma DJ, van Geenen RC, van Gulik TM, de Haan RJ, de Wit LT, Bush OR *et al.* (2000) Rates of complications and death after pancreaticoduodenectomy: risk factors and the impact of hospital volume. *Ann Surg* 232:786–795.
5. Nordback I, Parviainen M, Raty S, Kuivanen H, Sand J. (2002) Resection of the head of the pancreas in Finland: effects of hospital and surgeon on short-term and long-term results. *Scand J Gastroenterol* 37:1454–1460.
6. van Heek NT, Kuhlmann KFD, Schloten RJ, de Castro SMM, Busch ORC, van Gulik TM *et al.* (2005) Hospital volume and mortality after pancreatic resection: a systematic review and an evaluation of intervention in the Netherlands. *Ann Surg* 242:781–788.
7. Topal B, van de Sande S, Fieuws S, Penninckx F. (2007) Effect of centralization of pancreaticoduodenectomy on nationwide hospital mortality and length of stay. *Br J Surg* 94:1377–1381.
8. Balzano G, Zerbi A, Capretti G, Rocchetti S, Capitanio V, Di Carlo V. (2008) Effect of hospital volume on outcome of pancreaticoduodenectomy in Italy. *Br J Surg* 95:357–362.
9. Yeo CJ, Cameron JL, Sohn TA, Lillemoe KD, Pitt HA, Talamini MA *et al.* (1997) Six hundred fifty consecutive pancreaticoduodenectomies in the 1990s: pathology, complications, and outcomes. *Ann Surg* 226:248–257.
10. Neoptolemos JP, Russell RC, Bramhall S, Theis B. (1997) Low mortality following resection for pancreatic and periampullary tumours in 1026 patients: UK survey of specialist pancreatic units. UK Pancreatic Cancer Group. *Br J Surg* 84:1370–1376.

11. Buechler MW, Friess H, Wagner M, Kulli C, Wagener V, Z'graggen K *et al.* (2000) Pancreatic fistula after pancreatic head resection. *Br J Surg* 87:883–889.
12. Bentrem DJ, Yeh JJ, Brennan MF, Kiran R, Pastores SM, Halpem NA *et al.* (2005) Predictors of intensive care unit admission and related outcome for patients after pancreaticoduodenectomy. *J Gastrointest Surg* 9:1307–1312.
13. Fong Y, Gonen M, Rubin D, Radzyner M, Brennan MF. (2005) Long –term outcome is superior after resection for cancer in high-volume centers. *Ann Surg* 242:540–544.
14. Ho V, Heslin MJ. (2003) Effect of hospital volume and experience on in-hospital mortality for pancreaticoduodenectomy. *Ann Surg* 237:509–514.
15. VanSonnenberg E, Wittich GR, Goodacre BW, Casola G, D'Agostinho HB. (2001) Percutaneous abscess drainage: update. *World J Surg* 25:362–369.
16. Sohn TA, Yeo CJ, Cameron JL, Geschwind JF, Mitchell SE, Venbrux AC *et al.* (2003) Pancreaticoduodenectomy: role of interventional radiologists in managing patients and complications. *J Gastrointest Surg* 7:209–219.
17. Kotwall C, Maxwell JG, Brinker CC, Koch GG, Covington DL. (2002) National estimates of mortality rates for radical pancreaticoduodenectomy in 25 000 patients. *Ann Surg Oncol* 9:847–854.
18. Shrikhande SV, Barreto G, Shukla PJ. (2008) Pancreatic fistula after pancreaticoduodenectomy: the impact of a standardized technique of pancreaticojejunostomy. *Langenbecks Arch Surg* 393:87–91.
19. Balachandran P, Sikora SS, Raghavendra Rao RV, Kumar A, Saxena R, Kapoor VK. (2004) Haemorrhagic complications of pancreaticoduodenectomy. *ANZ J Surg* 74:945–950.
20. Balachandran P, Sikora SS, Kapoor S, Krishnani N, Kumar A, Saxena R *et al.* (2006) Long-term survival and recurrence patterns in ampullary cancer. *Pancreas* 32:390–395.
21. Jagannath P, Dhir V, Shrikhande S, Shah RC, Mullerpatan P, Mohandas KM. (2005) Effect of preoperative biliary stenting on immediate outcome after pancreaticoduodenectomy. *Br J Surg* 92:356–361.
22. Kapur BM, Misra MC, Seenu V, Goel AK. (1998) Pancreaticogastrostomy for reconstruction of pancreatic stump after pancreaticoduodenectomy for ampullary carcinoma. *Am J Surg* 176:274–278.
23. Ramesh H. (2001) Adenocarcinoma of the pancreatic head: can survival be improved? *Indian J Gastroenterol* 20:45–46.
24. Tewari M, Shukla HS. (2005) Anterior gastrotomy technique of fashioning pancreaticogastrostomy following pancreaticoduodenectomy for pancreatic head and periampullary cancer. *Indian J Surg* 67:339–341.
25. Gvalani AK. (1996) Pancreaticogastrostomy versus pancreaticojejunostomy following pancreaticoduodenectomy for periampullary carcinoma. *Indian J Surg* 15:132–134.
26. Wagle PK, Joshi RM, Mathur SK. (2001) Pancreaticoduodenectomy for periampullary carcinoma. *Indian J Surg* 20:53–55.
27. Barreto G, D'Souza M, Shukla PJ, Shrikhande SV. (2008) The gray zone between post pancreaticoduodenectomy collections and pancreatic fistulae. *Pancreas* 37:422–425.
28. Shukla PJ, Barreto SG, Mohandas KM, Shrikhande SV. (2009) Defining the role of surgery for complications after pancreatoduodenectomy. *ANZ J Surg* 79:33–37.
29. Kingsnorth AN. (2000) Major HPB procedures must be undertaken in high volume quaternary centres? *HPB Surg* 11:359–361.
30. Birkmeyer JD, Warshaw AL, Finlayson SR, Grove MR, Tosteson AN. (1999) Relationship between hospital volume and late survival after pancreaticoduodenectomy. *Surgery* 126:178–183.
31. Pedrazzoli S, Beger H, Obertop H, Andren-Sandberg A, Fernandez-Cruz L, Henne-Bruns D *et al.* (1999) A surgical and pathological based classification of resective treatment of pancreatic cancer. Summary of an international workshop on surgical procedures in pancreatic cancer. *Dig Surg* 16:337–345.
32. Bassi C, Dervenis C, Butturini G, Fingerhut A, Yeo C, Izbicki J *et al.* (2005) Postoperative pancreatic fistula: an international study group (ISGPF) definition. *Surgery* 138:8–13.
33. Ueno T, Yamamoto K, Kawaoka T, Takashima M, Oka M. (2005) Current antibiotic prophylaxis in pancreatoduodenectomy in Japan. *J Hepatobiliary Pancreat Surg* 12:304–309.
34. Sudo T, Murakami Y, Uemura K, Hayashidani Y, Hashimoto Y, Ohge H *et al.* (2007) Specific antibiotic prophylaxis based on cultures is required to prevent postoperative infectious complications in pancreatoduodenectomy patients who have undergone preoperative biliary drainage. *World J Surg* 31:2230–2235.
35. Khan SA, Rao PG, Rao A, Rodrigues G. (2006) Survey and evaluation of antibiotic prophylaxis usage in surgery wards of tertiary level institution before and after the implementation of clinical guidelines. *Indian J Surg* 68:150–156.
36. Jagannath P, Dhir V, Shrikhande SV, Shah RC, Mullerpatan P, Mohandas KM. (2005) Effect of preoperative biliary stenting on immediate outcome after pancreaticoduodenectomy. *Br J Surg* 92:356–361.
37. Kulkarni RA, Kochhar PH, Dargude VA, Rajadhyaksha SS, Thatte UM. (2005) Patterns of antimicrobial use by surgeons in India. *Indian J Surg* 67:308–315.
38. Buchler M, Friess H, Klempa I, Hermanek P, Sulkowski U, Becker H, *et al.* (1992) Role of octreotide in the prevention of postoperative complications following pancreatic resection. *Am J Surg* 163:125–130.
39. Pederzoli P, Bassi C, Falconi M, Camboni MG. (1994) Efficacy of octreotide in the prevention of complications of elective pancreatic surgery. Italian Study Group. *Br J Surg* 81:265–269.
40. Montorsi M, Zago M, Mosca F, Capusotti L, Zotti E, Ribotta G *et al.* (1995) Efficacy of octreotide in the prevention of pancreatic fistula after elective pancreatic resections: a prospective, controlled, randomised clinical trial. *Surgery* 117:26–31.
41. Friess H, Beger H, Sulkowski U, Becker H, Hofbauer B, Dennler HJ *et al.* (1995) Randomized controlled multicentre study of the prevention of complications by octreotide in patients undergoing surgery for chronic pancreatitis. *Br J Surg* 82:1270–1273.
42. Suc B, Msika S, Piccinini M, Fourtanier G, Hay JM, Flamant Y *et al.* (2004) Octreotide in the prevention of intra-abdominal complications following elective pancreatic resection: a prospective, multicenter randomized controlled trial. *Arch Surg* 139:288–294.
43. Yeo CJ, Cameron JL, Lillemoe KD, Sauter PK, Coleman J, Sohn TA *et al.* (2000) Does prophylactic octreotide decrease the rates of pancreatic fistula and other complications after pancreaticoduodenectomy? Results of a prospective randomized placebo-controlled trial. *Ann Surg* 232:419–429.
44. Iqbal N, Lovegrove RE, Tilney HS, Abraham AT, Bhattacharya S, Tekkis PP *et al.* (2009) A comparison of pancreaticoduodenectomy with extended pancreaticoduodenectomy: a meta-analysis of 1909 patients. *Eur J Surg Oncol* 35:79–86.
45. McKay A, Mackenzie S, Sutherland FR, Bathe OF, Doig C, Dort J *et al.* (2006) Meta-analysis of pancreaticojejunostomy versus Pancreaticogastrostomy reconstruction after pancreaticoduodenectomy. *Br J Surg* 93:929–936.

46. Wente MN, Shrikhande SV, Mueller MW, Diener MK, Seiler CM, Friess H, Buchler MW. (2007) Pancreaticojejunostomy versus Pancreaticogastrostomy: systematic review and meta-analysis. *Am J Surg* 193:171–183.

47. Bassi C, Falconi M, Molinari E, Salvia R, Butturini G, Sartori N *et al.* (2005) Reconstruction by pancreaticojejunostomy versus Pancreaticogastrostomy following Pancreatectomy. Results of a comparative study. *Ann Surg* 242:767–773.

48. Duffas JP, Suc B, Msika S, Fourtanier G, Muscari F, Hay JM *et al.* (2005) A controlled multicentre trial of pancreatogastrostomy or pancreatojejunostomy after pancreatoduodenectomy. *Am J Surg* 189:720–729.

49. Yeo CJ, Cameron JL, Maher MM, Sauter PK, Zahurak ML, Talamini MA *et al.* (1995) A prospective randomised trial of Pancreaticogastrostomy versus pancreaticojejunostomy after pancreaticoduodenectomy. *Ann Surg* 222:580–592.

50. Tewari M, Hazrah P, Kumar V, Shukla HS. (2009) Options of restorative pancreaticoenteric anastomosis following pancreaticoduodenectomy: a review. *Surg Oncol*: DOI:10.1016/j.suronc.2009.01.002.

51. Murakami Y, Uemura K, Sudo T, Hayashidani Y, Hashimoto Y, Nakagawa N *et al.* (2008) An antecolic Roux-en-Y type reconstruction decreased delayed gastric emptying after pylorus-preserving pancreatoduodenectomy. *J Gastroinetst Surg* 12:1081–1086.

52. Tani M, Terasawa H, Kawai M, Ina S, Hirono S, Uchiyama K *et al.* (2006) Improvement of delayed gastric emptying in pylorus-preserving pancreaticoduodenectomy: results of a prospective, randomised, controlled trial. *Ann Surg* 243:316–320.

53. Hartel M, Wente MN, Hinz U, Kleeff J, Wagner M, Müller MW *et al.* (2005) Effect of antecolic reconstruction on delayed gastric emptying after pylorus-preserving Whipple procedure. *Arch Surg* 140:1094–1099.

54. Traverso LW, Hashimoto Y. (2008) Delayed gastric emptying: the state of the highest level of evidence. *J Hepatobiliary Pancreat Surg* 15:262–269.

55. Buchler MW, Friess H. (2006) Evidence forward, drainage on retreat. Still we ignore and drain!? *Ann Surg* 244:8–9.

56. Strasberg SM, McNevin MS. (1998) Results of a technique of pancreaticojejunostomy that optimizes blood supply to the pancreas. *J Am Coll Surg* 187:591–596.

57. Kawai M, Tani M, Terasawa H, Ina S, Hirono S, Nishioka R *et al.* (2006) Early removal of prophylactic drains reduces the risk of intra-abdominal infections in patients with pancreatic head resections. Prospective study of 104 consecutive patients. *Ann Surg* 244:1–7.