Open pancreaticoduodenectomy is associated with high morbidity and significant mortality. Does laparoscopic resection improve outcomes?

M. Brand



Terhune et al. 2008

| Table 21.1 Complications after pancreaticoduodenectomy | | | | | | | |
|--|-----------------------|--|--|--|--|--|--|
| Type of complication | Approximate incidence | | | | | | |
| Delayed gastric emptying | 8-45% | | | | | | |
| Pancreatic fistula/leak | 3-30% | | | | | | |
| Hemorrhage | 2-16% | | | | | | |
| Intra-abdominal abscess | 1 - 14% | | | | | | |
| Wound infection | 5-10% | | | | | | |
| Other infections | 3–5% | | | | | | |
| Biliary complications | 3–9% | | | | | | |
| Reoperation | 2-4% | | | | | | |

Mortality rates

• Low volume hospitals (<10PD/yr) 9.4%

• High volume (<u>>10PD/yr</u>) 5.3%

Billingsley 2008

Hospital costs of complications after a pancreatoduodenectomy Trientje et al. HPB 2015

| | No complication <i>N</i> = 27 | With \geq 1 complication $N = 73$ | RD or MD (95% CI) | P-value |
|---|----------------------------------|-------------------------------------|-----------------------------|---------|
| Age at surgery in years (SD) | 64.2 (11.9) | 64.0 (9.3) | MD 0.2 (-4.3 to 4.7) | 0.105 |
| Gender (%) | | | | |
| Male | 15 (55.6) | 44 (60.3) | RD -0.047 (-0.257 to 0.157) | 0.670 |
| Type of resection (%) | | | | |
| Severity of complications (%) | | | | |
| Grade 1 | | 58 (79.5) | | |
| Grade 2 | | 13 (17.8) | | |
| Grade 3 | | 1 (1.4) | | |
| Grade 4 | | 1 (1.4) | | |
| Number of complications (%) | | | | |
| 1 | | 28 (38.4) | | |
| 2 | | 19 (26.0) | | |
| 3 | | 10 (13.7) | | |
| 4 | | 6 (8.2) | | |
| ≥5 | | 10 (13,7) | | |
| Type of complication (%) | | | | |
| Post-operative haemorrhage | | 12 (16.4) | | |
| Anastomotic leakage | | 24 (32.9) | | |
| Isolated delayed gastric emptying | | 18 (24.7) | | |
| Post-operative infection (local or systemic) | | 33 (45.2) | | |

Median hospital costs

• €17 482 (R296 450,71) without complications

• €55 623 (R943 226,04) for a patient with a post-operative haemorrhage.

Improve M&M

Improve outcomes





Decrease cost

Agenda

- What are the options?
 - Hybrid laparoscopic whipple
 - Complete laparoscopic whipple (LPD)
 - Robotic whipple (RPD)
- Is there less M&M?
- Shorter time to adjuvant chemotherapy?
- Longer overall survival?
- Is it cost effective?

Hybrid LPD

A Non-Randomized Comparative Study of Laparoscopy-Assisted Pancreaticoduodenectomy and Open Pancreaticoduodenectomy

T. Kuroki et al. 2012

| Laparoscopy-assisted PD Open PD | | | | | | | | |
|----------------------------------|----------------------|--|----|--|--|--|--|--|
| | (n=20) | (n=31) | | | | | | |
| Age (y) | $71.2 	\pm	8.8$ | 73.5 ± 7.3 | NS | | | | | |
| Sex (M/F) | 11 / 9 | 21/ 10 | NS | | | | | |
| ASA status | 1.5 \pm 0.6 | $1.6 	\pm	0.7$ | NS | | | | | |
| Preoperative BMI (kg/m2) | $21.9	\pm	4.0$ | $22.9 \hspace{.1in} \pm \hspace{.1in} 3.4$ | NS | | | | | |
| Preoperative serum bilirubin (mm | nol/L) 1.7 ± 3.7 | $2.4 	\pm	3.3$ | NS | | | | | |
| HbA1c (%) | $5.5 	\pm	0.5$ | $6.0	ext{ }	\pm	ext{ }	1.6$ | NS | | | | | |
| BT-PABA test (%) | $57.7	\pm	14.9$ | $60.2 	\pm	17.7$ | NS | | | | | |
| Diagnosis | | | NS | | | | | |
| Bile duct carcinoma | 8 | 18 | | | | | | |
| IPMN of the pancreas | 6 | 7 | | | | | | |
| Ampullary carcinoma | 5 | 1 | | | | | | |
| Islet cell tumor | 1 | 0 | | | | | | |
| Pancreatic carcinoma | 0 | 4 | | | | | | |
| Chronic pancreatitis | 0 | 1 | | | | | | |

| Table 2. Intraoperative data of the patients | | | | | | | | | |
|--|------------------------|---------------------|---------|--|--|--|--|--|--|
| L | aparoscopy-assisted PD | Open PD | P value | | | | | | |
| | (n=20) | (n=31) | | | | | | | |
| Type of pancreatic resection | | | NS | | | | | | |
| PPPD | 16 | 26 | | | | | | | |
| SSPP | 4 | 5 | | | | | | | |
| Lymphadenectomy | | | NS | | | | | | |
| Non | 6 | 5 | | | | | | | |
| Regional | 14 | 26 | | | | | | | |
| Texture of the pancreas | | | NS | | | | | | |
| Soft | 18 | 26 | | | | | | | |
| Hard | 2 | 5 | | | | | | | |
| Main pancreatic duct size (mm) | $3.0		\pm		1.5$ | $3.0	\pm	1.4$ | NS | | | | | | |
| Operative time (min) | 656.6 ± 191.4 | 554.6 ± 119.4 | NS | | | | | | |
| Intraoperative bleeding (ml) | $376.6 \ \pm \ 291.4$ | 1509.5 ± 1000.2 | < 0.01 | | | | | | |
| Red blood cell transfusion | 0 | 13 | < 0.01 | | | | | | |

-

| Tuble 5.1 obtoportuitive complications of the patients | | | | | | | |
|--|-------------------------|---------|---------|--|--|--|--|
| | Laparoscopy-assisted PD | Open PD | P value | | | | |
| | (n=20) | (n=31) | | | | | |
| Pancreatic fistula, ISGPF | | | NS | | | | |
| Grade A | 6 | 7 | | | | | |
| Grade B | 3 | 5 | | | | | |
| Grade C | 0 | 0 | | | | | |
| Delayed gastric emptying, ISGPS | | | NS | | | | |
| Grade A | 2 | 2 | | | | | |
| Grade B | 1 | 1 | | | | | |
| Grade C | 0 | 0 | | | | | |
| Bile leakage | 0 | 3 | NS | | | | |
| | | | | | | | |

Table 3. Postoperative complications of the patients

ISGPF ,International Study Group on Pancreatic Fistula; ISGPS, International Study Group on Pancreatic Surgery.

Total laparoscopic whipple

Total Laparoscopic Pancreaticoduodenectomy Feasibility and Outcome in an Early Experience. Michael Kendrick & Daniel Cusati. JSLS 2013

Table 1. Patient Demographics and Operative Data

| Characteristic | Median (Range) | | | | |
|---|----------------|--|--|--|--|
| Patients, No. | 62 | | | | |
| Age, mean (SD), y | 66 (12) | | | | |
| Body mass index ^a | 26 (17-40) | | | | |
| American Society of Anesthesiologists score | 3 (2-3) | | | | |
| Sex, female/male, No. | 30/32 | | | | |
| Disease status, No. (%) | | | | | |
| Benign | 17 (27) | | | | |
| Malignant | 45 (73) | | | | |
| Type of procedure, No (%) | | | | | |
| Pylorus-preserving | 59 (95) | | | | |
| Robotic-assisted | 8 (13) | | | | |
| Operative time, mm | 368 (258-608) | | | | |
| Estimated blood loss, mL | 240 (30-1200) | | | | |
| No. of lymph nodes retrieved | 15 (6-31) | | | | |

26 (42%) patient's complications:

- pancreatic anastomotic leak (n=11 [18%]),
- delayed gastric emptying (n=9 [15%]),
- re-operation was necessary in 3 patients

• 1 mortality

Robotic PD

A Multi-institutional Comparison of Perioperative Outcomes of Robotic and Open Pancreaticoduodenectomy Zureikat et al. 2016

| | Univariate | | | | Multivariable | | | |
|----------------------------------|------------|--------|------|---------|---------------|--------|------|--------|
| | OR | 95% CI | | Р | OR | 95% CI | | Р |
| Increasing age | 1.01 | 1.00 | 1.02 | 0.01 | 1.02 | 1.00 | 1.03 | 0.04 |
| Female gender | 0.89 | 0.66 | 1.21 | 0.46 | _ | | | |
| Increasing BMI | 1.05 | 1.04 | 1.06 | < 0.001 | 1.05 | 1.03 | 1.07 | <0.001 |
| Increasing CCI | 1.14 | 1.01 | 1.28 | 0.03 | 1.10 | 0.97 | 1.24 | 0.12 |
| Prior abdominal surgery | 1.27 | 0.00 | 1.75 | 0.17 | | | | |
| Increasing albumin | 0.72 | 0.59 | 0.88 | 0.002 | 0.68 | 0.56 | 0.83 | <0.001 |
| Pancreatic ductal adenocarcinoma | 0.78 | 0.57 | 1.08 | 0.14 | 0.68 | 0.49 | 0.93 | 0.02 |
| Robotic surgical approach | 0.99 | 0.75 | 1.30 | 0.95 | 0.64 | 0.47 | 0.85 | 0.003 |
| Classic pancreaticoduodenectomy | 1.00 | 0.71 | 1.40 | 0.98 | | | | |
| Intracoverative transfosion | 2.50 | 1.67 | 2.05 | -0.001 | 2.38 | 1.32 | 4.35 | 0.004 |
| Pancreatic stent | 0.88 | 0.57 | 1.36 | 0.58 | | | | |
| Peritoneal drain | 1.12 | 1.01 | 1.35 | 0.05 | | | | |
| Soft pancreas | 1.85 | 1.43 | 2.40 | < 0.001 | 1.92 | 1.44 | 2.55 | <0.001 |
| Duet size, mm | | | | | | | | |
| <3 | 1.20 | 0.67 | 2.14 | 0.54 | | | | |
| 3-8 | 1.08 | 0.63 | 1.85 | 0.78 | | | | |
| >8 | Ref | Ref | Ref | Ref | | | | |

TABLE 5. Analysis of Factors Associated With Major Complications (Clavien-Dindo Grade III–V)

Bold values indicate P < 0.05.

BMI indicates body mass index; CCI, Charlson Comorbidity Index (without age-adjustment); CI, confidence interval; OR, odds ratio; Ref, reference variable.

| Increasing age Female sex | Univariate | | | | Multivariable | | | |
|--|----------------------|----------------------|----------------------|--------------------------------|----------------------|----------------------|----------------------|--------------------------------|
| | OR | 95% CI | | Р | OR | 95% CI | | P |
| | 1.04 1.05 | 1.01 0.40 | 1.07 2.71 | 0.003 0.93 | 1.02 | 0.99 | 1.05 | 0.12 |
| Increasing BMI Increasing CCI | 0.96 1.17 1.20 | 0.89 1.07 | 1.03 1.27 2.22 | 0.21 < 0.001 0.72 | | | | |
| Increasing albumin Pancreatic ductal adenocarcinoma | 0.36 | 0.19 | 0.71 1.98 | 0.003 0.89 | 0.35 | 0.19 | 0.63 | <0.001 |
| Robotic surgical approach Classic pancreaticoduodenectomy | 0.67 0.70 3.70 | 0.34 0.37 | 1.28 1.32 7.14 | 0.23 0.27 | 2 56 | 1 25 | 5 56 | 0.01 |
| Pancreatic stent Peritoneal drain Soft pancreas | 0.55 0.41 1.03 | 0.20 0.27 0.63 | 1.52 0.63 1.70 | 0.25 < 0.001 0.90 | 0.38 0.23 1.66 | 0.11 0.13 0.96 | 1.32 0.41 2.89 | 0.13 < 0.001 0.07 |
| Duct size, mm <3 3-8 >8 | 0.75 0.62 Ref | 0.21 0.20 Ref | 2.65 1.88 Ref | 0.65 0.40 Ref | | | | |

TABLE 3. Analysis of Factors Associated With 90-Day Mortality

Bold values indicates P < 0.05.

BMI indicates body mass index; CCI, Charlson Comorbidity Index (without age-adjustment); CI, confidence interval; OR, odds ratio; Ref, reference variable.

Benefit's RLPD

- Robotic pro's: improved ergonomics, enhanced dexterity, and the addition of stereotactic vision
- Robotic cons: a lack of rigorous data to support safety and efficacy of RPD, and expense of the robotic platform

Time to adjuvant chemotherapy

Minimally invasive versus open pancreaticoduodenectomy for cancer A Adam et al. Annals of Surgery 2015

- 7061 underwent whipple: 983 MIPD and 6078 open
- Unadjusted 30 day mortality rate 5.1% MIPD vs 3.1% Open surgery (p <0.002)
- No difference in time to adjuvant chemotherapy

Minimally Invasive Pancreaticoduodenectomy Does Not Improve Use or Time to Initiation of Adjuvant Chemotherapy for Patients With Pancreatic Adenocarcinoma. Nussbaum D et al. Annals of Surg Onc 2016

- 7967 px: 1191 MIPD (14.9 %) vs 6776 OPD
- 50 % of the px received adjuvant chemotherapy, initiated at a median of 54 versus 55 days postoperatively
- Odds ratio 1.00; p = 0.99

Does it improve overall survival?

Laparoscopic versus open pancreaticoduodenectomy for pancreatic adenocarcinoma: long-term results at a single institution Stauffer et al. Surg Endoscopy 2016

- Compared 193 OPD to 58 LPD
- Operative time longer but blood loss less in LPD
- Post-operative complications; length of ICU stay and overall hospital stay were not statistically significant
- Estimated median survival LPD 18.5 months vs 20.3 OPD (p=0.2)

Is it cost effective?

Cost analysis of open and laparoscopic pancreaticoduodenectomy: a single institution comparison. Mesleh et al.. Surg Endoscopy 2013

- 123 px: 75 LPD vs 48 OPD
- LPD 17% conversion rate
- Mean operative time: OPD and LPD was 355 min (range 199–681) and 551 min (range 390–819) respectively (p < 0.0001)
- Median hospital stay for OPD and LPD was 8 days (range 5–63), and 7 days (range 4–68) respectively (p = 0.5)
- Morbidity rates equal: 31%
- Mortality rate



Fig. 1

Total cost LPD and OPD. The total cost, shown at the *superior* aspect of the *bar graph*. The total cost is made up of the surgical cost, *lower* aspect of the *bar graph*, and the admission cost, *upper* aspect of the *bar graph*. p = 0.95

Conclusions

- No clear evidence to use LPD over OPD
- At best they are equivalent
 - High volume centers
 - Patient selection
 - Beware of soft pancreas

Thank you

References in congress notes

