Minimally Invasive Pancreatic Resection, Who Benefits?

Melissa E. Hogg MD MS

April 12, 2025

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Agenda

1. History
2. Early Evidence
3. Consensus Conferences
4. Randomized Trials
5. Patient Centered Outcomes
6. Video

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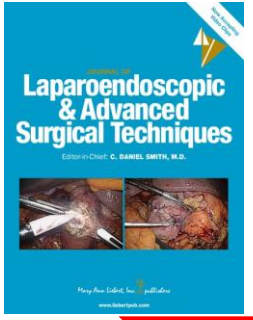
The Rise of Robotic Pancreas Surgery

The Rise of Robotic Pancreas Surgery



Robotic Resection of Pancreatic Neuroendocrine Tumor

W.S. Melvin, B.J. Needleman, K.R. Krause, and E.C. Ellison

2003 2003 2011 2013

The First Robotic Distal

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The Rise of Robotic Pancreas Surgery

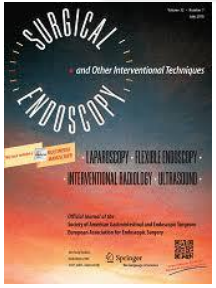
The First Robotic Whipple

2003 | 2003 | 2011 | 2013

Robotics in general surgery: personal experience in a large community hospital

Pier Cristoforo Giulianotti [1], Andrea Coratti, Marta Angelini, Fabio Sbrana, Simone Cecconi, Tommaso Balestracci, Giuseppe Caravaglios

The Rise of Robotic Pancreas Surgery



Robot-assisted laparoscopic pancreatic surgery: single-surgeon experience

Pier Cristoforo Giulianotti · Fabio Sbrana · Francesco Maria Bianco · Enrique Fernando Elli · Galaxy Shah · Pietro Addeo · Giuseppe Caravaglios · Andrea Coratti

2003 → 2003 → 2011 → 2013

The First Large Single Surgeon Robotic Pancreas Experience

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The Rise of Robotic Pancreas Surgery

The First Large Single Institution Robotic Pancreas Experience

2003 → 2003 → 2011 → 2013

250 Robotic Pancreatic Resections

Safety and Feasibility

Amer H. Zureikat, MD, A. James Moser, MD,‡ Brian A. Boone, MD,* David L. Bartlett, MD,* Mazen Zenati, MD, PhD,† and Herbert J. Zeh III, MD**

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2016 Brazil State of Art

IHPBA

Proceedings of the first international state-of-the-art conference on minimally-invasive pancreatic resection (MIPR)

Charles M. Vollmer[1]
Kevin C.P. Conlon[6]
C. Palanivelu[11], Bår
David A. Kooby[16]

Worldwide survey on opinions and use of minimally invasive pancreatic resection

Jony van Hilst
Uggo Boggi[5], (
Paul D. Hanse
Bård I. Røsok[1]
David A. Koob

Training in Minimally Invasive Pancreatic Resections: a paradigm shift away from "See one, Do one, Teach one"

Melissa E. Hogg
David A. Kooby[6]

Standardizing terminology for minimally invasive pancreatic resection

, Jeffrey Barkun[4], Marc G. Besselink[5],
ng Han[9], Paul D. Hansen[10], Melissa E. Hogg[11],
n V. Shrikhande[14], Go Wakabayashi[15],

Research considerations in the evaluation of minimally invasive pancreatic resection (MIPR)

Jeffrey Barkun[1]
Jane Holt[5], Ste
Resection Orga

Minimally invasive pancreatic resections: cost and value perspectives

Kevin C. Conlon[1]
Mark Talamonti[5],
Charles M. Vollm

Minimally invasive distal pancreatectomy

Bård I. Røsok
David A. Koob
Art Conferenc

Minimally invasive pancreatoduodenectomy

Michael L. Kendrick[1], Jony van Hilst[2], Ugo Boggi[3], Thijs de Rooij[2], R. Matthew Walsh[4], Herbert J. Zeh[5], Steven J. Hughes[6], Yoshiharu Nakamura[7], Charles M. Vollmer[8], David A. Kooby[9], Horacio J. Asbun[10] & the Minimally Invasive Pancreatic Resection Organizing Committee

Robotic Pancreas Outcomes

Mastery of the Console

Step #1
Simulation Curriculum

Mastery of Loss of Haptic Feedback

Step #2
Inanimate Curriculum

Mastery of the Procedures

Step #3
Video Library

Mastery of Psychomotor Performance

Step #4
Surgical Curriculum

Decision Making and Judgment

Step #5
Ongoing QAQI

- Feasible

Robotic-Assisted Major Pancreatic Resection

H.J. Zeh III, MD*, David L. Bartlett, MD, A. James Moser, MD*
Division of Surgical Oncology, Department of Surgery, University of Pittsburgh School of Medicine, Suite 417, UPMC Cancer Pavilion, 5150 Center Avenue, Pittsburgh, PA 15232, USA

- Safe

250 Robotic Pancreatic Resections
Safety and Feasibility
Amer H. Zureikat, MD, A. James Moser, MD,‡ Brian A. Boone, MD,* David L. Bartlett, MD,* Mazen Zenati, MD, PhD,† and Herbert J. Zeh III, MD**

- Efficacious

A Multi-institutional Comparison of Perioperative Outcomes of Robotic and Open Pancreaticoduodenectomy
Amer H. Zureikat, MD,· Lauren M. Postlewait, MD,† Yuan Liu, PhD,‡ Theresa W. Gillespie, PhD,† Sharon M. Weber, MD,§ Daniel E. Abbott, MD,¶ Syed A. Ahmad, MD,¶ Shishir K. Maithel, MD,† Melissa E. Hogg, MD,· Mazen Zenati, MD, PhD, MPH,· Clifford S. Cho, MD,§ Ahmed Salem, MD,§

- Cost Effective

ORIGINAL ARTICLE
Comprehensive comparative analysis of cost-effectiveness and perioperative outcomes between open, laparoscopic, and robotic distal pancreatectomy
Deepa R. Magge[1], Mazen S. Zenati[1], Ahmad Hamad[2], Caroline Rieser[1], Amer H. Zureikat[1], Herbert J. Zeh[1] & Melissa E. Hogg[1]
[1]Division of GI Surgical Oncology, University of Pittsburgh Medical Center, USA, [2]Department of Surgery, Ohio State University, USA, and [3]University of Texas Southwestern, USA

A Combination of Robotic Approach and ERAS Pathway Optimizes Outcomes and Cost for Pancreatoduodenectomy
Stacy J. Kowalsky, MD, Mazen S. Zenati, MD, MPH, PhD,† Jennifer Steve, BS,* Stephen A. Esper, MD, MBA, Kenneth K. Lee, MD,* Melissa E. Hogg, MD,* Herbert J. Zeh III, MD,* and Amer H. Zureikat, MD**

- PRO

Association of robotic approach with patient-reported outcomes after pancreatectomy: a prospective cohort study
Jason B. Liu • Vernissia Tam • Mazen S. Zenati • ... Herbert J. Zeh III • Amer H. Zureikat • Melissa E. Hogg • Show all authors

- Teachable

ORIGINAL ARTICLE
Training in Minimally Invasive Pancreatic Resections: a paradigm shift away from "See one, Do one, Teach one"
Melissa E. Hogg[1], Marc G. Besselink[2], Pierre-Alain Clavien[3], Abe Fingerhut[4], D. Rohan Jeyarajah[5], David A. Kooby[6], A. James Moser[7], Henry A. Pitt[8], Oliver A. Varban[9], Charles M. Vollmer[10], Herbert J. Zeh III[1], Paul Hansen[11] & the Minimally Invasive Pancreatic Resection Organizing Committee

- Transplantable

Developing a robotic pancreas program: the Dutch experience
Carolijn L. Nota[1,2], Maurice J. Zwart[1], Yuman Fong[2], Jeroen Hagendoorn[1], Melissa E. Hogg[2], Bas Groot Koerkamp[3], Marc G. Besselink[3*], I. Quintus Molenaar[3*]; for the Dutch Pancreatic Cancer Group
[1]Department of Surgery, University Medical Center Utrecht, CX Utrecht, The Netherlands; [2]Department of Surgery, City of Hope Medical Center, Duarte, California, USA; [3]Department of Surgery, Academic Medical Center Amsterdam, AZ Amsterdam-Zuidoost, The Netherlands; [4]Department of Surgery, University of Pittsburgh Medical Center, Pittsburgh, USA; [5]Department of Surgery, Erasmus Medical Center, Rotterdam, CE Rotterdam, The Netherlands

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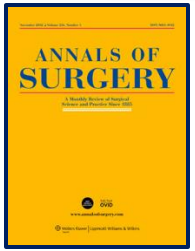
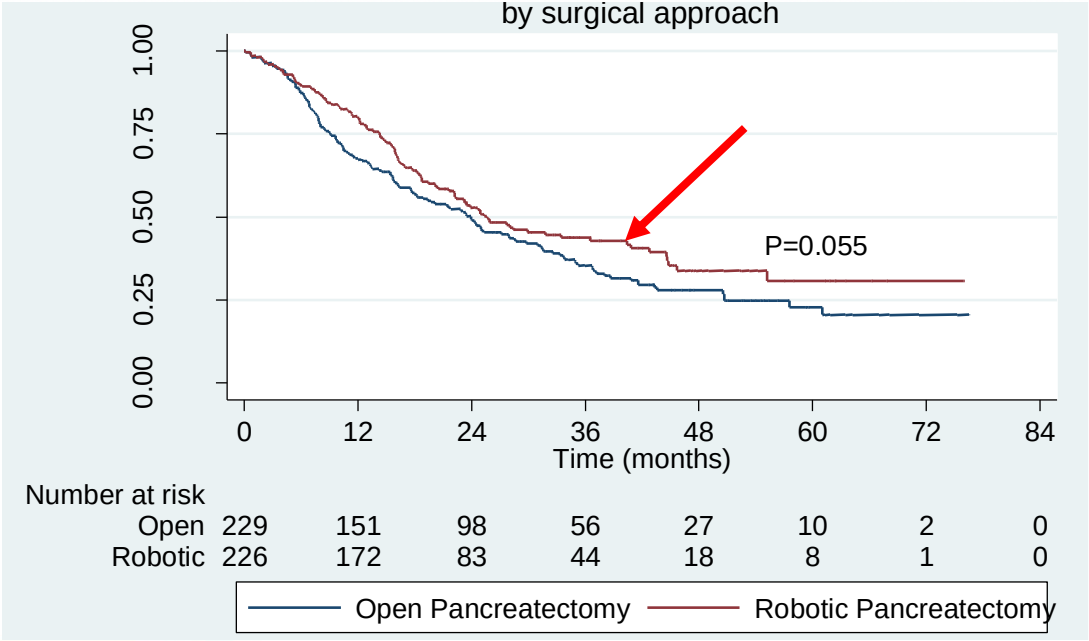
Where are We Now? . . . With Cancer

First Robot Pancreas Cancer Study



Oncologic Outcomes after Robotic Pancreatic Resections are Not Inferior to Open Surgery

Mark D. Girgis MD[1], Mazen S. Zenati MD PhD[2], Jon C. King MD[1], Ahmad Hamad MD[3], Amer Zureikat MD[2], Herbert J. Zeh MD[4], Melissa E. Hogg MD MS[5]



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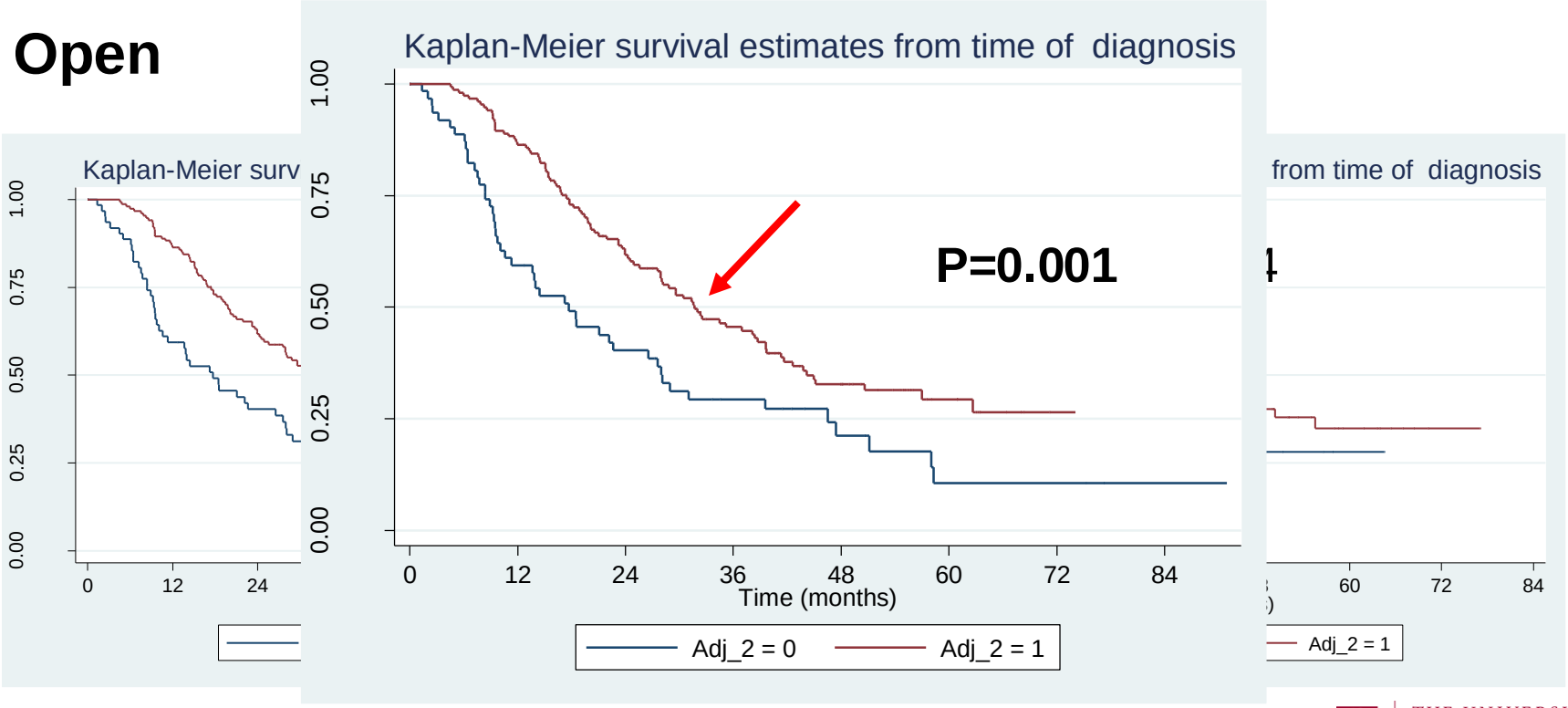
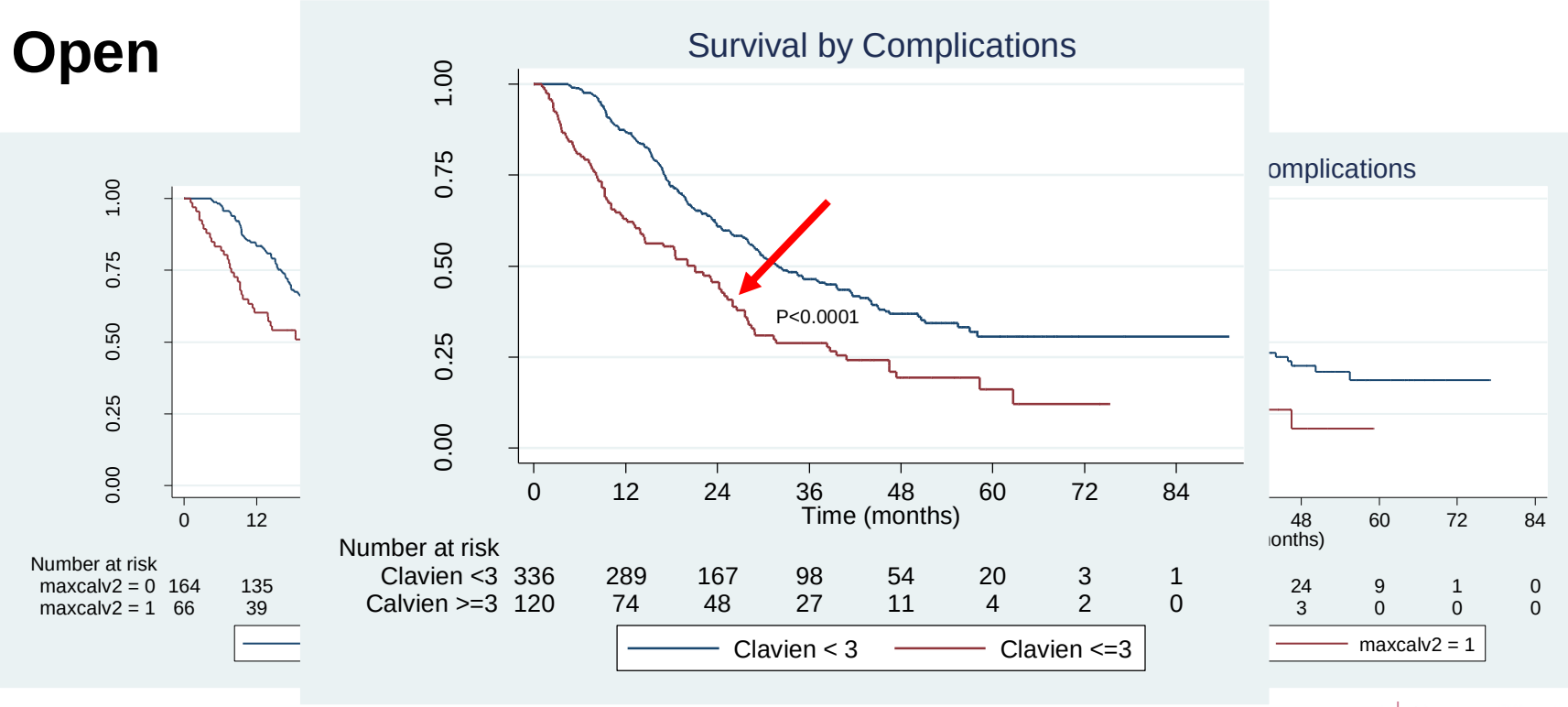
Adjuvant Therapy has Improved Survival

Open



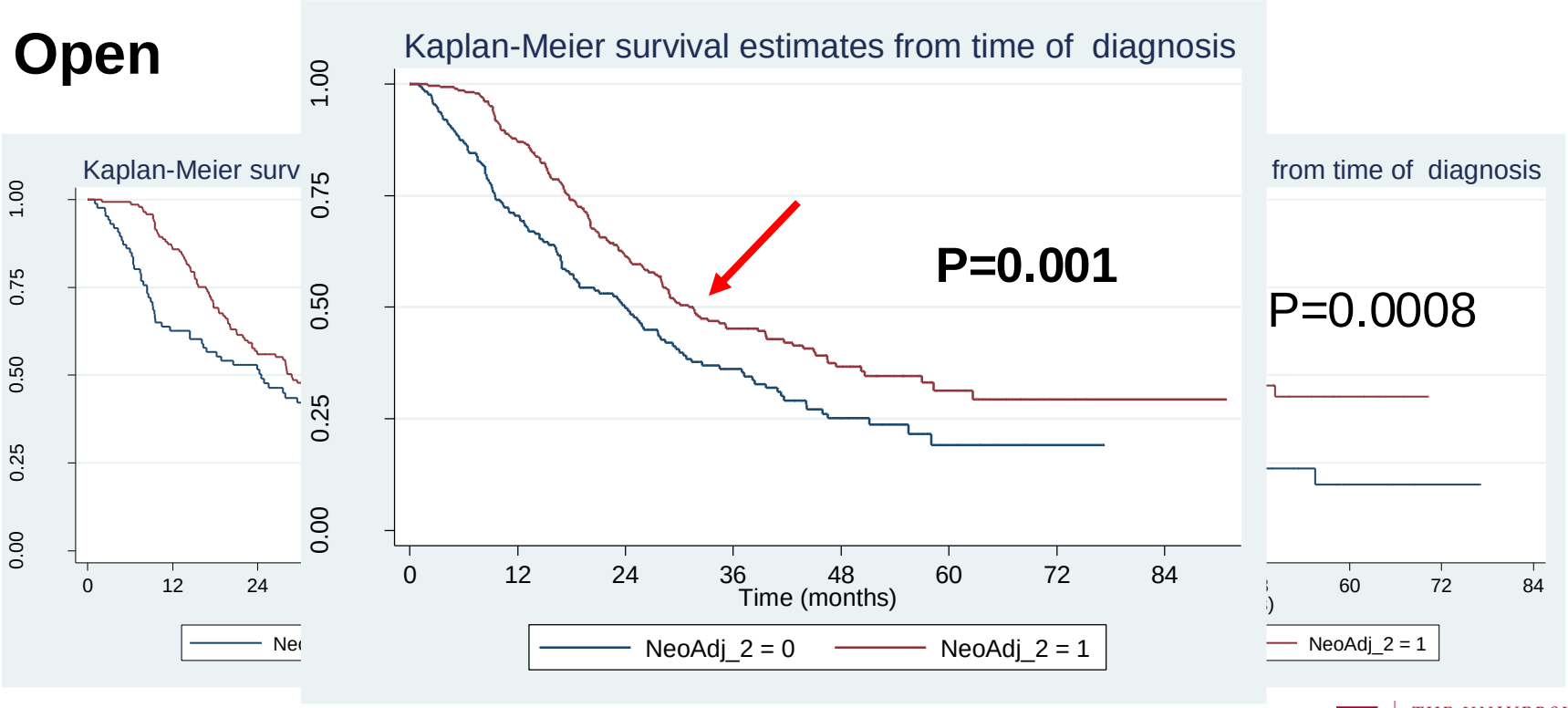
Complications Have Worse Survival

Open



Neoadjuvant Has Better Survival

Open



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Robotic Improved Survival on MVA

	Univariate Analysis				Multivariate Analysis		
	HR	95% CI	P		HR	95% CI	P
Robotic approach	**0.79**	**0.622, 1.006**	**0.056**	*	**0.77**	**0.601, 0.989**	**0.041**
Age	**1.02**	**1.008, 1.031**	**0.001**	*	-	-	
Sex (males)	**1.06**	0.836, 1.347	0.623				
BMI	**0.96**	0.941, 0.988	0.003	*	-	-	
Pre-op Albumin	**0.75**	0.604, 0.924	0.007	*	-	-	
Previous Abdominal surgery	**1.32**	1.031, 1.689	0.028	*	-	-	
CCI	**1.04**	0.943, 1.154	0.414				
AA-CCI	**1.08**	1.009, 1.156	0.026	*	-	-	
Stage	**1.36**	1.178, 1.568	<0.0001	*	-	-	
Tumor size	**1.13**	1.044, 1.220	0.002	*	1.08	0.989, 1.172	0.089
Vein Rxn	**1.37**	1.048, 1.786	0.021	*	-	-	
R0 margin	**2.00**	**1.518, 2.628**	**<0.0001**	*	**1.55**	**1.121, 2.175**	**0.001**
Pathology N	**1.79**	**1.357, 2.362**	**<0.0001**	*	**1.624**	**1.164, 2.062**	**0.003**
LN positive	**1.07**	1.050, 1.099	<0.0001				
LN harvested	**0.99**	0.985, 1.004	0.254				
NAC	**0.77**	0.606, 0.980	0.034	*	-		
NAC cycles	**0.95**	0.906, 0.993	0.025	*	-		
AC	**0.50**	0.390, 0.651	<0.0001	*	-		
Adj Chemo cycles	**0.88**	0.846, 0.924	<0.0001	*	-		
AC>6	**0.43**	0.337, 0.549	<0.0001	*	-		
Total Cycles 0 1-5, ≥6	**0.54**	**0.461, 0.638**	**<0.0001**	*	**0.55**	**0.463, 0.649**	**<0.0001**
Clavien ≥ 3	**1.89**	**1.465, 2.434**	**<0.0001**	*	**1.45**	**1.111, 1.888**	**0.006**
Wound Infection	**1.04**	0.784, 1.375	0.794				
XRT	**1.05**	0.724, 1.518	0.799				
Whipple vs Distal	**1.21**	0.870, 1.644	0.216				

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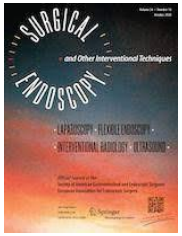
Experience Single Institution Study



Robotic pancreaticoduodenectomy may offer improved oncologic outcomes over open surgery: a propensity-matched single-institutio study

Maria Baimas-George[1] · Michael Watson[1] · Keith J. Murphy[1] · David Iannitti[1] · Erin Baker[1] · Lee Ocuin[1] · Dionisios Vrochides[1] · John B. Martinie[1,2]

Oncologic outcomes	Open	Robotic	*p* value
Tumor size (mm)	29 (9–70)	30 (4.8–60)	0.8233
Pathologic T stage	3 (1–4)	3 (1–4)	–
R1 resection	17 (44.7)	16 (42.1)	0.8170
Differentiation			
Grade 1	5 (14)	4 (11)	0.6582
Grade 2	14 (39)	25 (66)	0.0205
Grade 3	17 (47)	9 (24)	0.0340
Lymphovascular invasion	18 (47)	27 (71)	0.0477
Perineural invasion	19 (51)	34 (89)	0.0003
Lymph node positivity ratio	0.125 (0–0.74)	0.102 (0–0.625)	0.1875

Oncologic outcomes	Open	Robotic	*p* value
Median overall survival (mos)	23.0	30.4	0.1105
Recurrence pattern			
N	20 (53)	15 (39)	0.1706
Time to recurrence (days)	284 (70–1182)	402 (33–1049)	0.7471
Local recurrence	6 (16)	3 (8)	0.2870
Distant recurrence	14 (37)	12 (32)	0.6287

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Multi-Institutional Study

A Multi-institutional Comparison of Perioperative Outcomes of Robotic and Open Pancreaticoduodenectomy

*Amer H. Zureikat, MD,[*] Lauren M. Postlewait, MD,[†] Yuan Liu, PhD,[‡] Theresa W. Gillespie, PhD,[†] Sharon M. Weber, MD,[§] Daniel E. Abbott, MD,[¶] Syed A. Ahmad, MD,[¶] Shishir K. Maithel, MD,[†] Melissa E. Hogg, MD,[*] Mazen Zenati, MD, PhD, MPH,[*] Clifford S. Cho, MD,[§] Ahmed Salem, MD,[§] Brent Xia, MD,[¶] Jennifer Steve, BS,[*] Trang K. Nguyen, MD,[‖] Hari B. Keshava, MD,[‖] Sricharan Chalikonda, MD,[‖] R. Matthew Walsh, MD,[‖] Mark S. Talamonti, MD,[**] Susan J. Stocker, LPN,[**††] David J. Bentrem, MD,[††] Stephanie Lumpkin, MD,[‡‡] Hong J. Kim, MD,[‡‡] Herbert J. ZehIII , MD,[*] and David A. Kooby, MD, FACS[†]*

TABLE 1. Clinicopathologic Treatment and Outcome Data for 1028 Pancreaticoduodenectomies

Variable	All Patients (n = 1028)	Robotic (n = 211)	Open (n = 817)	*P*
Pancreatic cancer outcomes†				
Microscopically positive (R1) margins†	174 (33.6)	35 (50.0)	139 (31.0)	**0.002**
Number of lymph nodes harvested†	20 (3–72)	27.5 (7–65)	19 (3–72)	**<0.001**
≥12 Lymph nodes harvested†	455 (87.5)	64 (91.4)	391 (86.9)	0.29

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The Assessment of Robotic Pancreas Surgery

A Multi-institutional Comparison of Perioperative Outcomes of Robotic and Open Pancreaticoduodenectomy

*Amer H. Zureikat, MD,[*] Lauren M. Postlewait, MD,[†] Yuan Liu, PhD,[‡] Theresa W. Gillespie, PhD,[†] Sharon M. Weber, MD,[§] Daniel E. Abbott, MD,[¶] Syed A. Ahmad, MD,[¶] Shishir K. Maithel, MD,[†] Melissa E. Hogg, MD,[*] Mazen Zenati, MD, PhD, MPH,[*] Clifford S. Cho, MD,[§] Ahmed Salem, MD,[§] Brent Xia, MD,[¶] Jennifer Steve, BS,[*] Trang K. Nguyen, MD,[‖] Hari B. Keshava, MD,[‖] Sricharan Chalikonda, MD,[‖] R. Matthew Walsh, MD,[‖] Mark S. Talamonti, MD,[**] Susan J. Stocker, LPN,[**††] David J. Bentrem, MD,[††] Stephanie Lumpkin, MD,[‡‡] Hong J. Kim, MD,[‡‡] Herbert J. ZehIII , MD,[*] and David A. Kooby, MD, FACS[†]*

TABLE 7. Analysis of Factors Associated With Microscopically Positive (R1) Margins in Patients With Pancreas Ductal Adenocarcinoma

	Univariate				Multivariable			
	OR	95% CI		*P*	OR	95% CI		*P*
Increasing age	0.99	0.98	1.01	0.44				
Female sex	1.01	0.78	1.32	0.92				
Increasing BMI	0.99	0.97	1.01	0.45				
Increasing CCI	1.10	0.91	1.34	0.33				
Prior abdominal surgery	1.35	0.77	2.38	0.29				
Increasing albumin	0.77	0.50	1.19	0.24				
Robotic surgical approach	2.22	1.20	4.17	**0.01**	1.33	0.88	2.00	0.17
Classic pancreaticoduodenectomy	1.41	0.75	2.64	0.28	1.67	1.00	2.80	0.05
Intraoperative transfusion	2.04	1.22	3.45	**0.01**	1.82	1.19	2.78	**0.01**
	1.12	0.91	1.37	0.29				
Lymphovascular invasion	3.03	2.17	4.35	**<0.001**	2.78	2.13	3.57	**<0.001**
Soft pancreas	0.99	0.80	1.22	0.93	1.16	0.96	1.39	0.12
Duct size, mm								
<3	0.24	0.10	0.55	**<0.001**	0.31	0.12	0.80	**0.02**
	0.47	0.21	1.04	0.06	0.48	0.19	1.18	0.11
>8	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref

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.

RDP better than ODP in NCDB

Long-term oncologic outcomes of robotic and open pancreatectomy in a national cohort of pancreatic adenocarcinoma

Ibrahim Nassour MD, MSCS[1] | Sharon B. Winters MS[2] | Richard Hoehn MD[1] | Samer Tohme MD[1] | Mohamed A. Adam MD[1] | David L. Bartlett MD[1] | Kenneth K. Lee MD[1] | Alessandro Paniccia MD[1] | Amer H. Zureikat MD[1]

- RDP Higher LN than ODP (17 v. 15, p=0.002).
- RDP had improved median overall survival (35.3 vs 24.9 months, logrank p=0.001)
- RDP had higher rates of 1-, 3-, and 5-year overall survival
- RDP was also associated with higher rates of receiving adjuvant chemotherapy (64% vs 56%, p=0.017)

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RPD similar to ODP in NCDB

Long-term oncologic outcomes of robotic and open pancreatectomy in a national cohort of pancreatic adenocarcinoma

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- RPD had higher LN harvest compared to OPD
- Multiple studies have also found equivalent R0 resection rates
- Median overall survival was similar between RPD and OPD (22 vs 21.8 months, logrank p=0.755)

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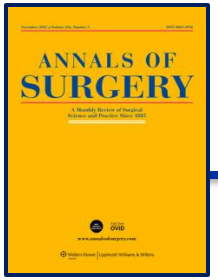

2019 Miami Evidence Based Guidelines

The Miami International Evidence-based Guidelines on Minimally Invasive Pancreas Resection

Horacio J. Asbun, MD, FACS,✉ *Alma L. Moekotte, MD,†‡ Frederique L. Vissers, MD,‡ Filipe Kunzler, MD,* Federica Cipriani, MD,§ Adnan Alseidi, MD, EdM, FACS,¶ Michael I. D'Angelica, MD, FACS,|| Alberto Balduzzi, MD,** Claudio Bassi, MD, FRCS, FACS,** Bergthor Björnsson, MD, PhD,†† Ugo Boggi, MD, FEBS,‡‡ Mark P. Callery, MD, FACS,§§ Marco Del Chiaro, MD, PhD, FACS,¶¶ Felipe J. Coimbra, MD,|||| Claudius Conrad, MD, PhD, FACS,*** Andrew Cook, MBBS, MPH,††† Alessandro Coppola, MD, PhD,‡‡‡ Christos Dervenis, MD, PhD, FRCS,§§§ Safi Dokmak, MD, PhD,¶¶¶ Barish H. Edil, MD, FACS,|||||| Bjørn Edwin, MD, PhD,**** Pier C. Giulianotti, MD,†††† Ho-Seong Han, MD, PhD,‡‡‡‡ Paul D. Hansen, MD, FACS,§§§§ Nicky van der Heijde, MD,†‡ Jony van Hilst, MD, MSc, PhD,‡ Caitlin A. Hester, MD,¶¶¶¶ Melissa E. Hogg, MD, MS,|||||||| Nicolas Jarufe, MD,***** D. Rohan Jeyarajah, MD, FACS,††††† Tobias Keck, MD, MBA, FACS,‡‡‡‡‡ Song Cheol Kim, MD, PhD,§§§§§ Igor E. Khatkov, MD, PhD,¶¶¶¶¶ Norihiro Kokudo, MD, PhD, FACS, FRCS,||||||||| David A. Kooby, MD, FACS,****** Maarten Korrel, BSc,‡ Francisco J. de Leon, MD,†††††† Nuria Lluis, MD,‡‡‡‡‡‡ Sanne Lof, MD,†‡ Marcel A. Machado, MD, FACS,§§§§§§ Nicolas Demartines, MD, FACS, FRCS,¶¶¶¶¶¶ John B. Martinie, MD, FACS,|||||||||| Nipun B. Merchant, MD, FACS,******* I. Quintus Molenaar, MD, PhD,††††††† Cassadie Moravek, BS,‡‡‡‡‡‡‡ Yi-Ping Mou, MD, FACS,§§§§§§§ Masafumi Nakamura, MD, PhD,¶¶¶¶¶¶¶ William H. Nealon, MD,||||||||||||| Chinnusamy Palanivelu, MD,******** Patrick Pessaux, MD, PhD,†††††††† Henry A. Pitt, MD,‡‡‡‡‡‡‡‡ Patricio M. Polanco, MD,¶¶¶¶ John N. Primrose, FMedSci,† Arab Rawashdeh, MD,† Dominic E. Sanford, MD,§§§§§§§§ Palanisamy Senthilnathan, MD,******** Shailesh V. Shrikhande, MD, FRCS,¶¶¶¶¶¶¶¶ John A. Stauffer, MD,|||||||||||||| Kyoichi Takaori, MD, PhD, FACS,******** Mark S. Talamonti, MD,|||||||| Chung N. Tang, MD, MDDS, FCSHK, FRCS, FHKAM,††††††††† Charles M. Vollmer, MD,‡‡‡‡‡‡‡‡‡ Go Wakabayashi, MD, PhD, FACS,§§§§§§§§§ R. Matthew Walsh, MD, FACS,¶¶¶¶¶¶¶¶¶ Shin-E Wang, MD,|||||||||||||||| Michael J. Zinner, MD,* Christopher L. Wolfgang, MD, MSc, PhD, FACS,********* Amer H. Zureikat, MD, FACS,†††††††††† Maurice J. Zwart, MSc,‡ Kevin C. Conlon, MD, FRCSI, FACS, FRCSG, FTCD,‡‡‡‡‡‡‡‡‡‡ Michael L. Kendrick, MD,§§§§§§§§§§ Herbert J. Zeh, MD,††††††††††*

Mohammad Abu Hilal, MD, PhD, FACS, FRCS,†¶¶¶¶¶¶¶¶¶¶ and Marc G. Besselink, MD, PhD‡, on behalf

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Cancer Related Data

The Miami International Evidence-based Guidelines on Minimally Invasive Pancreas Resection

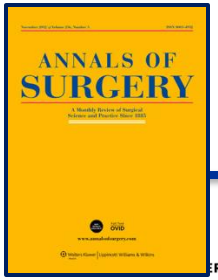
Horacio J. Asbun, MD, FACS,✉ Alma L. Moekotte, MD,†‡ Frederique L. Vissers, MD,‡ Filipe Kunzler, MD,**

Distal and Central Pancreatectomy

1a	MIDP for benign and low-grade malignant tumors is to be considered over ODP since it is associated with a shorter hospital stay, reduced blood loss, and equivalent complication rates.	1B
1b	Prospective data about the cost effectiveness of MIDP compared to ODP is limited and requires further studies.	2C
1c	MIDP is associated with a better postoperative quality of life than ODP.	2B
2	MIDP for pancreatic ductal adenocarcinoma appears to be a feasible, safe, and oncologically efficient technique in experienced hands, although prospective comparative studies are lacking.	2B

Pancreatoduodenectomy

8	There is insufficient data to recommend MIPD over OPD. Centers performing MIPD should be including all their MIPD outcomes data into national and international registries, and prospectively maintained pancreas databases.	2A
9	Both MIPD and OPD are valid approaches for selected patients with adenocarcinoma.	2B
10	No comparative data regarding MIPD vs OPD after neoadjuvant therapy exists and further investigation is warranted.	Expert opinion



2022 Brescia European Guidelines

ER

The Brescia Internationally Validated European Guidelines on Minimally Invasive Pancreatic Surgery (EGUMIPS)

Abu Hilal, Mohammad MD, PhD[*]; van Ramshorst, Tess M.E. MD[*,†,‡]; Boggi, Ugo MD, PhD[§]; Dokmak, Safi MD, PhD[‖]; Edwin, Bjørn MD, PhD[¶]; Keck, Tobias MD, PhD[#]; Khatkov, Igor MD, PhD[**]; Ahmad, Jawad MD, PhD[††]; Al Saati, Hani MD, PhD[‡‡]; Alseidi, Adnan MD, PhD[§§]; Azagra, Juan S. MD, PhD[‖‖]; Björnsson, Bergthor MD, PhD[¶¶]; Can, Fatih M. MD, PhD[##]; D'Hondt, Mathieu MD, PhD[***]; Efanov, Mikhail MD, PhD[**]; Alvarez, Francisco Espin MD, PhD[†††]; Esposito, Alessandro MD, PhD[‡‡‡]; Ferrari, Giovanni MD, PhD[§§§]; Koerkamp, Bas Groot MD, PhD[‖‖‖]; Gumbs, Andrew A. MD, MSc[¶¶¶]; Hogg, Melissa E. MD, MS[###]; Huscher, Cristiano G.S. MD, PhD[****]; Ielpo, Benedetto MD, PhD[††††]; Ivanecz, Arpad MD, PhD[‡‡‡‡]; Jang, Jin-Young MD, PhD[§§§§]; Liu, Rong MD, PhD[‖‖‖‖]; Luyer, Misha D.P. MD, PhD[¶¶¶¶]; Menon, Krishna MD, PhD[####]; Nakamura, Masafumi MD, PhD[*****]; Piardi, Tullio MD, PhD[†††††]; Saint-Marc, Olivier MD, PhD[‡‡‡‡‡]; White, Steve MD, FRCS[§§§§§]; Yoon, Yoo-Seok MD, PhD[‖‖‖‖‖]; Zerbi, Alessandro MD, PhD[¶¶¶¶¶]; Bassi, Claudio MD, PhD[‡‡‡]; Berrevoet, Frederik MD, PhD[#####]; Chan, Carlos MD, PhD[******]; Coimbra, Felipe J. MD, PhD[†††††]; Conlon, Kevin C.P. MD, PhD[‡‡‡‡‡]; Cook, Andrew MBBS, MPH[§§§§§]; Dervenis, Christos MD, PhD[‖‖‖‖‖]; Falconi, Massimo MD[¶¶¶¶¶]; Ferrari, Clarissa PhD[#######]; Frigerio, Isabella MD, PhD[*******]; Fusai, Giuseppe K. MD, PhD[†††††††]; De Oliveira, Michelle L. MD, PhD[‡‡‡‡‡‡‡]; Pinna, Antonio D. MD, PhD[§§§§§§§]; Primrose, John N. MD, PhD[‖‖‖‖‖‖‖]; Sauvanet, Alain MD, PhD[¶¶¶¶¶¶¶]; Serrablo, Alejandro MD, PhD[########]; Smadi, Sameer MD, PhD[********]; Badran, Ali MD[*]; Baychorov, Magomet MD[**]; Bannone, Elisa MD[*]; van Bodegraven, Eduard A. MD[†,‡]; Emmen, Anouk M.L.H. MD[†,‡]; Giani, Alessandro MD[§§§]; de Graaf, Nine MD[†,‡]; van Hilst, Jony MD, PhD[†,‡]; Jones, Leia R. MSc[†,‡]; Sandri, Giovanni B. Levi MD, PhD[†††††††††]; Pulvirenti, Alessandra MD, PhD[*]; Ramera, Marco MD[*]; Rashidian, Niki MD, PhD[######]; Sahakyan, Mushegh A. MD, PhD[‡‡‡‡‡‡‡‡,§§§§§§§,‖‖‖‖‖‖‖‖‖]; Uijterwijk, Bas A. MD[*,†,‡]; Zampedri, Pietro MSc[*]; Zwart, Maurice J.W. MD[†,‡]; Alfieri, Sergio MD, PhD[¶¶¶¶¶¶¶¶¶]; Berti, Stefano MD, PhD[#########]; Butturini, Giovanni MD, PhD[*******]; Di Benedetto, Fabrizio MD, PhD[********]; Ettorre, Giuseppe M. MD, PhD[†††††††††]; Giuliante, Felice MD, PhD[¶¶¶¶¶¶¶¶¶]; Jovine, Elio MD, PhD[††††††††††]; Memeo, Riccardo MD, PhD[‡‡‡‡‡‡‡‡‡]; Portolani, Nazario MD, PhD[§§§§§§§§§]; Ruzzenente, Andrea MD, PhD[‖‖‖‖‖‖‖‖‖‖]; Salvia, Roberto MD, PhD[‡‡‡]; Siriwardena, Ajith K. MD[¶¶¶¶¶¶¶¶¶¶]; Besselink, Marc G. MD, PhD[†,‡]; Asbun, Horacio J. MD, PhD[##########]; Collaborators

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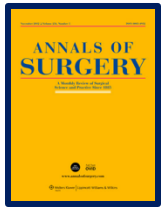
Possible but Not Standard



REVIEW PAPER

The Brescia Internationally Validated European Guidelines on Minimally Invasive Pancreatic Surgery (EGUMIPS)

	Topic 4: Pancreatic Ductal Adenocarcinoma (PDAC)			
L10	What is the role of LS in the management of PDAC in the pancreatic body and tail?	Laparoscopic left radical pancreatectomy should be considered as an alternative approach in the management of resectable PDAC in the pancreatic body and tail, when performed by experienced surgeons in high volume centers.	Moderate	Weak
R10	What is the role of RAS in the management of PDAC in the pancreatic body and tail?	Robot-assisted left radical pancreatectomy should be considered as an alternative approach in the management of resectable PDAC in the pancreatic body and tail, when performed by experienced surgeons in high-volume centers.	Moderate	Weak
L11	What is the role of LS in the management of PDAC in the pancreatic head?	LPD can be considered as an alternative approach in the management of PDAC in the pancreatic head, when performed by experienced surgeons in high-volume centers. Surgeons performing LPD must participate in a registry or follow their outcomes in a prospectively maintained database.	High	Weak
R11	What is the role of RAS in the management of PDAC in the pancreatic head?	RPD can be considered as an alternative approach in the management of PDAC in the pancreatic head, when performed by experienced surgeons in high-volume centers. Surgeons performing RPD must participate in a registry or follow their outcomes in a prospectively maintained database.	Low	Weak

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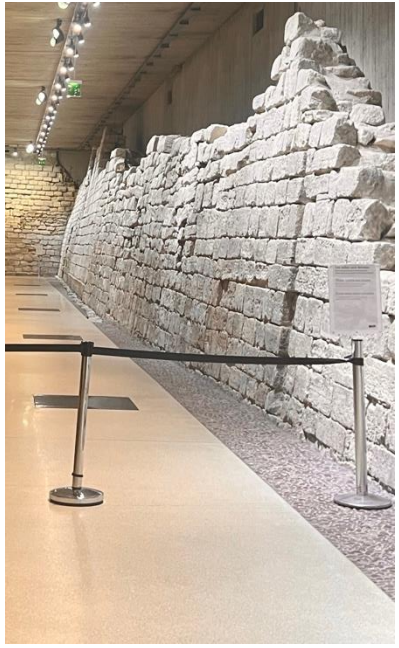
2023 Paris International Consensus

ROBOT4HPB

1ST INTERNATIONAL CONSENSUS CONFERENCE ON ROBOTIC HEPATO-PANCREATO-BILIARY SURGERY



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Section F. Robotic Pancreatic Surgery

- **Distal Pancreatectomy**

24. Robotic distal pancreatectomy should be considered an acceptable approach for patients with left-sided benign or premalignant neoplasms.
Recommendation: Strong, [Level of Evidence: Moderate]
25. Compared to laparoscopy, robotic distal pancreatectomy is associated with a lower conversion and failure to preserve spleen rates.
Statement: Conditional, [Level of Evidence: Low]
26. Robotic distal pancreatectomy performed with expertise should be considered an acceptable approach for patients with resectable pancreatic adenocarcinoma.
Recommendation: Conditional, [Level of Evidence: Low]

- **Pancreatoduodenectomy**

27. Compared to open, robotic pancreatoduodenectomy performed with expertise and in selected patients is non-inferior in terms of perioperative outcomes.
Statement: Conditional, [Level of Evidence: Moderate]
28. Robotic pancreatoduodenectomy performed with expertise should be considered an acceptable approach for selected patients with right-sided benign or premalignant neoplasms.
Recommendation: Conditional, [Level of Evidence: Moderate]
29. Compared to laparoscopy, robotic pancreatoduodenectomy performed with expertise may improve conversion and transfusion rates.
Statement: Conditional, [Level of Evidence: Very Low]
30. Robotic pancreatoduodenectomy performed with expertise could be considered an acceptable approach for selected patients with resectable pancreatic ductal adenocarcinoma.
Recommendation: Conditional, [Level of Evidence: Moderate]

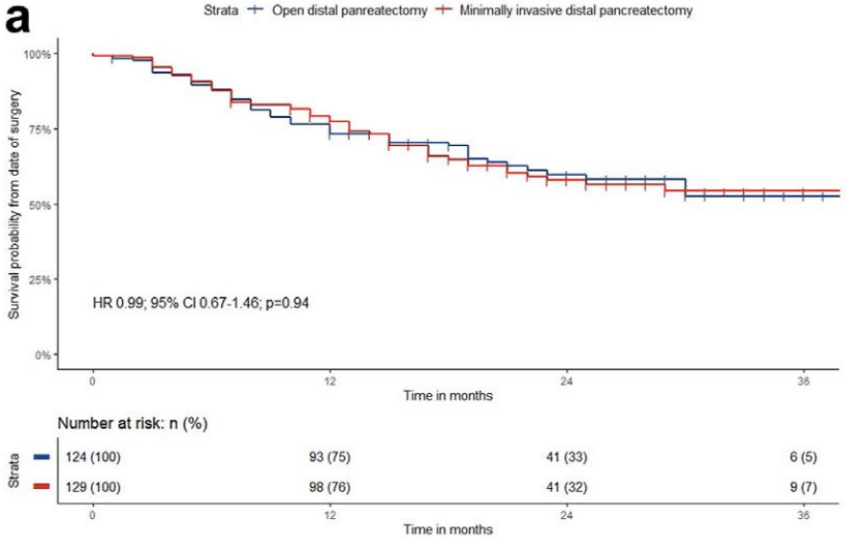
Agenda

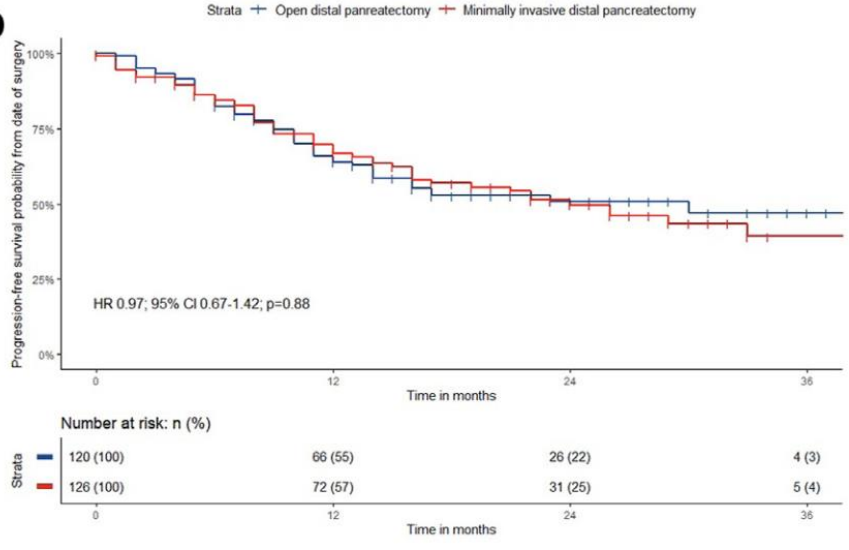
1. History
2. Early Evidence
3. Consensus Conferences
4. Randomized Trials
5. Patient Centered Outcomes
6. Video

First Robot vs. Open RCT

DIPLOMA

Distal pancreatectomy, minimally invasive or open, for malignancy





DIPLOMA –MIDP not Inferior to ODP

Minimally invasive versus open distal pancreatectomy for resectable pancreatic cancer (DIPLOMA): an international randomised non-inferiority trial

Maarten Korrel,[a,b,c,z] Leia R. Jones,[a,b,c,z] Jony van Hilst,[b,c,d] Gianpaolo Balzano,[e] Bergthor Björnsson,[f] Ugo Boggi,[g] Svein Olav Bratlie,[h] Olivier R. Busch,[b,c] Giovanni Butturini,[i] Giovanni Capretti,[j,k] Riccardo Casadei,[l] Bjørn Edwin,[m] Anouk M. L. H. Emmen,[a,b,c] Alessandro Esposito,[n] Massimo Falconi,[e] Bas Groot Koerkamp,[o] Tobias Keck,[p] Ruben H. J. de Kleine,[q] Dyre B. Kleive,[r] Arto Kokkola,[s] Daan J. Lips,[t] Sanne Lof,[b,u] Misha D. P. Luyer,[v] Alberto Manzoni,[a] Ravi Marudanayagam,[w] Matteo de Pastena,[n] Nicolò Pecorelli,[e] John N. Primrose,[u] Claudio Ricci,[l] Roberto Salvia,[n] Per Sandström,[f] Frederique L. I. M. Vissers,[b,c] Ulrich F. Wellner,[p] Alessandro Zerbi,[j,k] Marcel G. W. Dijkgraaf,[x,y] Marc G. Besselink,[b,c,aa,**] and Mohammad Abu Hilal,[a,u,aa,*] for the European Consortium on Minimally Invasive Pancreatic Surgery (E-MIPS)

- Equal(LN) harvest (22 vs 23 nodes, p=0.86)
- Same intra-peritoneal recurrence (41% vs 38%, p=0.45)
- Median time to functional recovery and LOS were comparable
- Equal two-year survival rates
- 131 patients who underwent MIDP, only 31 patients underwent RDP

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1st RCT RPD vs OPD – China

Effect of robotic versus open pancreaticoduodenectomy on postoperative length of hospital stay and complications for pancreatic head or periampullary tumours: a multicentre, open-label randomised controlled trial

Qu Liu, Mengyang Li*, Yuanxing Gao*, Tao Jiang*, Bing Han*, Guodong Zhao, Chao Lin, Wan Yee Lau, Zhiming Zhao†, Rong Liu†*

	Modified intention-to-treat analysis				Per-protocol analysis			
	RPD (n=81)	OPD (n=80)	Difference (95% CI)	p value	RPD (n=78)	OPD (n=76)	Difference (95% CI)	p value
Primary outcome								
Pathological properties	..	..	..	0·47	..	..	..	0·47
Malignant	58 (72%)	62 (78%)	..	..	55 (71%)	58 (76%)	..	..
Benign	23 (28%)	18 (23%)	..	..	23 (30%)	18 (24%)	..	..
Histopathological types	..	..	..	0·48	..	..	..	0·41
PDAC	27 (33%)	30 (38%)	..	..	26 (33%)	27 (36%)	..	..
Ampullary tumour	12 (15%)	8 (10%)	..	..	11 (14%)	8 (11%)	..	..
Cholangiocarcinoma	10 (12%)	16 (20%)	..	..	9 (12%)	16 (21%)	..	..
Duodenal adenocarcinoma	6 (7%)	9 (11%)	..	..	6 (8%)	9 (12%)	..	..
SPT	4 (5%)	1 (1%)	..	..	4 (5%)	1 (1%)	..	..
IPMN	10 (12%)	5 (6%)	..	..	10 (13%)	5 (7%)	..	..
pNET	4 (5%)	3 (4%)	..	..	4 (5%)	2 (3%)	..	..
Other	8 (10%)	8 (10%)	..	..	8 (10%)	8 (11%)	..	..

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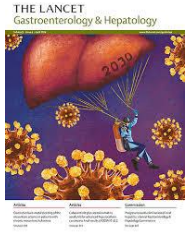
1st RCT RPD vs OPD – China



Effect of robotic versus open pancreaticoduodenectomy on postoperative length of hospital stay and complications for pancreatic head or periampullary tumours: a multicentre, open-label randomised controlled trial

Qu Liu, Mengyang Li*, Yuanxing Gao*, Tao Jiang*, Bing Han*, Guodong Zhao, Chao Lin, Wan Yee Lau, Zhiming Zhao†, Rong Liu†*

	Modified intention-to-treat analysis				Per-protocol analysis			
	RPD (n=81)	OPD (n=80)	Difference (95% CI)	p value	RPD (n=78)	OPD (n=76)	Difference (95% CI)	p value
Primary outcome								
Lymph nodes harvested	13 (12–16)	13 (11–15)	0·0 (–1·0 to 1·0)	0·36	13 (12–16)	13 (11–15)	–1·0 (–1·0 to 1·0)	0·32
Tumour-positive nodes	0·0 (0·0–1·0)	0·0 (0·0–2·0)	0·0 (0·0 to 0·0)	0·21	0·0 (0·0–1·0)	0·0 (0·0–2·0)	0·0 (0·0 to 0·0)	0·20
Positive resection margin	3 (4%)	3 (4%)	–0·05% (–7·2 to 7·0)	1·00	2 (3%)	3 (4%)	–1·4% (–8·7 to 5·4)	0·68
Time to first adjuvant therapy, days	42·0 (39·0 to 51·0)	48·5 (42·0 to 58·0)	–5·0 (–10·0 to –2·0)	0·0025*	42·0 (38·0 to 46·0)	46·5 (42·0 to 57·0)	–5·0 (–10·0 to –2·0)	0·0013*

for sustained surgical stress. Despite this promising outcome, as elucidated by Liu and colleagues,[1] the debate surrounding the necessary caseload to achieve proficiency in RPD persists as a topic of international discussion.[3] This debate emphasises the necessity for a

2nd RCT RPD vs OPD – Germany

Robotic versus open partial pancreatoduodenectomy (EUROPA): a randomised controlled stage 2b trial

Rosa Klotz,[a,b] André L. Mihaljevic,[a,c] Yakup Kulu,[a,e] Anja Sander,[d] Christina Klose,[d] Rouven Behnisch,[d] Maximilian C. Joos,[a] Eva Kalkum,[b] Felix Nickel,[a,f] Phillip Knebel,[a] Frank Pianka,[a,b] Markus K. Diener,[a,g] Markus W. Büchler,[a,*,h] and Thilo Hackert[a,f]

	RPD n = 29	OPD n = 33	p value
Malignant disease	16 (55.2%)	18 (54.5%)	
Benign neoplastic lesion	9 (31.0%)	9 (27.3%)	
Benign non-neoplastic lesion	4 (13.8%)	6 (18.2%)	
Pancreatic cancer subtype according to the current classification of the WHO			
Pancreatic ductal adenocarcinoma	12 (75.0%)	10 (55.6%)	
Intraductal papillary-mucinous carcinoma	0 (0.0%)	3 (16.7%)	
Ampullary cancer	1 (6.3%)	2 (11.1%)	
Intrapancreatic cholangiocarcinoma	1 (6.3%)	2 (11.1%)	
Neuroendocrine tumour	1 (6.3%)	0 (0.0%)	
Other	1 (6.3%)	1 (6.7%)	
Resection			0.154
R0 CRM–	7 (43.8%)	9 (50.0%)	
R0 CRM+	6 (37.5%)	9 (50.0%)	
R1	3 (18.8%)	0 (0.0%)	

Values in parentheses are percentages unless indicated otherwise; CRM: Circumferential resection margin. No p values were calculated regarding histopathological results as these cannot be influenced by the trial intervention.

Table 4: **Histopathology in the modified intention-to-treat population.**

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2nd RCT RPD vs OPD – Germany

Robotic versus open partial pancreatoduodenectomy (EUROPA): a randomised controlled stage 2b trial

Rosa Klotz,[a,b] André L. Mihaljevic,[a,c] Yakup Kulu,[a,e] Anja Sander,[d] Christina Klose,[d] Rouven Behnisch,[d] Maximilian C. Joos,[a] Eva Kalkum,[b] Felix Nickel,[a,f] Phillip Knebel,[a] Frank Pianka,[a,b] Markus K. Diener,[a,g] Markus W. Büchler,[a,*,h] and Thilo Hackert[a,f]

Zoom

	RPD n = 29	OPD n = 33	Difference with 95% CI	p value
Degree of SMA dissection				0.170
Inoue level 1	6 (20.7%)	11 (33.3%)		
Inoue level 2	20 (69.0%)	15 (45.5%)		
Inoue level 3	3 (10.3%)	7 (21.2%)		
Triangle procedure performed	12 (41.4%)	12 (36.4%)	5.0% [-19.3%; 29.3%]	0.686
Arterial resection performed	0 (0.0%)	2 (6.1%)		
Venous resection performed	5 (17.2%)	3 (9.1%)	8.2% [-8.7%; 25.0%]	0.339
Number of resected lymph nodes (N)[a]	29 ± 14	26 ± 9	3 [-6; 11]	0.536
Resection of additional organs performed beyond PD	4 (13.8%)	6 (18.2%)	-4.4% [-22.6%; 13.8%]	0.639

challenging. When performed too early, the intervention effects may be contaminated by the learning curve. If performed too late, after full implementation of the intervention, surgeons may feel that "equipoise" has been lost and may not be interested to join the RCT.

Second Robot vs. Open RCTs for Cancer

DIPLOMA-2

Minimally invasive versus open pancreatoduodenectomy for pancreatic and periampullary neoplasms:

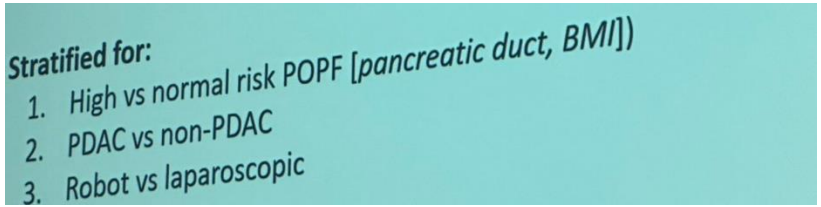
an international multicenter patient-blinded randomized controlled trial

(enrollment started January 2022)

Marc Besselink
@MarcBesselink

🚀🚀#DIPLOMA2 international RCT MIS vs open #Whipple: 2nd presentation! Focus on methodology #IHPBA24

🔑 Patients blinded up to day 5
🔑 Surgeons at least 60 MIPD experience
🔑 Centers at least 30 MIPD/yr prior
🔑 Randomization 2:1 to maintain skills in robot (lap) Whipple group



Stratified for:

1. High vs normal risk POPF [*pancreatic duct, BMI*])
2. PDAC vs non-PDAC
3. Robot vs laparoscopic

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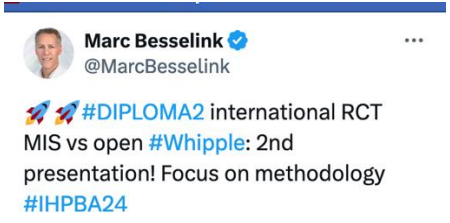
[Some] Improved Outcomes with MIS



⏩Primary endpoint (non-inferiority): no differences in CCI complication score ✅

⏩1-day faster time to func recovery ✅

⏩2-day shorter hospital stay ✅

⏩13% less grade B/C POPF ✅

⏩Reduced blood loss ✅

⏩10% less wound infections ✅

⏩More daily steps (day 14-38) ✅

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Agenda

1. History
2. Early Evidence
3. Consensus Conferences
4. Randomized Trials
5. Patient Centered Outcomes
6. Video

Approaches To Local Control Will Not Impact Survival From Cancer

Bernard Fisher, MD

But they may improve patient centered outcomes

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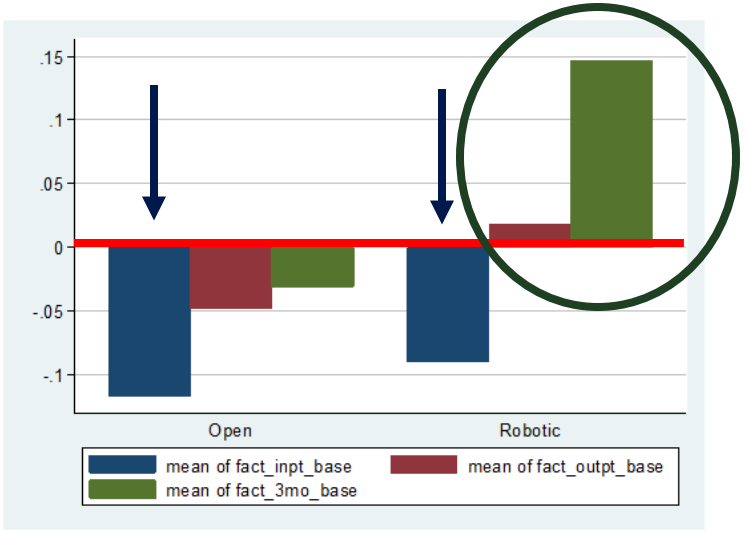
Culmination of SAGES Grant

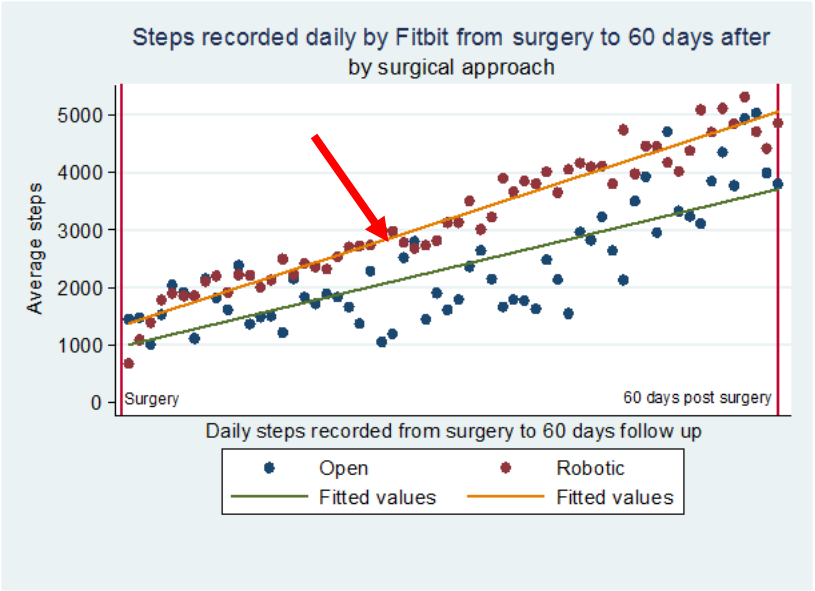
Association of robotic approach with patient-reported outcomes after pancreatectomy: a prospective cohort study

Jason B. Liu • Vernissia Tam • Mazen S. Zenati • ... Herbert J. Zeh III • Amer H. Zureikat • Melissa E. Hogg • Show all authors

QoL Surveys (FACT-Hep)



Fitbit Steps



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Agenda

1. History
2. Early Evidence
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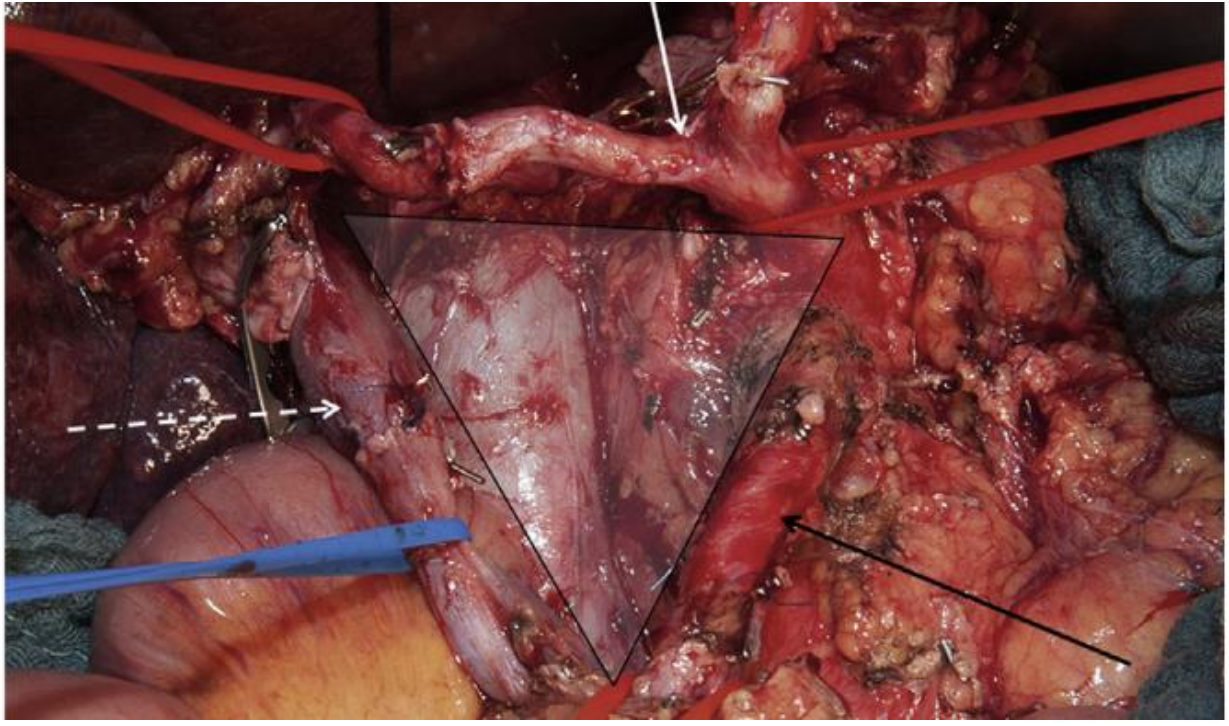
5. Patient Centered Outcomes
6. Video

What is the Triangle Operation?

The TRIANGLE operation for pancreatic head and body cancers: early postoperative outcomes

Rosa Klotz [1], Thilo Hackert [2], Patrick Heger [1], Pascal Probst [1], Ulf Hinz [2], Martin Loos [2], Christoph Berchtold [2], Arianeb Mehrabi [2], Martin Schneider [2], Beat P Müller-Stich [2], Oliver Strobel [2], Markus K Diener [1], André L Mihaljevic [1], Markus W Büchler [3]



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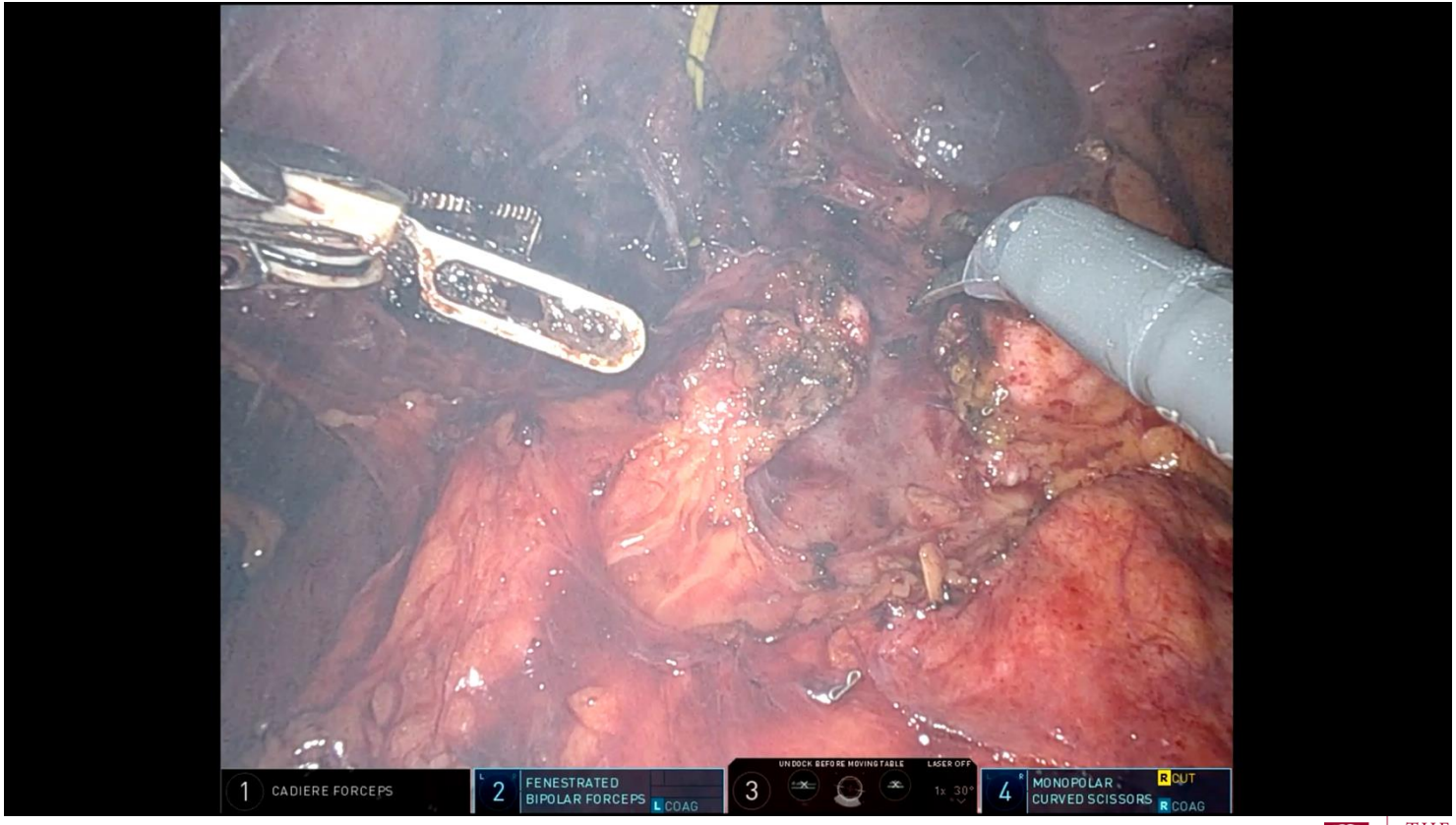
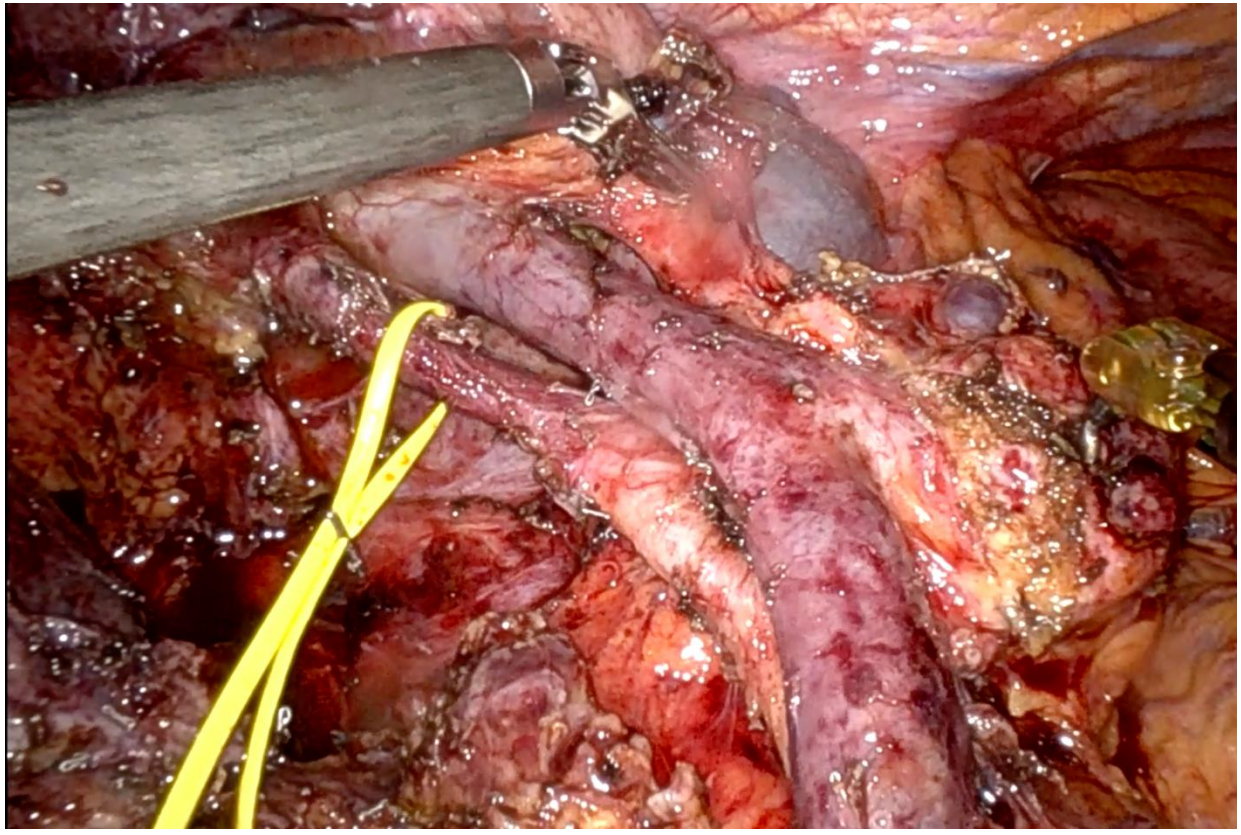
Robotic Vascular Dissection



Robotic Vascular Dissection



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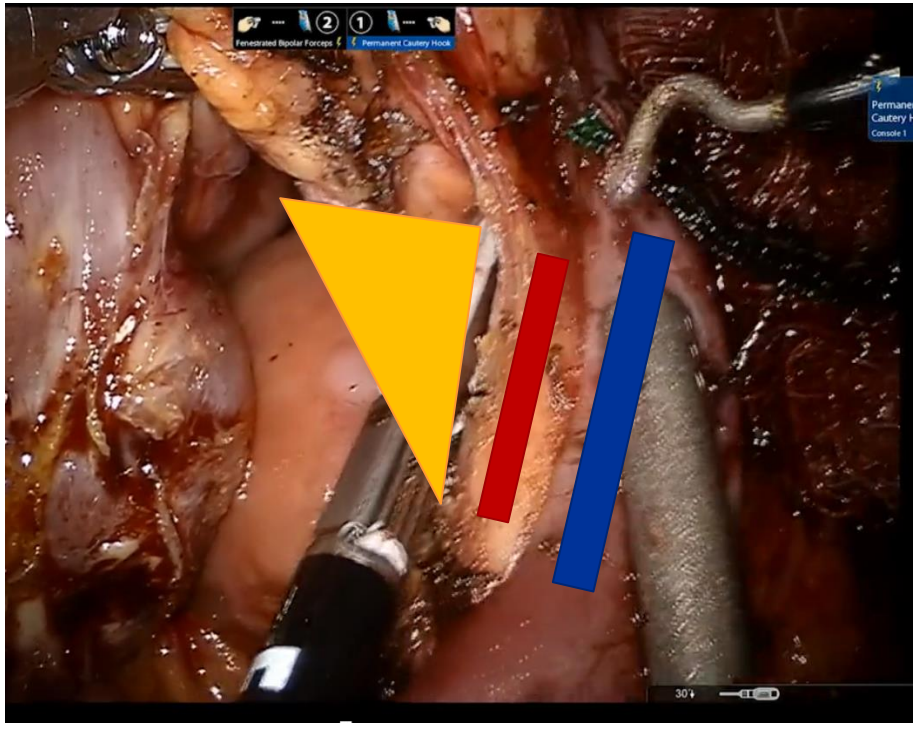
Three Layers of the Uncinate



Summary

1. EBL consistently reported lower in Robot
2. LOS consistently reported lower in Robot
3. Wound infections consistently reported lower in Robot
4. OR time consistently reported longer in Robot

- In general, RO/R1, LN Harvest, and survival comparable with a few specific studies showing benefit of one variable in robotic
- In general, peri-op morbidity and mortality have overall been equivalent with a few non-generalizable studies showing benefit in robotic of one variable

Thank You

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