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Mortality After Hepatobiliary and Pancreatic Surgery in Queensland, Australia (2007-2018): *An Analysis of 30-Day Mortality Data After Hepatobiliary and Pancreatic Surgery*

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Abstract

Introduction: Hepatobiliary and Pancreatic surgery (HBPS) carries a significant morbidity and mortality which prompts appropriate pre-operative risk mitigation of patients. With an aging population, who inherently have a higher perioperative risk, it is important to determine which factors predispose HBPS patients to death after their surgeries. We analysed the QASM data between 2007-2018 specific to HBPS, to identify what characteristics led to patient death.

Method: Patients (18 years of age and older) who died while under the care of a surgeon after HBPS were identified via the Queensland Audit of Surgical Mortality (QASM) database, and their characteristics were analysed.

Results: A total of 118 eligible patients were identified for analysis, 103 (87.3%) of these were 50 years of age or older. Most admissions were emergencies (69.5%). Nearly all the patients (89.0%) had comorbidities, and older patients tended to have more comorbidities compared to their younger counterparts. ASA physical status was three or higher for most patients (83.5%) who died after HBPS. Gallbladder and/or biliary tract operations were far more numerous than others (78.8%). Nearly two thirds of patients had complications (61.9%).

Conclusion: Older age, in association with multiple medical comorbidities are overwhelming responsible for mortality post HBPS. When these patients present acutely with cholecystitis, only limited medical optimisation is possible which compounds their risks of perioperative mortality.

Keywords: Hepatobiliary and Pancreatic Surgery; Mortality; Audit; Risk.

Introduction

Hepatobiliary and Pancreatic surgery (HBPS) carries a significant morbidity and mortality due to the complex nature of the surgery and the patients' pre-existing co-morbidities. For that reason, it is important to appropriately risk stratify patients who are referred for surgery. This enables better management of high-cost resources and leads to an overall improvement in healthcare [1,2]. Patients with comorbidities are at a higher risk of a complicated post-operative course especially if they are elderly [3-5]. Over the last 20 years in Australia, the elderly population (≥65 y.o.) has increased from 12.2% to 15.7% and is expected to increase more rapidly over the coming years [6], so more preparation is required for the increase in HBPS.

The aim of this study was to analyse the mortality data after HBPS in Queensland over an 11-year period from 2007 to 2018, with a view to determining what patient characteristics contributed to the deaths. The Queensland Audit of Surgical Mortality (QASM) records all surgical mortalities within Queensland hospitals, both public and private. It is compulsory for administrators to report such deaths to QASM, irrespective of the cause of death [7]. Data is conveyed to QASM by the treating surgeon via a generic surgical

case form (Appendix 1). A peer review of the case reported is then undertaken and a confidential feedback is given to the surgeon – mainly for educational purposes.

Method

Data was retrospectively collected from the QASM database, over 11 years (2007-2018). A list of HBP surgical procedures undertaken (Appendix 2). A total of 184 deceased patients were identified. Surgical Trauma with no hepato-biliary injuries were excluded (66 cases) allowing 118 cases for analysis.

Results

Of the 118 cases who died there were 72 (61.0%) males and 46 (39.0%) females. The average age was 68.3 (range 19-94 years). For those aged ≥50 years, there were 103 cases (87.3%) with 64 males and 39 females. There were 15 cases below 50 years: 8 males, 7 females (Table 1).

Table 1: Demographic data of patients who died after HBPS.

	Combined cohort	Younger than 50	50 and over
Total number of patients	118	15	103
Number of males	72	8	64
Number of females	46	7	39
Average age	68.3		
Median age	72.0		
Age range	19 - 94		
Average LOS (days)	24.0	29.5	23.2
LOS range (days)	0 - 157		
Number (%) died on day 0	2 (2)		
Number (%) of elective admissions	32 (27)	3 (20)	29 (28)
Number (%) of emergency admission	82 (70)	11 (73)	71 (69)
number not known	4 (3)		

LOS, Length of stay (days)

Emergency admissions were the commonest at 82 (69.5%), elective admissions were less common with 32 cases (27.2%); the admission data in 4 cases was not recorded. The average length of stay (LOS) was 24.0 days. For patients over 50 years average LOS was 23.2 (including 2 deaths on day 0). For patients under 50 years average LOS was considerably longer at 29.5 days. Comorbidities were present in 105 cases (89.0%) and included cardiovascular 61.9%, respiratory 40.9%, and renal disease 38.1%. The ASA (American society of Anaesthesiologists [8]) physical scoring system being ≥3 in 83.5% of patients. Seventeen cases were ASA 5 and not expected to survive (Table 2).

Table 2: Distribution of comorbidities and ASA physical status within age groups.

	Younger than 50	50 to less than 60	60 to less than 70	70 to less than 80	80 to less than 90	90 and older
Number (%†)	15 (13)	14 (12)	23 (19)	41 (35)	20 (17)	5 (4)
Average LOS (days)	29.5	36.9	30.8	19.4	14.8	14.2
With comorbidities (%)‡	12 (80)	10 (71)	22 (96)	36 (88)	20 (100)	5 (100)
Without comorbidities (%)†	3 (20)	4 (29)	1 (4)	5 (12)	0 (0)	0 (0)
Comorbidity: Malignancy (%)†	1 (7)	1 (7)	5 (22)	5 (12)	1 (5)	0 (0)
Comorbidity: Cardiovascular (%)†	4 (27)	3 (21)	12 (52)	24 (59)	17 (85)	5 (100)
Comorbidity: Diabetes (%)†	1 (7)	2 (14)	5 (22)	14 (34)	4 (20)	2 (40)
Comorbidity: Hepatic (%)†	5 (33)	6 (43)	7 (30)	6 (15)	1 (5)	0 (0)
Comorbidity: Neurological (%)†	3 (20)	2 (14)	0 (0)	4 (10)	4 (20)	1 (20)
Comorbidity: Obesity (%)†	1 (7)	3 (21)	5 (22)	5 (12)	4 (20)	1 (20)
Comorbidity: Renal (%)†	2 (13)	5 (36)	8 (35)	14 (34)	9 (45)	2 (40)
Comorbidity: Respiratory (%)†	4 (27)	3 (21)	8 (35)	15 (37)	11 (55)	2 (40)

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Comorbidity: Other (%)†	4 (27)	6 (43)	9 (39)	6 (15)	7 (35)	2 (40)
0 comorbidities†	20%	29%	4%	12%	0%	0%
1-2 comorbidities†	53%	21%	48%	39%	45%	40%
3-4 comorbidities†	27%	43%	35%	44%	45%	60%
5 or more comorbidities†	0%	7%	13%	5%	10%	0%
ASA 1 (%)†	2 (13)	1 (7)	0 (0)	1 (2)	0 (0)	0 (0)
ASA 2 (%)†	4 (27)	1 (7)	2 (9)	8 (20)	0 (0)	0 (0)
ASA 3 (%)†	2 (13)	2 (14)	10 (43)	16 (39)	7 (35)	2 (40)
ASA 4 (%)†	3 (20)	6 (43)	7 (30)	12 (29)	9 (45)	3 (60)
ASA 5 (%)†	4 (27)	4 (29)	2 (9)	3 (7)	4 (20)	0 (0)

†percentage of cohort; †percentage of age group

The surgical procedures were classified into three groups for analysis (Table 3):

i. Gallbladder and/or Bile ducts – 93 patients (78.8%)

ii. Liver – 24 patients (20.3%)

iii. Pancreas – 10 patients (8.5%)

Table 3: Operations performed for each age bracket analysed. For analysis, the operations were separated into Liver, Gallbladder +/- Bile ducts, and Pancreas.

	Younger than 50 n = 15	50 to less than 60 n = 14	60 to less than 70 n = 23	70 to less than 80 n = 41	80 to less than 90 n = 20	90 and older n = 5
Liver Transplant (%)	2 (13)	3 (21)	0 (0)	0 (0)	0 (0)	0 (0)
Left Hepatectomy (%)	0 (0)	0 (0)	0 (0)	1 (2)	0 (0)	0 (0)
Right Hepatectomy (%)	3 (20)	1 (7)	4 (17)	6 (15)	0 (0)	0 (0)
Other operation on Liver (%)	0 (0)	0 (0)	2 (9)	2 (5)	0 (0)	0 (0)
Cholecystectomy (%)	6 (40)	7 (50)	17 (74)	32 (78)	20 (100)	5 (100)
Bile Duct Operation (%)	1 (7)	0 (0)	6 (26)	6 (15)	2 (10)	1 (20)
Resection of Pancreas (Total or Partial) (%)	3 (20)	2 (14)	2 (9)	3 (7)	0 (0)	0 (0)
Splenectomy (%)	6 (40)	1 (7)	3 (13)	2 (5)	0 (0)	0 (0)

Those aged 50 years and over had mostly gallbladder/and or bile duct surgery 86/103 (83.5%) while those under 50 years 7/15 (46.7%) had biliary surgical procedures. Postoperative complications were high 73/118 (61.9%); of these 40 (33.9%) had an unplanned admission to the Intensive Care Unit (ICU) and 38 (32.2%) needed a return to the operating theatre for post-operative problems. In 12.7% of cases no complications were recorded even though the patients had unplanned admission to ICU or reoperations. An important tool in the audit assessment is that of the surgeon's opinion of the risk of death in each case (Table 4).

Ninety-eight per cent of surgeons responded as follows:

i. 70/118 (60.3%) were at high risk of death. Of these high-risk patients, 13/15 (86.7%) were under 50 years and 58/101 (57.4%) were ≥50 years.

ii. Thirty-one (26.7%) patients were at moderate risk.

iii. Fifteen (12.7%) patients were at low risk.

Table 4: Surgeons' view on perioperative risk of mortality.

Surgeons' view on risk of death	Number of patients	Percentage of cohort
Minimal	1	<1%
Small	14	12%
Moderate	31	26%
Considerable	58	49%
Expected	12	10%
Futile	0	0%

Discussion

Our analysis indicated that age was a significant factor in determining mortality after HBPS, with 87% of deaths occurring in patients 50 years and over, and particularly between the ages 70 to 79 years. This can be related to the very high ASA scores and comorbidities in this group of patients. Some studies have

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indicated that age alone is not an absolute determinant of outcome after HBPS [2,9-12]. Notably, the common theme within these studies is rigorous patient selection based on preoperative assessment, and the subsequent exclusion of patients with significant comorbidities or high ASA scores. In contrast, our data includes both elective and emergency cases which involved several patients with an ASA score of four or more. In addition, preoperative optimisation was limited for many of these patients.

In our study, the number of co-morbidities per patient increased with age, with those over 70 years having three or more comorbidities. Patients with comorbidities have a higher rate of post-operative morbidity and mortality [3,13] with one study identifying a four-fold increase in mortality in the presence of three or more comorbidities [4]. Additionally, in our study the number of patients with cardiac and respiratory disease increased with age; similar studies with comorbidities confirmed a higher mortality [3-5,13]. In our study some 83% of patients older than 60 years had gallbladder and/or bile duct surgery. 25 of these patients were older than 80 years with all of these very elderly patients dying due to established sepsis and multiorgan failure. Nikfarjam [14] showed that patients over 80 years are more likely to have gangrenous cholecystitis and this was found in our study as well. The surgeons risk assessment in this study indicated that many cases were at high risk.

When compared, our cohort of specific HBPS mortality to the Queensland and Australian general surgical mortality data from similar periods, notable differences were seen. The median age was younger in our cohort, consisted of more elective admissions, had fewer patients with high ASA scores, and had fewer comorbidities. The post-operative complication rate in our cohort of patients was almost double both the QASM [15] and ANZASM [16] findings: 61.9% in comparison to 33.3% and 33.9% respectively. Our cohort consisted of younger and healthier patients, but the significantly high post-operative complication rate directly contributed to patient deaths. Post-operative complications have been shown to be a "strong predictor of death" [15].

Conclusion

We have analysed the mortality data after HBPS and identified common characteristics. Of the patients who died, increasing age in association with several comorbidities and emergency surgery were common. When compared to the state and national data, the HBPS cohort analysed from QASM were younger and healthier but their post-operative course was considerably more complicated. Evidence shows that patient optimisation prior to surgery is ideal, but our analysis suggests that this may not always be applicable potentially leading to an increased rate of complications and post-operative death.

Disclosure Statement

There are no financial interests that relate to the research in this article.

List of Hepatobiliary and Pancreatic Surgeries

Operation

Cholecystectomy

Bile duct or Biliary

Liver resection or Hepatectomy

Shunt surgery for portal hypertension

Pancreatectomy

Necrosectomy (Pancreas)

Splenectomy

Duodenectomy

Choledochoduodenostomy

Choledochojejunostomy

Hepaticojejunostomy

Pancreaticogastrostomy

Pancreaticojejunostomy

Bile Duct

Excision of bile duct

Extirpation of lesion of bile duct

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Extirpation of lesion of bile duct

Open operations on prosthesis in bile duct

Repair of bile duct

Incision of bile duct

Plastic repair of sphincter of Oddi using duodenal approach.

Incision of sphincter of Oddi using duodenal approach.

Other operations on ampulla of Vater using duodenal approach.

Other open operations on bile duct

Therapeutic percutaneous attention to bile duct connection

Therapeutic percutaneous insertion prosthesis into bile duct

Other therapeutic percutaneous operations on bile duct

Therapeutic operations on bile duct along T tube track

Percutaneous examination of bile duct

Other operations on bile duct

Pancreas

Transplantation of pancreas

Total excision of pancreas

Excision of head of pancreas

Other partial excision of pancreas

Extirpation of lesion of pancreas

Connection of pancreatic duct

Other open operations on pancreatic duct

Open drainage of lesion of pancreas

Incision of pancreas

Open examination of pancreas

Other open operations on pancreas

Therapeutic percutaneous operations on pancreas

Diagnostic percutaneous operations on pancreas

Liver

Transplantation of liver

Partial excision of liver

Extirpation of lesion of liver

Repair of liver

Incision of liver

Other open operations on liver

Therapeutic endoscopic operations on liver using laparoscope

Diagnostic endoscopic examination of liver using laparoscope

Transluminal operations on blood vessel of liver

Other therapeutic percutaneous operations on liver

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Diagnostic percutaneous operations on liver

Other puncture of liver

Other operations on liver

Spleen

Total excision of spleen

Other excision of spleen

Other operation on spleen

Duodenum

Connection of stomach to duodenum NEC

Excision of duodenum

Open extirpation of lesion of duodenum

Bypass of duodenum

Other open operations on duodenum

Other operations on duodenum

Operations on duodenal ulcer

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