Outcome of Pancreaticoduodenectomy at Low-Volume Centre in Tier-II City of India

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Abstract

Currently, pancreaticoduodenectomy (PD) is considered a common and feasibly performed surgery for periampullary tumours, but it is still a high-risk surgical procedure with potential morbidity and mortality rates. Previously, it was emphasised for the need of high-volume centres to perform specialised surgery such as PD. The authors have made an attempt to know the relation between low-volume centre and outcomes of PD. The study was conducted in a Tier-II city referral hospital located in Karnataka, India. A total of 37 patients with suspected periampullary neoplasms underwent surgical exploration with curative intent over a period of 4 years, i.e. from May 2012 to May 2016. Out of 37 patients, 26 underwent PD, either classic Whipple resection ($n = 01$) or pylorus-preserving modification ($n = 25$). In 11 patients, resection was not possible, where biliary and gastric drainage procedures were done. All patients were treated by standardised post-operative care protocols for pancreatic resection used at our centre. We recorded the perioperative outcome along with demographics, indications for surgery, and pre- and intra-operative factors of PD. Post-operative pancreatic fistulae were evident in 4 patients. Two patients had hepaticojejunostomy leak. One patient had chyle leak. Three patients had infection at the surgical site. One patient had post-operative pneumonia leading to mortality. None of the patients had post-op haemorrhage. The surgeon volume and surgeon experience may have minimal contributing factor in post-operative morbidity, especially if there is availability of well-equipped ICU and imaging facilities, along with well-experienced personnel like oncosurgeon, anaesthesiologist, intensivist, radiologist, and nursing staff. There is a need of a multicentre study from Tier-II city hospitals/low-volume centres and high-volume centres to come with perioperative surgical outcomes following PD.

Keywords Pancreaticoduodenectomy · Low-volume centre · High-volume centre · Outcome

There are many studies which have recognised that there is a significant procedure volume-patient outcome relation for hospitals performing many surgical procedures [1–3]. The magnitude of the relation between procedure volume and inpatient mortality is particularly high for patients undergoing pancreaticoduodenectomy (PD). Inpatient mortality rates for this procedure range by as much as fourfold between the

lowest-volume and highest-volume hospitals in patient populations found in Maryland, New York, and the US Medicare program [4, 5]. Currently, PD is considered a common and feasibly performed surgery for periampullary tumours, but it is still a high-risk surgical procedure with potential morbidity and mortality rates. PD is the only potential chance for long-term survival in malignant periampullary lesions.

All these previous studies, which emphasised on the need of high-volume centres to perform specialised surgery such as PD, have been done in Western countries, with scarcity of data from India. There is no universally accepted cut-off point of surgical volume. The number varies according to the medical situation and total surgical volume of states or countries. In the last decade, healthcare facilities in India have improved tremendously both in terms of technical infrastructure and skilled personnel. These kinds of facilities are now available even in small cities, which are having low volume of surgeries such as PD. Therefore, authors have made an attempt to know the relation

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between low-volume centre and outcomes of PD. We present the perioperative outcome of PD at our low-volume centre.

Methods

The study was conducted in a Tier-II city hospital located in Karnataka, India. A total of 37 patients with suspected periampullary neoplasms underwent surgical exploration with curative intent over a period of 4 years, i.e. from May 2012 to May 2016. The surgeries were done by a single surgical unit lead by a surgical oncologist. Out of 37 patients, 26 underwent PD. In 11 patients, resection was not possible, where biliary and gastric drainage procedures were performed. The reasons for non-resection were due to intra-operative findings such as presence of superior mesenteric vein involvement ($n = 05$), metastatic peritoneal nodules ($n = 03$), sub-centimetric liver metastasis ($n = 02$), and coeliac trunk encasement ($n = 01$).

A total of 27 patients in our study presented with history of obstructive jaundice. Patients were evaluated with computed tomography (CT) scan of abdomen and pelvis, chest X-ray, and routine blood investigations. Patients were advised endoscopic retrograde cholangiopancreatography (ERCP) and biliary stenting (plastic) in cases of acute cholangitis or if the total bilirubin level was above 15 mg/dl. Patients who underwent stenting were evaluated after 3 weeks for surgery. In this study, a total of 10 patients were advised stenting, out of which one patient refused stenting and was taken up for upfront surgery. In two cases, stenting was not possible due to technical reasons; both cases were having bilirubin > 15 mg/dl without cholangitis and were not considered for percutaneous transhepatic biliary drainage due to unavailability of skilled expert at that time. In stented patients, dissection at and around the common bile duct was difficult compared to non-stented patients, which may be the result of fibrosis secondary to the intervention.

Following pancreaticoduodenectomy, a pancreatico-jejunal anastomosis was constructed in a duct-to-mucosa, end-to-side fashion, with two-layer interrupted sutures. Infant feeding tube was used as pancreatic duct stent and was used in 24 cases. In two cases, the pancreatic duct was not visible; dunking was performed. One drain was placed in Morison's pouch. Multiple drains were placed in four patients, who were thought to be at high risk for either pancreatic or biliary fistula development. The additional drain was placed posterior to the pancreatico-jejunostomy anastomotic site. The resected specimens were sent for histopathological examination. All the patients were extubated on-table.

All patients were treated by standardised post-operative care protocols for pancreatic resection followed at our centre. Prophylactic octreotide (100 µg) was given subcutaneously, starting about an hour before transection of neck of pancreas then every 8 h for 5 days. All patients received perioperative intravenous third-generation cephalosporins for 5 days.

Amylase levels were obtained from drains on post-operative day 5. Drains were removed if amylase levels were below three times normal. They were maintained longer if patients had high amylase levels or if there was chyle leak. All patients had naso-jejunal tube and started feeding from post-operative day 2. None of the patients received neo-adjuvant treatment.

Retrospective analyses of outcomes such as incidence of anastomotic leaks, and post-operative morbidity and mortality were done. Standard definitions were used for the classification of complications especially post-operative pancreatic fistula (POPF) which was defined by International Study Group of Pancreatic Fistula (ISGPF) criteria [6]. The other outcome perioperative mortality was defined as deaths taking place during surgery, immediate post-operative (irrespective of as a result of 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.

Results

The demographics, indications for surgery, and pre- and intra-operative factors are summarised in Table 1.

Table 1 Patient-related factors including demography, indications for PD, and intra-operative factors

Demography	Findings
Year-wise number of cases	
2012 (from May)	2
2013	9
2014	9
2015	12
2016 (until May)	5
Age	55 ± 9 years
Male	14 (53.85%)
Female	12 (46.15%)
Preoperative biliary stent	7 (26.92%)
Indications for PD	Periampullary tumor
Pylorus-preserving	25
Classic Whipple	01
Blood loss	500 ± 200 ml
Duration of surgery	479 ± 52 min
Type of pancreatic reconstruction	
Pancreatico-jejunostomy	26
Pancreatico-gastrostomy	0
Extent of lymph node dissection	
Standard	26
Radical	0
Type of GJ/DJ	
Antecolic	26
Retrocolic	0

The final histopathology reports confirmed 23 patients had adenocarcinoma, 3 had carcinoma head of the pancreas, 1 had duodenal adenocarcinoma, and the remaining had ampullary or terminal common bile duct adenocarcinoma. One patient was a child with pancreatoblastoma. One patient had chronic pancreatitis with no evidence of malignancy, and 1 patient had mucinous cystadenoma. The median number of lymph nodes retrieved in specimens was 10 (4–25) nodes. As per TNM staging, 7 patients were in stage IA, 4 patients in stage IB, 6 patients stage IIA, and 6 patients in stage IIB.

Three patients had biochemical leak. One patient had clinically relevant POPF for which CT-guided pigtail catheter was inserted and was left in situ for 6 weeks. Two patients had hepaticojejunostomy leak, among them one patient had readmission for the same, and both were managed conservatively with dietary measures and drain kept in situ for 3 weeks. No patient required re-surgery for any of the mentioned complications. One patient had post-operative pneumonia which ended in mortality (Table 2).

Discussion

Certainly, all types of pancreatic resections are technically challenging and require expert surgical and anaesthetic care that can be achieved only through frequent exposure to such procedures. The treatment of post-operative complications requires the skills of diagnostic and interventional radiologists, critical care specialists, and infectious disease, nursing, and nutritional support services [7]; these skills also could improve only after treating several patients. Therefore, good results were noted in high-volume centres. Johns Hopkins performed 271 Whipple procedures between 1988 and 1993, which enabled them to employ dedicated intensive care unit attending physicians and specialty support services [8]. The

high volume of procedures also led Johns Hopkins to formulate treatment protocols and critical pathways for the Whipple procedure, as well as standardisation of diagnostic workups, technical operative details, and management of the post-operative course [9]. The association between higher volume and better outcomes for the Whipple procedure and all types of pancreatic resection has been used to recommend regionalisation of these procedures either through minimum volume standards or referral of patients to “centres of excellence” [10–13].

In recent studies, the differences in the outcome between high-volume and low-volume centres have been analysed. The real difference appears to be due to the difference in the management of complications once they occur. The best outcomes after a complex surgery depend on two important factors: surgical team and the system (anaesthesiologist/intensivist/nursing staff). In case of Whipple’s procedure, there are several life-threatening complications which require timely identification and intervention to prevent the cascade of events that lead to death. There is strong evidence that the differences in mortality between high-volume and low-volume centres are mediated by differences in how effectively the system rescues patients from complications. High-volume hospitals have systems in place that rely on resources and tacit knowledge to detect these problems early and mobilise resources to address them quickly [14, 15].

These high-volume centres have reported the incidence of pancreatic fistula, which ranges between 2 and 40% and the mortality reaches up to 40% for grade C fistulas [16–18]. In our study, three cases (11.54%) had biochemical leak and one patient (3.85%) had clinically relevant POPF. Amongst these, three had undergone duct-to-mucosa pancreatico-jejunostomy and one had undergone dunking procedure. There is no solid evidence to conclude which anastomotic method is superior over the other in terms of pancreatic fistula. The studies have revealed no significant difference in the morbidity and pancreatic fistula rate between duct-to-mucosa anastomosis and single-layer end-to-side pancreatico-jejunostomy [19–21]. One patient (3.85%) who died had pneumonia.

Literally, most of the oncosurgeons are being trained in such high-volume centres (viz. Tata Memorial Hospital, Mumbai, India) and later they have started working in Tier-II city referral hospitals with well-experienced anaesthesiologist, intensivist, and nursing personnel. Over a period of time with changing trends and experience of the surgeons, the numbers of such major surgical procedures like PD being done in such hospitals are increasing with comparable surgical outcome with high-volume centres. Even though India is a country with low incidence of pancreatic cancer and a disproportionate distribution of resources, the centres with high volumes, standardisation, and service reconfiguration have achieved perioperative outcomes comparable to high-incidence developed nations [13, 22]. Similarly in this study,

Table 2 Details of post-operative complications

Surgical complications	Findings
Wound infections (SSI)	4 (15.38%)
Haemorrhage	0
Persistent high drain output	1 (3.84%)
Chyle leak	1 (3.84%)
Hepaticojejunostomy leak	2 (7.69%)
Biochemical POPF	3 (11.54%)
Clinically relevant (POPF)	1 (3.85%)
Delayed gastric emptying	0
Infection—pneumonia	1 (3.84%)
Acute pancreatitis	0
Mortality	1 (3.84%)
The median post-operative hospital stay	10 (7–24) days

we have shared our surgical outcomes of a Tier-II city hospital, which is comparable to any high-volume centre hospital nationwide/worldwide in terms of facilities.

In a study [23] done in South Korea, the inverse relationship between surgical volume and hospital mortality in performing PD has been clarified. According to the authors, the hospital mortality after PD is affected by many independent variables. Significant risk factors for hospital mortality, other than surgical volume, were age and operation type. Regionalisation and centralisation of high-risk surgical procedures are worldwide trends, which may occur naturally by patients' free selection or intentionally by governmental policy across the world. Many PDs were performed safely in community hospitals by surgeons with varying degrees of experience [9, 24, 25], as evidenced by a comparably low mortality rate and a high 1-year survival rate [26, 27]. Surgeon volume [25, 28] or experience [28] could be a more exact and detailed indicator of hospital outcome after PD than total hospital surgical volume.

However, Schmidt et al. in a study [28] defined an experienced surgeon as one who performs 50 or more PDs, and reported experienced surgeons had comparable outcomes irrespective of their annual volume. Learning curves also projected that less experienced surgeons would achieve morbidity and mortality rates equivalent to those of experienced surgeons when they reached 20 and 60 PDs, respectively. In other studies, a high-volume surgeon was defined as having an average of 10 or more PDs per year [25], or 5 or more PDs per year [29]. Like stratification of hospitals by surgical volume, defining experienced or high-volume surgeons is difficult and varies according to the medical situation or surgeon training system of each country. These cut-off points of surgical volume were varying according to the medical situation and total surgical volume of states or countries. For example, Birkmeyer et al. [5] defined > 5/year for high-volume hospitals in the USA between 1992 and 1995, and Topal et al. [24] did > 10/year for high-volume and > 20/year for very high-volume hospitals in Belgium between 2000 and 2004. Accordingly, it is not easy to reach an international consent on established stratification of hospitals by surgical volume. Similarly, there is no concrete evidence to say that high-volume centres are better than low-volume centres for PDs. In a recent study, authors have opined that performing PD in a mid-volume municipal hospital is feasible, with comparable results and cost-effectiveness [30].

Conclusion

Our data suggest that the outcomes of PDs are unaffected, if the hospital infrastructure is having well-equipped ICU and imaging facilities, along with well-experienced personnel like oncosurgeon, anaesthesiologist, intensivist, radiologist, and

nursing staff. The hospital volume may not have that much of influence on outcome of PDs. In India or for that matter any third world country, where populations' health is not covered by insurance and affordability is being less, the regionalisation or centralisation of such surgical procedure though desirable may not be possible. Therefore, many patients are dependent on such Tier-II city referral hospitals. The surgeon volume and surgeon experience may have minimal contributing factor in post-operative morbidity. There is a need of multicentre trials from Tier-II city hospitals/low-volume centres and high-volume centres to come with results of surgical outcomes.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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