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EFFECT OF HOSPITAL VOLUME ON OUTCOMES IN PATIENTS UNDERGOING PANCREATICODUODENECTOMY: A SINGLE INSTITUTIONAL STUDY FROM NORTH-EAST INDIA.

Oncology

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ABSTRACT

Background/Aim: Pancreaticoduodenectomy (PD) has been considered to be a technically demanding and complex procedure. The purpose of this study was to explore the effect of increase in volume of PDs on perioperative outcomes of patients undergoing PD. **Methods and materials:** This is a retrospective study. All patients who underwent Whipple's procedure in a period between January 2010 and December 2019 at our institute were included in this study. **Results:** Eighty five patients underwent PD during this study period. The number of PDs ranged from 2(in 2010) to 16(in 2019). There were 30 patients in low volume group A (< 10 PDs/year) and 55 in medium volume group B (10-24 PDs/year). There was no statistical significant differences in characteristics of both groups except in method used for biliary drainage. Duration of surgery, need for blood transfusion and mean blood transfused decreased with increase in hospital volume although none of these reached statistical significance. Post-operative morbidity, mortality and length of hospital stay also decreased in medium volume group but statistical significance was reached in wound infections, chest infections and total morbidity. **Conclusion:** Increase in hospital volume leads to better outcomes in patients undergoing complex surgical procedures like pancreaticoduodenectomy. Thus patients needing this procedure should be given the option of care at a high-volume referral center.

KEYWORDS

Pancreaticoduodenectomy, High volume, Post-operative morbidity, Outcome.

INTRODUCTION

Pancreaticoduodenectomy (PD) has been considered to be a technically demanding and complex procedure [1]. In past, PD has been associated with a high rate of complications (40–60%) and a high death rate (up to 20%). However mortality has decreased considerably from as high as 25%-30% in the 1970-1980s to less than 2%-4% in the modern era [2]. The reduction in operative mortality rates across the world has largely been attributed to a vast variety of factors including specialized surgery being performed in specialized centres [3]. Overall mortality is higher following PD in low-volume hospitals compared to high-volume hospitals [4-5]. Inpatient mortality rates differ by as much as fourfold between the lowest-volume and highest-volume hospitals [6-7]. Although the trend of centralization has been slow as demonstrated by a nationwide survey of PD in the United States [8], not much data has been published regarding volume-outcome association in India.

The purpose of this study was to explore the effect of increase in volume of PDs on perioperative outcomes of patients undergoing PD.

MATERIALS AND METHODS

This is a retrospective study. All patients who underwent Whipple's procedure in a period between January 2010 and December 2019 at our institute were included in this study. Data was collected from prospectively maintained case record files. Demographic data, co-morbidities, history of presenting illness, past history, laboratory and radiological investigation, intra-operative data including operating time, need for blood transfusion and number of packed cells transfused during surgery were recorded. Final histopathological report was recorded.

Postoperatively length of hospital stay, complications and mortality (in hospital or within 30 days) were also documented. Besides recording the annual departmental volume, we also categorized the volume of PDs into low volume group A (< 10 PDs/year) in the period between 2010-2015 and medium volume group B (10-24 PDs/year) in the period between 2016-2019 similar to a study from North India by Shah OJ et al [9].

Pancreatic fistula was defined as per International Study Group on Pancreatic Fistula criteria [10]. Inability of a patient to return to a standard diet by the end of the first postoperative week necessitating prolonged nasogastric intubation of the patient was treated as delayed gastric emptying (DGE) as defined by the International Study Group on Pancreatic Surgery (ISGPS) [11], bile leak was defined as bilious drain with raised bilirubin level. Statistical analysis was done using Statistical Package for Social Sciences 20.0 (SPSS Version 20.0).

RESULTS

A total of 97 patients were taken up for pancreaticoduodenectomy (PD) during the study period at our institute. Among them 85 patients (8% of all patients who presented with pancreatic cancer) had resectable disease and underwent PD. The number of PDs ranged from 2(in 2010) to 16(in 2019). Figure 1 shows number of PD's from year 2010 to year 2019. There were 30 patients in low volume group A (< 10 PDs/year) and 55 in medium volume group B (10-24 PDs/year).

Most common location of tumor was head of the pancreas (44; 51.7%) followed by periampullary (28; 32.9%), bile duct (9; 10.5%) and duodenum (4; 4.7%). Final histology confirmed 80 (94.1%) patients with adenocarcinoma, 3(3.5%) neuroendocrine tumors, 2 (2.4%) solid pseudopapillary tumors.

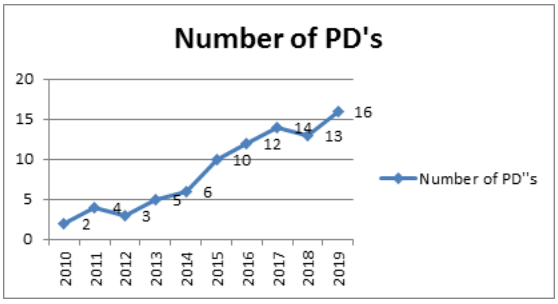

Figure 1: Yearly distribution of pancreaticoduodenectomies. PD: Pancreaticoduodenectomy

The various clinico-demographic characteristics of patients in low volume (group A) and medium volume (group B) categories are shown in Table 1. There was no statistical significant differences in characteristics of both groups except in method used for biliary drainage.

Table 2 shows comparative analysis of operative details and postoperative complications between group A and B. Although patients in group B did better than those in group B, statistical significance was seen in wound infection rate, chest infection rate and total morbidity rate.

Table 1: Clinico-demographic characteristics of patients in Group A and B. PTBD- Percutaneous transhepatic biliary drainage

Characteristics	Low volume (Group A) N=30	Medium volume (Group B) N=55	P Value
Age (years), mean ± SD	52.65 ± 8.44	51.43 ± 7.39	0.154
Sex(Male/Female)	19/11	32/23	0.782
Presenting symptoms			
Jaundice	15(50%)	26(47%)	0.872
Weight loss	12(40%)	20(36%)	0.793
Pain abdomen	10(33%)	22(40%)	0.564
Comorbidities			
Diabetes mellitus	10(33%)	20(36.4%)	0.975
Hypertension	6(20%)	15(27%)	0.865
Cerebrovascular disease	1(3%)	2(3.6%)	0.112
Pre-op blood investigations			
Hemoglobin(g/dl)	9.37 ± 1.19	9.73 ± 1.44	0.558
Albumin(g/dl)	3.33 ± 0.52	3.52 ± 0.58	0.914
Bilirubin(mg/dl)	9.48 ± 5.38	8.56 ± 4.00	0.754
Pre-op biliary drainage	5(16.7%)	12(22%)	0.109
PTBD	4(13.3%)	3(5.4%)	0.023
Stenting	1(3.33%)	9(16.6%)	0.015

Table 2: Operative details and postoperative complications and outcomes. POPF=Postoperative pancreatic fistula; DGE=Delayed gastric emptying. *Show statistically significant difference (p value<0.05)

Characteristics	Low volume(Group A) N=30	Medium volume (Group B) N=55
Intraoperative		
Duration of surgery(minutes)	445.8 ± 25.6	421.7 ± 31.5
Intra-operative blood transfusion required	30(100%)	50(90%)
Mean blood transfusion required(units)	2.3 ± 0.4	1.9 ± 0.6
Post-operative		
Wound infection	8(26.7%)	9(16.4%)*
Chest infections	4(13.3%)	4(7.2%)*
DGE	3(10.0%)	4(7.2%)
POPF	3(10.0%)	5(9.1%)
Bile leak	1(3.3%)	2(3.6%)
Total morbidity	19(63.3%)	24(43.6%)*
Mortality	2(6.7%)	3(5.4%)
Length of hospital stay(days)	13.8 ± 3.5	12.6 ± 3.1

DISCUSSION

More than four decades ago, Luft et al[12] introduced the empirical relationship between higher surgical volume and lower postoperative mortality. This finding lead to trend towards centralization of complex surgical procedures to improve outcome of the patients. This relationship between hospital volume and surgical mortality for complex surgical procedures including pancreaticoduodenectomy (PD) was amply described by Birkmeyer et al[13]. Despite improvements due to regionalization, PD remains a complex procedure associated with high perioperative morbidity and potential mortality.

In our study we have explored the effect of increasing volume of PD on outcomes of the patients. The 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. [7] defined > 5/year for high-volume hospitals in the USA between 1992 and 1995, and Topal et al. [14] did > 10/year for high-volume and > 20/year for very high volume hospitals in Belgium between 2000 and 2004. We have divided PD volume in our study as: low volume group A (< 10 PDs/year) and medium volume group B (10-24 PDs/year) similar to another study from North India by Shah et al[9].

In our study mean age was 52.65±8.44 years in group A and 51.43±7.39 years in group B, male to female ratio was 1.7 in group A and 1.4 in group B. Similarly in a study by Pal KM, Bari H et al [15] mean age was 54±9.8 years and male to female ratio was 1.7. However in study by Shah et al[9] mean age in low volume and medium volume group was 58.95±10.44 and 59.22±10.29 respectively; and male to female ratio was 1.5 and 1.31 respectively.

Head of pancreas was most commonly involved site (51.7%) in our study followed by periampullary (32.9%), bile duct (10.5%) and duodenum (4.7%). However in a study by Karim SA et al[16] most common location of tumor was periampullary(43.88%) followed by head of pancreas(16.33%), bile duct(14.29%), ampullary (9.18%) and benign(16.33%).Most common histology was adenocarcinoma (94.1%) similar to study by Pal KM, Bari H et al[15] in which adenocarcinoma was found in 90% cases. In our study, 20%(overall) underwent pre-operative biliary drainage, similarly pre-op biliary drainage was done in 22.4% patients in study by Karim SA et al [16] and 26.92% by Vinchurkar K et al[17] et al. however pre-op biliary drainage was higher in some other studies like 45% by Srivastava S et al[18] and 80% by Gouma DJ et al [4].

In our study the presenting complaints, comorbities and pre-op blood investigations were similar in both the groups. Our groups differed only in the method used for pre-operative biliary drainage. Most common presenting complaint was jaundice similar to other studies[4,16]Most common post-operative complication was wound infection in both the study groups. Table 3 show the comparison between post-operative complications in different studies.

Table 3: Comparison between post-operative complications in different studies. POPF=Postoperative pancreatic

Complication	Pal KM, Bari H et al[15]	Karim SA et al[16]	Wei HK et al[19]	Shrikhande SV et al[1]	Vinchurkar K et al[17]	Shah OJ et al[9]		In our study	
						Low volume group	Medium volume group	Low volume group	Medium volume group
Wound infection	20%	23.5%	NA	NA	15.38%	NA	NA	26.7%	16.4%
Chest infection	21%	17.3%	NA	NA	3.84%	NA	NA	13.3%	7.2%
DGE	16.5%	NA	NA	3.2%	0	20%	18.2%	10%	7.2%
POPF	12%	21.4%	9.7%	11%	15.39%	15%	15.3%	10%	9.1%
Bile leak	NA	NA	3%	3.4%	7.69%	5%	4.5%	3.3%	3.6%
Bleeding	12%	12.2	9.2%	6%	0	10%	2%	NA	NA
Intra-abdominal collections	NA	12.2%	11%		NA	5%	4.5%	NA	NA
Re-operation	NA	4%	NA	NA	0	10%	4.5%	0	0
Mortality	10%	4%	7%	5.4%	3.84%	10%	2.2%	6.7%	5.4%

fistula; DGE=Delayed gastric emptying; NA- Not available.

The mean length of hospital stay in group A and group B was 13.8 ± 3.5 and 12.6 ± 3.1 days respectively, similarly in study by Shah OJ et al[9] mean hospital stay in similarly divided groups was 11.8 ± 3.4 and 11.3 ± 2.9 respectively.

In our study we found that duration of surgery, need for blood

transfusion and mean blood transfused decreased with increase in hospital volume although none of these reached statistical significance. Post-operative morbidity, mortality and length of hospital stay also decreased in medium volume group but statistical significance was reached in wound infections, chest infections and total morbidity.

Surgeon volume has also been linked to mortality and may explain a significant part of an institution's volume effect [20]. A learning curve in pancreatic surgery has been hypothesized, suggesting that after an experience of 60 PDs, surgeons improved the perioperative outcomes of patients undergoing PD for periampullary adenocarcinoma [21].

However it has been stated that the volume-outcome relationship usually is stronger for hospital volume than for surgeon volume. This can be to the "experience effect" of the whole team taking care of the patient. There are two competing explanations for the observed association between volume and outcome. The first, "practice makes perfect", hypothesizes that institutions have better outcome because their case load and experience allow them to improve their systems and techniques. The second, "selective referral", hypothesizes that institutions with better outcomes have larger volumes because their excellence is known and thus more patients come to be cared for in these institutions. Which hypothesis is correct has not been established.[9]

This study demonstrates that with increase in hospital volume, the perioperative outcome of patients improves. Although in our study statistical significant difference was not noted in all the compared parameters, a clear trend of improved outcomes was seen with increasing volume; thus favouring centralization of this high risk procedure. Although our study has several limitations like retrospective nature, unavailability of data on quality of life and long term survival, the major strength of this study is that volume groups were compared within the same surgical unit and this eliminates several biased variables affecting inter-hospital comparisons.

CONCLUSION

Increase in hospital volume leads to better outcomes in patients undergoing complex surgical procedures like pancreaticod uodenectomy. Thus patients needing this procedure should be given the option of care at a high-volume referral center.

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