Pancreaticoduodenectomy in the Era of Minimally Invasive Surgery

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MIPD

Why make a difficult surgery harder

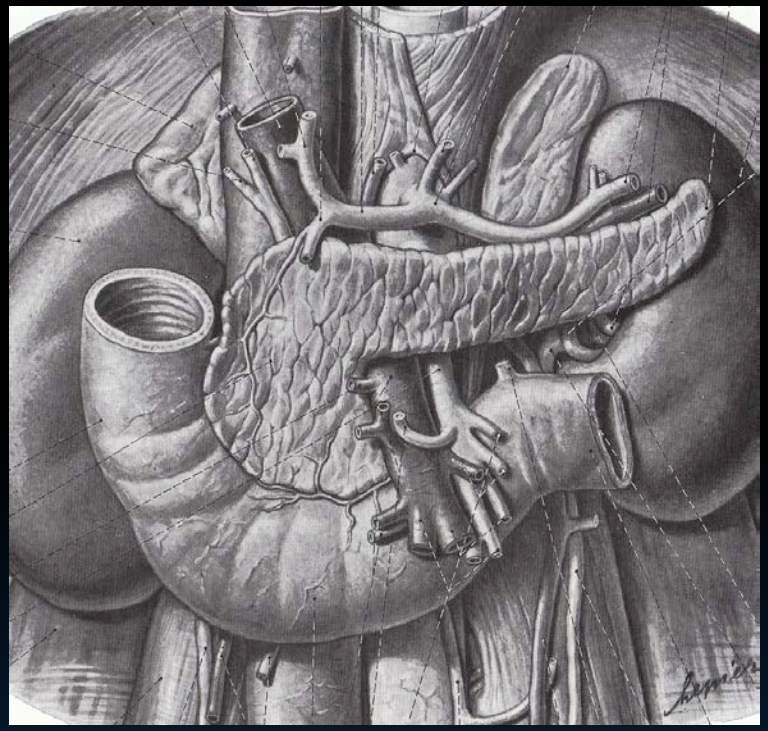
Is it really feasible

What are the barriers to implementation

Is it safe?

- Implementation of MIPD in the US

(Suggested Implementation program)



Pic from Dr Hansen

Barriers to Implementation

- Surgeon factors
  - Increased difficulty, set up time (robot), operative time
  - Productivity
- Patient factors
  - Obesity
  - High risk for leak (small duct, expected soft gland)
  - Oncologic barriers
    - Portal vein, SMV, hepatic artery, SMA contact
  - Inflammation

Barriers—Volume Needed

- Leapfrog and Birkmeyer data
  - Lower mortality at centers performing 22 PD's every 2 yrs
  - In US, many centers performing whipple surgeries are low volume
  - Referral system in US is relatively open

Birkmeyer. *Surgery.* 2004;135(6):569-575

University of Pittsburgh--MIPD

- Boone et al 2008 – 2014
- N = 200
- EBL and conversion rates decreased after 20 cases
- Decreased PF after 40 cases
- OR time improved after 80 cases

Boone. *JAMA surgery.* 2015;150(5):416-422

Last part of UPMC series MIS whipple

- N = 120 last cases
- Median EBL 250 ml
- Conversion 3.3%
- 90 d mortality 3.3%
- B/C fistula rate 6.9%
- Median LOS 9 days

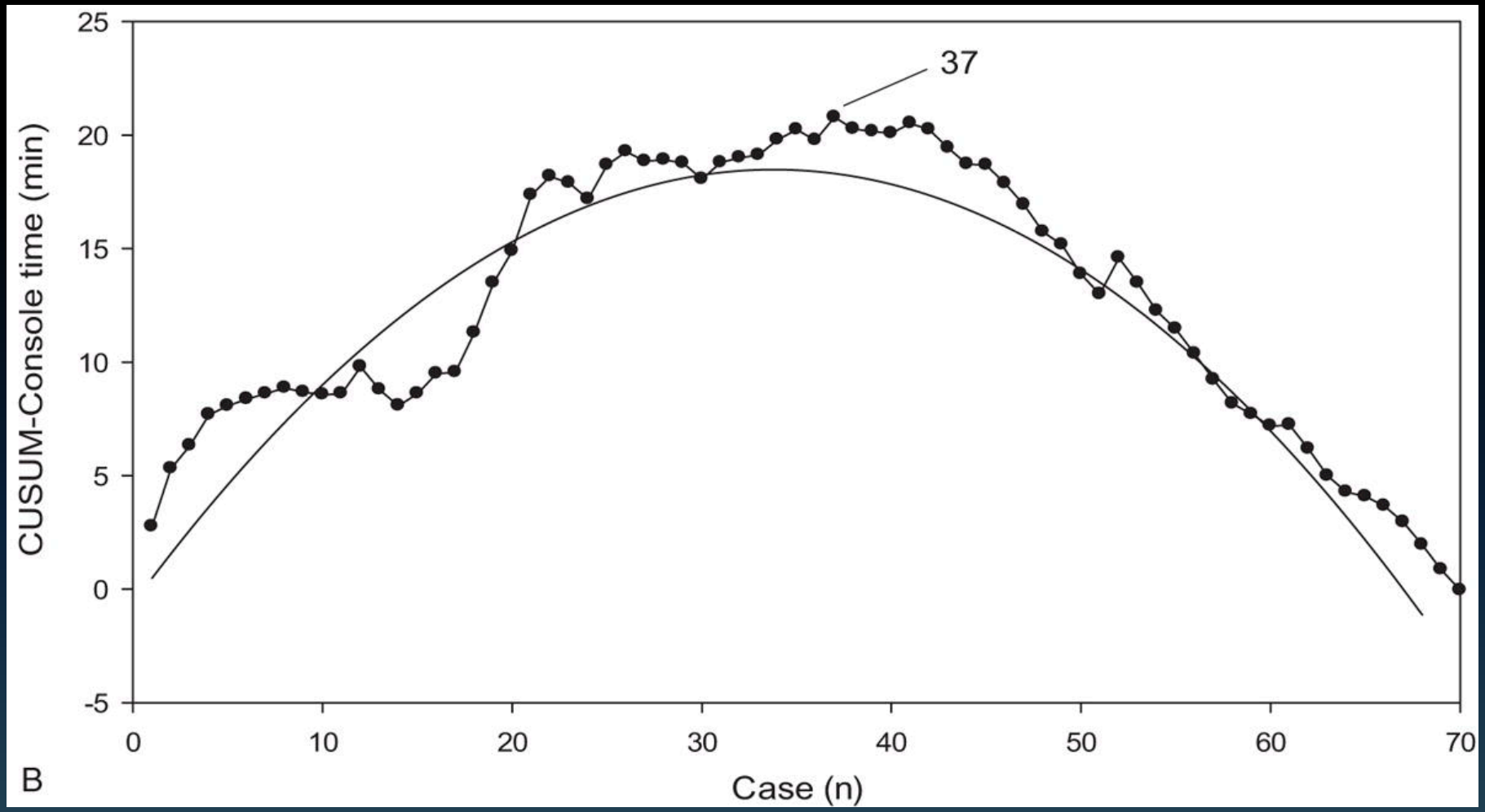
Boone. *JAMA surgery.* 2015;150(5):416-422

Robotic Series, Console Time

- Shyr et al, 61 Robotic PD's
- Early and late portion of learning curve
- 2 surgeons with 500 open PD experience
- CUSUM-CT analysis, n = 37 to reach 2nd half of learning curve (console time)

Shyr, SE Wang et al, Medicine 2018. 97(45) e 13000

Case volume vs Console Time Variable for Robotic PD



Shyr, SE Wang et al, Medicine 2018. 97(45) e 13000

Hypothesis

- Implementation of MIPD in the US may be limited by number of low volume centers performing PD

- Increased mortality could occur at centers starting programs or attempting MIPD without adequate overall PD volumes

Methods

National Cancer Database, 2010-2011

Minimally Invasive PD (MIPD)

Laparoscopic, Robotic, Conversion to open

Open Low Volume: < 22 PD over 2 years (Leapfrog)

MIS Low Volume: < 10 MIPD over 2 years

Logistic Regression Analysis

Adam, M.A., et al. Ann Surg 2015

Methods

Cohort categorized into 4 groups

1. Open PD at high-volume hospital (control)
2. Open PD at low-volume hospital
3. MIPD at high-volume hospital
4. MIPD at low-volume hospital

Methods: Propensity Match

Patient Factors	Clinical Factors
Age	Clinical Stage
Sex	Tumor Size
Race	Histology
Insurance Status	Preoperative chemotherapy
Year of Diagnosis	Preoperative radiation
Number of Co-Morbidities	

Results: Baseline Statistics

	Open PD	MIPD
Total Patients	6,083	974
Total Centers	634	251
Male	52%	51%
Mean Age	63	58
Co-Morbidities	34%	38%
Histology		
Adenocarcinoma	87%	84%
Endocrine	8%	10%
Other	5%	6%
Facility Type		
Community Cancer	2%	1%
Comprehensive Cancer Program	34%	26%
Academic	64%	73%

Number of MIPD and Number of Hospitals

Number of MIPD Performed	Number of Hospitals
1	123
2	42
3	22
4	16
5	9
6	6
7	5
8	2
9	3
10	6
11-51	17

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89% of hospitals performing MIPD were low-volume

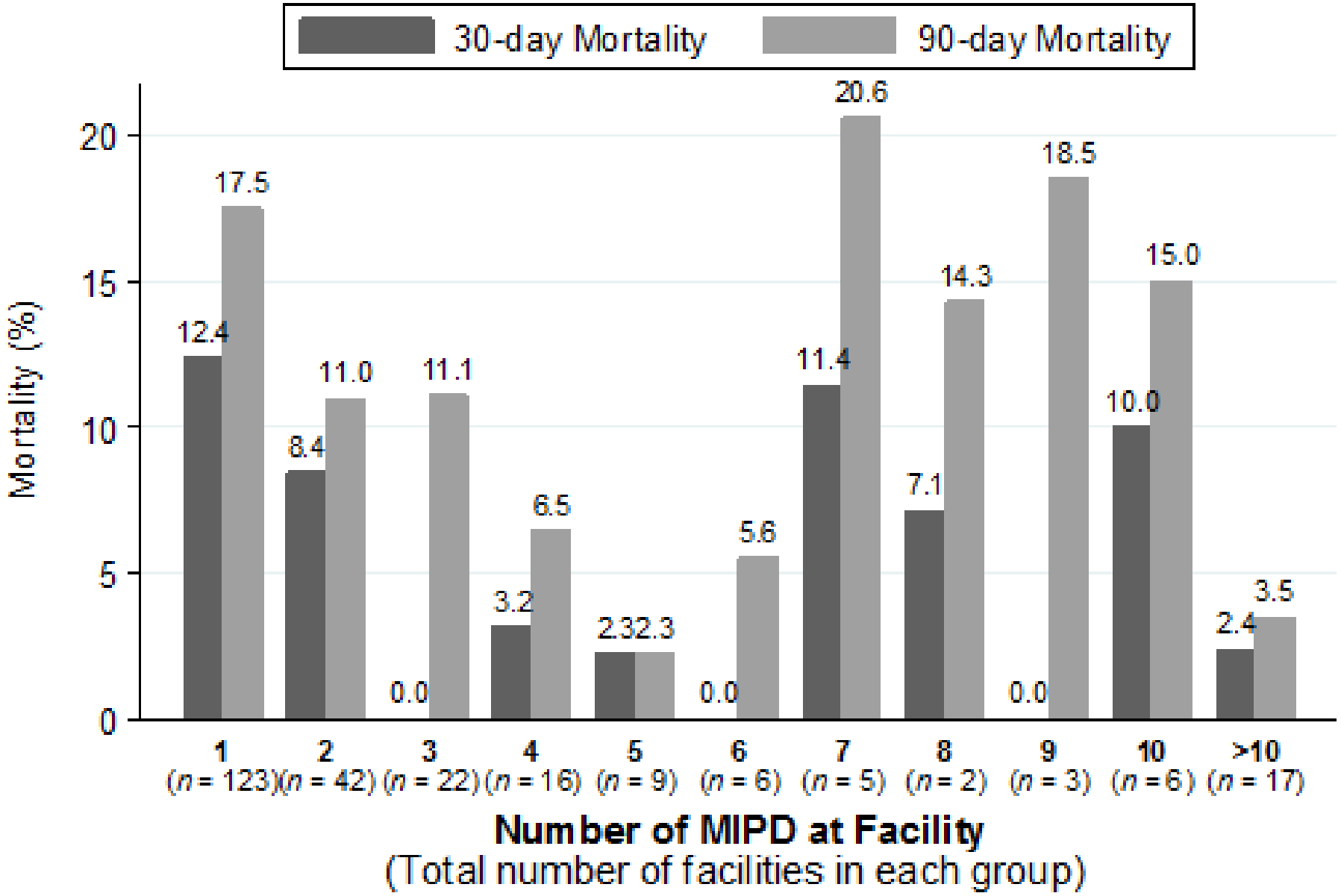
30 day mortality, adjusted

Surgical Approach, Hospital Volume	Open, High-Volume	Open, Low-Volume	Minimally Invasive, High-Volume	Minimally Invasive, Low-Volume	Total
30-day Mortality	2.4%	5.4%	3.2%	6.1%	4.3%

Propensity Match Logistic Regression Analysis

	30-Day Mortality Odds Ratio	p-Value	90-Day Mortality Odds Ratio	p-Value
Open, Low-volume	2.1 [1.4,3.0]	< 0.001	1.7 [1.3,2.2]	< 0.001
MIPD, Low-Volume	2.5 [1.5,4.1]	< 0.001	2.3 [1.5,3.3]	< 0.001
MIPD, High-Volume	1.7 [0.91,3.2]	NS	1.1 [0.6,1.8]	NS

* Control Group: Open, High-volume


30-day Mortality
90-day Mortality
Mortality (%)
0
5
10
15
20
12.4
17.5
8.4
11.0
0.0
11.1
3.2
6.5
2.3
2.3
0.0
5.6
11.4
20.6
7.1
14.3
0.0
18.5
10.0
15.0
2.4
3.5
1 (n = 123)
2 (n = 42)
3 (n = 22)
4 (n = 16)
5 (n = 9)
6 (n = 6)
7 (n = 5)
8 (n = 2)
9 (n = 3)
10 (n = 6)
>10 (n = 17)
Number of MIPD at Facility
(Total number of facilities in each group)

Conclusions

- Results of early and modern series for MIPD show acceptable outcomes at major reporting institutions
- It probably takes 60 MIPD cases and a foundation of open PD to be good at this
- Early administrative database results from US indicate enthusiasm in low volume sites to try MIPD
- Patients treated at low volume MIPD sites, like with open PD, have increased mortality, perhaps unacceptable for programs performing 1 or 2 cases per year
- Centralization and collaboration between programs may help bridge the early difficulties with learning MIPD**

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