Robotic Pancreas Surgery: Teaching Old Dogs New Tricks

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Objectives

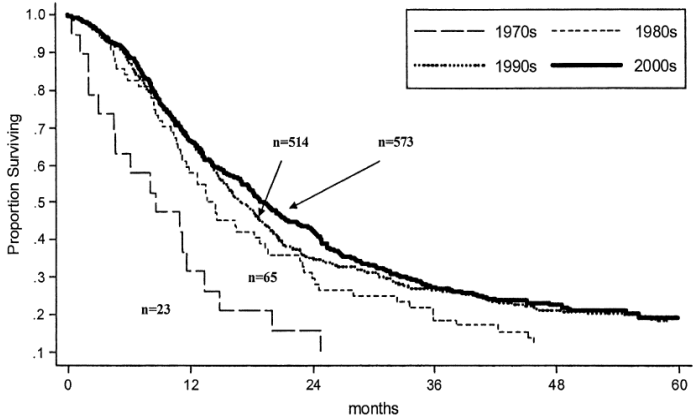
- Understand basic principles of pancreas cancer management
  - Cure occurs rarely
  - Multidisciplinary teamwork is important
- Describe treatment approach for advanced pancreas cancers
- Discuss robotic pancreas surgery
  - Safe in experienced hands
  - Role of formal education

Pancreas cancer – worst ever?

- Dismal prognosis
  - 5 year overall survival < 10%
  - 3rd leading cause cancer mortality in US
- Majority have metastatic disease
- Outcomes poor even with localized disease

Survival improving slightly

Hopkins



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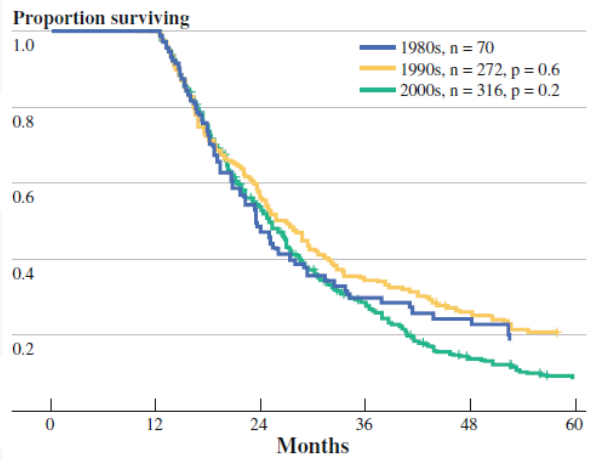
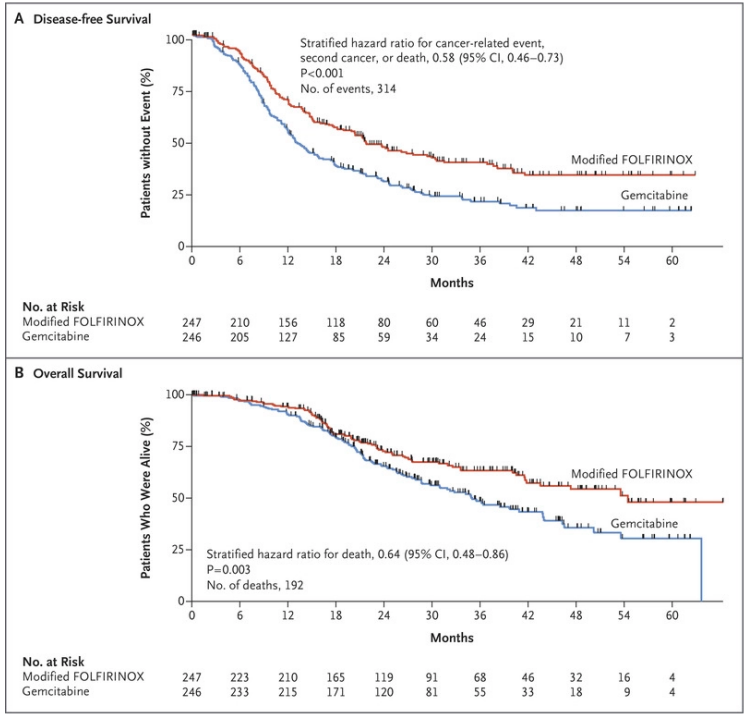


Tzeng *JOGS* 2014

Surgery alone not enough



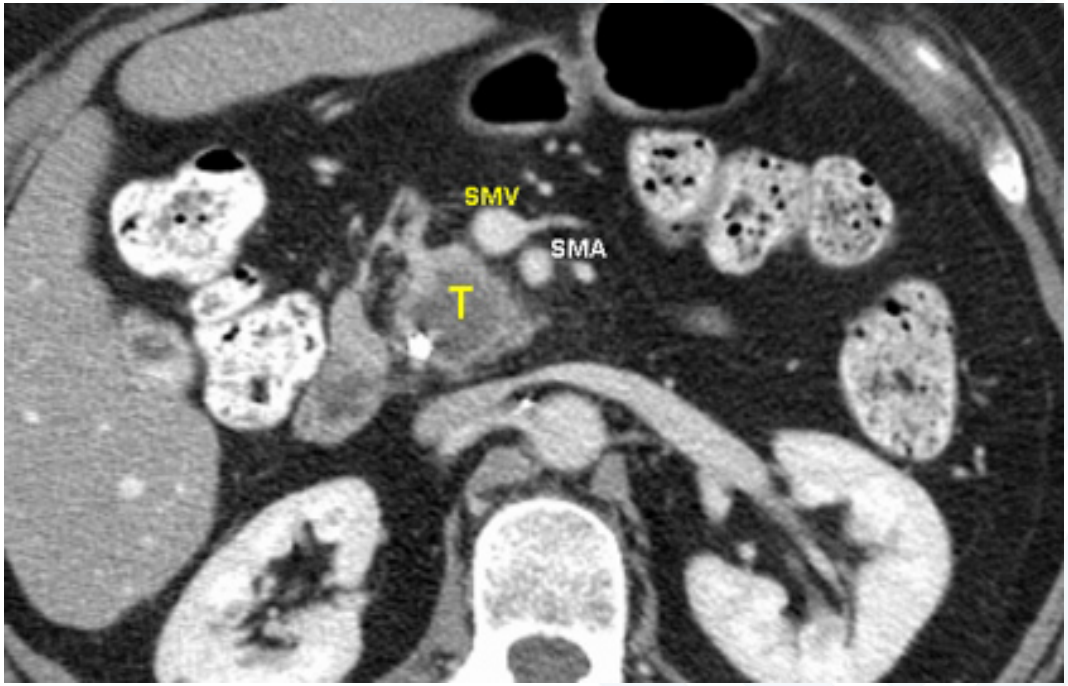
- Adjuvant therapy with mFOLFIRINOX now standard of care
- Median survival 54 months
- Median time to recur 22 months
- 32% in mFOLFIRINOX group stopped treatment

Conroy *NEJM* 2018

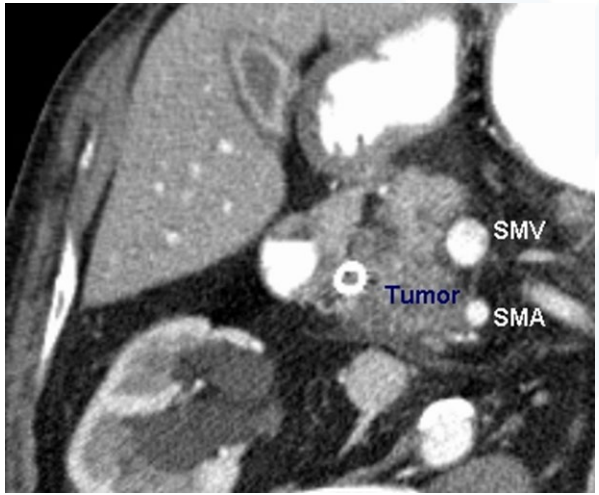
Rationale for preoperative therapy

- Cure levels low with “old school” approach
- Guarantee all receive some non-surgical therapy
- Early systemic therapy for micro-metastatic disease
- Outcomes so far encouraging
- Novel clinical trials

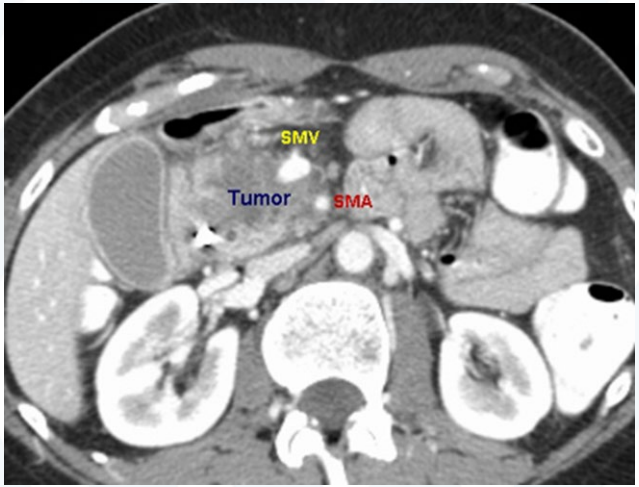
Resectable pancreas mass



Best to give preoperative therapy

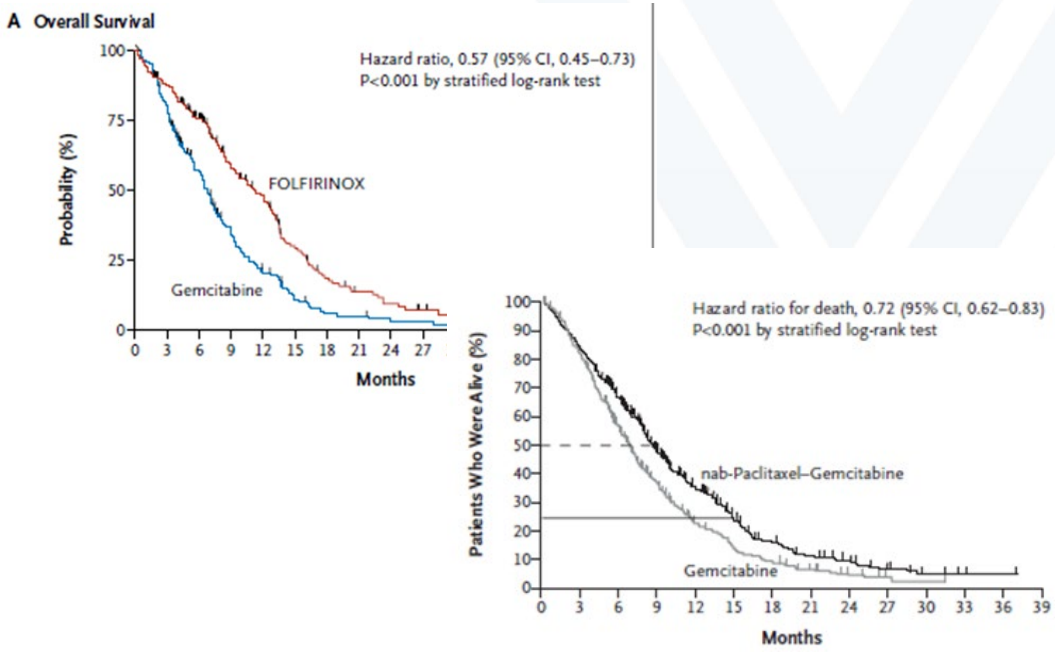


Borderline resectable



Locally advanced

Treat advanced like metastatic

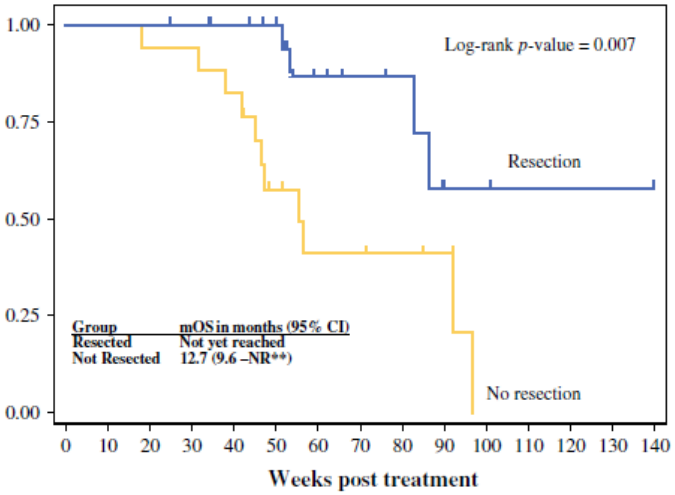


Median survival:
FOLFIRINOX - 11.1 months
Gem – 6.8 months
Response rate 30% vs 9%

Median survival:
Gem/Abx – 8.5 months Gem – 6.7 months
Response rate 20% vs 7%

Chemotherapy may allow operation

Neoadjuvant Modified (m) FOLFIRINOX for Locally Advanced Unresectable (LAPC) and Borderline Resectable (BRPC) Adenocarcinoma of the Pancreas



- 43 unresectable
- 50% XRT
- 23% response
- 50% resection
- 20% vascular resection
- 86% negative margins

- I tell patients 50/50

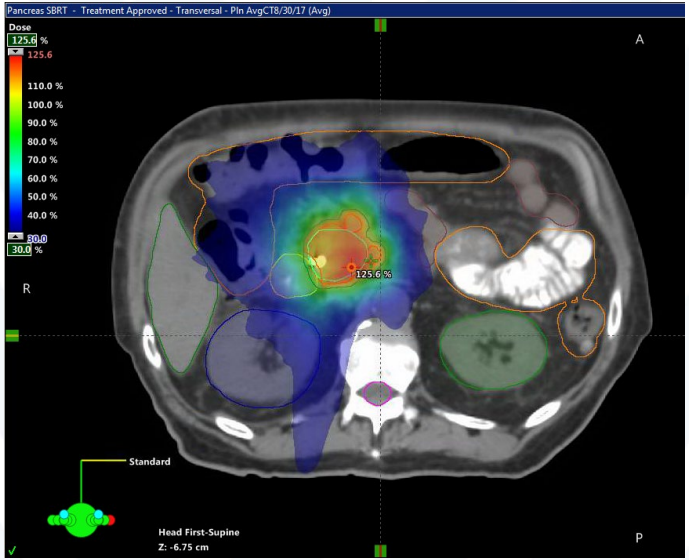
Blazer *Ann Surg Onc* 2015

New methods of radiation therapy

Stereotactic body radiation (SBRT)
High fraction short course

Intraoperative radiation under study

Great area for clinical trials



Pancreas cancer surgical goals

- Margin-negative resection
- Adequate lymphadenectomy (?)
- Safe conduct of operation (hemorrhage, injury)
- Minimize postoperative complications (leak)
- Critical steps of the operations are the same regardless of approach, MIS or open

Laparoscopic distal - outcomes

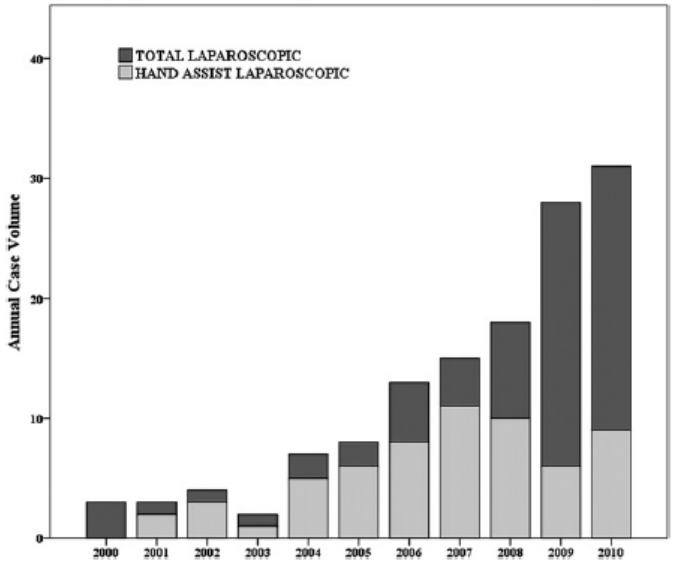


Figure 1. Number of hand-assisted and total laparoscopic left-sided pancreatectomies, 2000 to 2011.

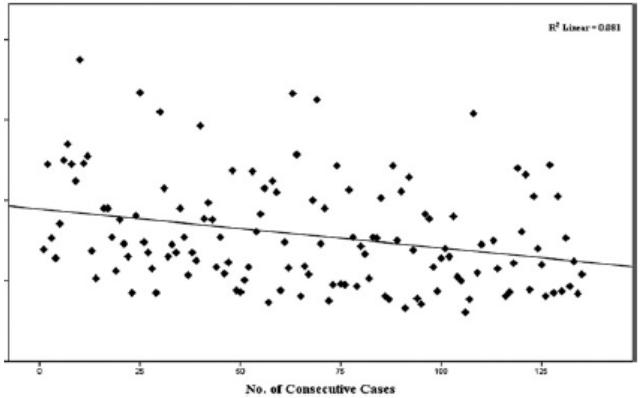


Figure 2. Operative time for 132 consecutive cases with trend line.

Kneuertz *JACS* 2012

Laparoscopic vs. open distal

- Uncontrolled studies, > 3000 patients
- LDP associated improvements in EBL, LOS, time to oral intake
- Complications (fistula), readmit and mortality similar
- Surgical margins similar
- “No more nonrandomized trials are needed…”

Jin *HPB* 2012

Mehrabi *Surgery* 2015

Lap distal outcomes for cancer

Table 4. Clinicopathologic Features of the Matched Patients Undergoing Distal (Left) Pancreatectomy for Adenocarcinoma

Variable	ODP (n = 70)	LDP (n = 23)	p Value
Age, y*	65.9 ± 11.1	64.6 ± 12.3	NS 0.76
Female	43 (61)	12 (48)	NS 0.33
ASA > 2*	2.6 ± 0.7	2.7 ± 0.7	NS 0.29
BMI, kg/m^2	25.8 ± 4.6	28.5 ± 5.7	0.03
Operative time, min	216 ± 69	238 ± 68	NS 0.18
Blood loss, mL	751 ± 853	422 ± 473	NS 0.08
Tumor size, cm*	3.5 ± 1.4	3.6 ± 1.3	NS 0.92
Total nodes	12.3 ± 8.3	14.0 ± 8.6	NS 0.41
Positive nodes	1.2 ± 1.6	1.0 ± 1.8	NS 0.73
Margin positive	24 (34)	6 (26)	NS 0.61
Specimen length, cm	9.6 ± 2.8	9.4 ± 3.7	NS 0.82
Adjuvant therapy	45 (64)	13 (57)	NS 0.62
Length of stay, d	9.4 ± 4.7	7.4 ± 3.4	NS 0.06

Results expressed as mean ± standard deviation or n (%) where appropriate.
*Variable used in matching process.
ASA, American Society of Anesthesiologists classification; BMI, body mass index; LDP, laparoscopic distal pancreatectomy; NS, not significant; ODP, open distal pancreatectomy.

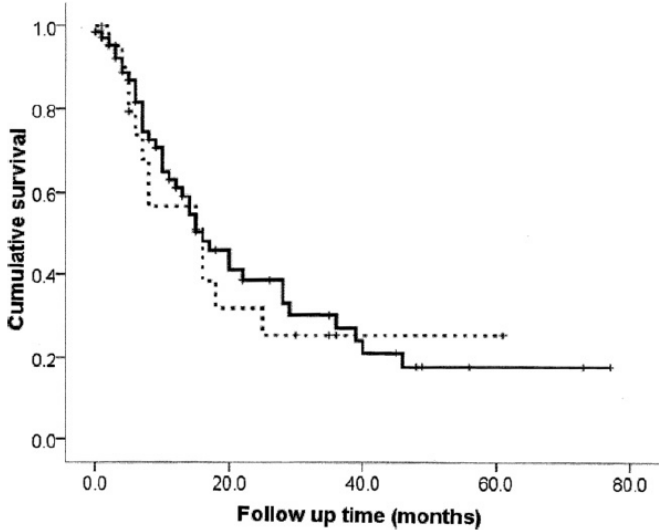


Figure 2. Matched analysis overall survival for patients undergoing open (solid line, n = 70, median survival 16 months) versus laparoscopic (dotted line, n = 23, median survival 16 months) distal pancreatectomy for adenocarcinoma, in the 3:1 matched analysis (p = 0.71, log rank).

Kooby *JACS* 2010

Robotic surgery

- Evolving technology
- Increased ROM
- 3-D 10x binocular vision

- What about surgeons without laparoscopic skills?

Robotic distal pancreatectomy

- Uncontrolled studies
- <200 patients
- Safe in selected patients

Table 5
Post-operative clinical evolution in patients on robotic DP.

Study	Robotic DP (number of patients)	Length of post-operative hospital stay [days] (mean)	Morbidity		90-days mortality
			Major complications (Clavien 3/4)	Minor complications (Clavien 1/2)	
Hwang et al. [21]	22	7.0 ± 2.4	0	0	0
Daouadi et al. [20]	30	13.7 ± 4.0	47 (50%)	14 (46%)	0
Suman et al. [23]	40	SPDP 4.5 SDP 5	SPDP 2 (17%) SDP 0	SPDP 4 (33%) SDP 10 (36%)	0
Waters et al. [24]	17	4		3 (18%)	0
Giulianotti et al. [28]	46	NA, excepted for robotic DP		NA	0

SPDP: spleen preserving distal pancreatectomy; SDP: distal pancreatectomy with splenectomy; NR: not reported; NA: not available.

Cirocchi *Surgical Oncology* 2013

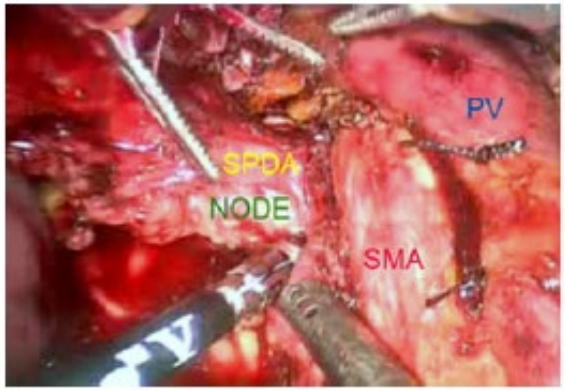
Robotic Whipple

TABLE 3 Perioperative outcomes of the RAPD cohort

Characteristic	Value
Procedure duration (min), median (IQR)	568 (536–629)
Converted to open, *n* (%)	8 (16%)
Blood loss (ml), median (IQR)	350 (150–625)
Blood transfusion, *n* (%)	11 (22%)
Pancreatic duct (mm), median (IQR)	3.0 (3.0–5.0)
Soft pancreatic remnant, *n* (%)	36 (72%)
Length of stay (d), median (IQR)	10.0 (8.0–13.0)

TABLE 5 Postoperative complications after RAPD

Characteristic	Value
Pancreatic fistula	11 (22%)
Grade A	5 (10%)
Grade B	2 (4%)
Grade C	4 (8%)
30-day morbidity	
Minor (Clavien I/II)	13 (26%)
Major (Clavien III/IV)	15 (30%)
Reoperation	3 (6%)
90-day readmission	15 (30%)
90-day mortality	1 (2%)



Zeh *Annals of Surg Onc* 2012

N=50

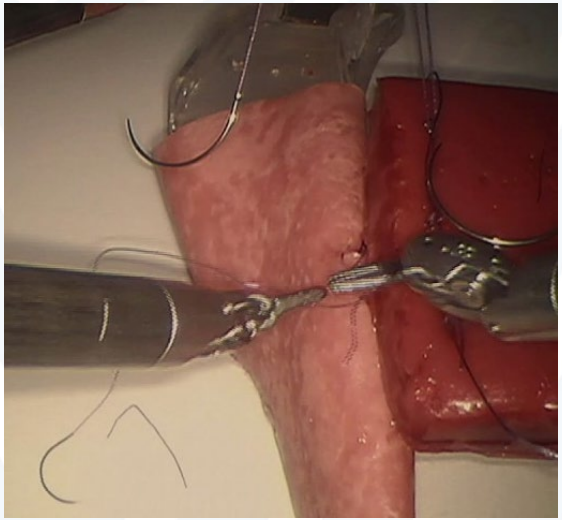
My path to learning a new trick

- Surgical oncology fellowship – zero robot cases, minimal laparoscopy
- First nine years in practice – excellent MIS and robot support
- First robot cases for surgical oncology – colon, liver, esophagus
- Around 100 Whipples
- Around 50 robot cases
- Decision to learn robot Whipple


②
①
③

Robot Whipple training

- Case observation – Carolinas Medical Center
  - One surgeon with one scrub tech
  - Xi robot with vessel sealer
- UPMC formal program
  - Robot virtual drills – 23 total – high scores required
  - Biotissue – practice anastomoses with video review
  - UPMC visit –
    - Method – two surgeons, busy bedside assist
    - Day 1 - case observation, biotissue practice
    - Day 2 – lectures, frozen cadaver



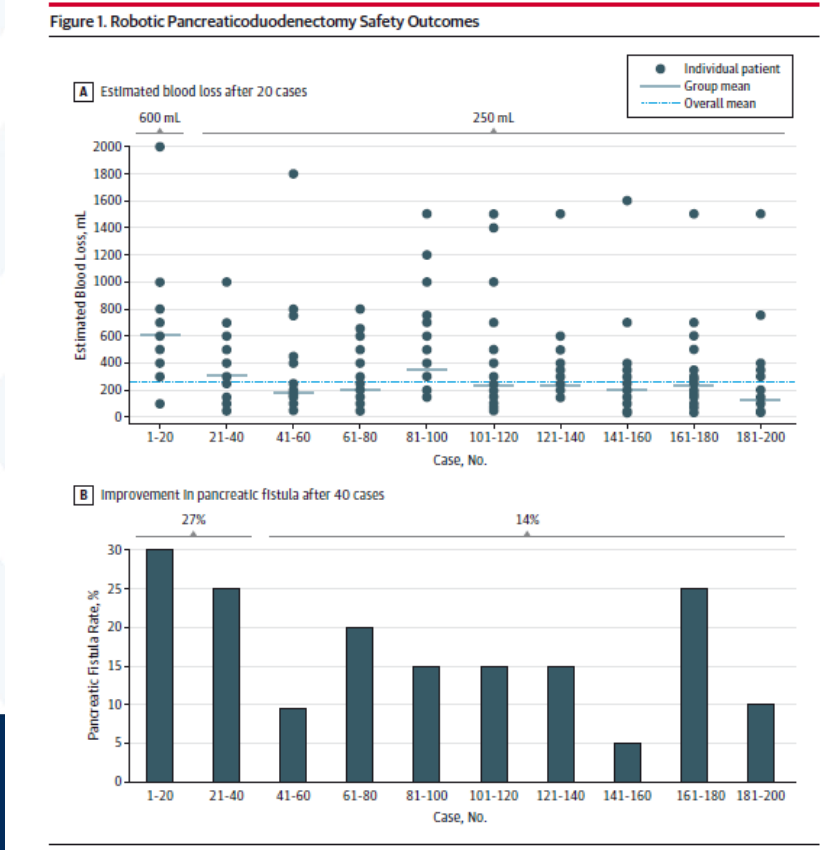
Ohio State experience

- Two surgeons – one junior and one mid-level (old?)
- First robot Whipple Nov 1, 2017
- First three operations:
  - 9 hours
  - 8 hours
  - 7 hours
- First 13 cases –
  - Good – one fistula, LOS 8 days, one conversion for vein resection
  - Bad – high rate of DGE (>80%), one GDA bleed

UPMC Robot Whipple learning curve

- 200 Robot Whipples
- Outcomes improve after 20-80 cases
  - EBL – 600 to 250 ml (20)
  - Fistula – 27% to 14% (40)
  - OR time – 581 to 471 min (80)
  - LN harvest – 17 to 26 nodes (80)
  - Conversion – 35% to 3% (20)
- **Hypothesis – formal training eliminates learning curve**

Boone *JAMA Surgery* 2015



WVU outcomes so far…

Outcome	UPMC (N=120)	WVU (N= 13)
OR time, mean min	417	387
EBL, ml	250 (150-400)	253 (50-800)
Conversion, %	3.3	7.1 (1/14)
Mortality, %	3.3	0
Pancreas fistula grade B/C, %	6.9	15.4
Readmission, %	29.2	38.5
R0 resection, %	91.4	92
LOS, median days	9 (7-14)	8 (5-22)
LN harvest, median	26 (19-32)	18 (7-34)

Outcomes of a New RPD Program for Surgeons with Formal Robotic Training		
	Reported Optimized RPD Outcomes[1] (n=120)	Initial RPD w/ formal training (n=20)
Operative time, mean (SD), min	417 (78)	375 (59)
Estimated blood loss, median (IQR), ml	250 (150-400)	300 (50-1000)
Rate No. (%)		
Conversion	3.3	5
Transfusion	21.7	5
Pancreatic Fistula (ISGPF grade B/C)	6.9	10
Readmission	29.2	25
Mortality	3.3	0
R0 resection	91.4	90
Clavien-Dindo classification rate (%)		20
<3	43.2	15
>3	23.3	25
Length of stay, median (IQR)	9 (7-14)	7 (5-22)
Lymph node harvest, median (IQR)	26 (19-32)	22.5 (7-38)

- Oct 2018 – Aug 2019
- N = 20 RPD
- N = 1 conversion
- Mean age 62
- 65% women
- Mean BMI 28
- Median CCI = 3
- N = 8 PDAC

[1]Boone *JAMA Surg* 2015

Summary

- Pancreas cancer is rarely cured
- Multimodal therapy has the best outcomes – think TEAMWORK
- Robotic pancreas operations have encouraging early results
  - Need high volume program
  - Multiple levels of support
  - Formal education and training

Conclusions

- Old dogs can learn new tricks as long as young dogs help them out

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