



Prediction of Morbidity Following Surgery for Primary Retroperitoneal Sarcomas Using a Surgical Complexity Score: An Analysis of the REtroperitoneal SArcoma Registry (RESAR)

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Enter Patient and Surgical Information



i Procedure

Clear

Begin by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the desired procedure to properly select it. You may also search using two words (or two partial words) by placing a '+' in between, for example: "cholecystectomy + cholangiography"

Reset All Selections

i Are there other potential appropriate treatment options? ☐ Other Surgical Options ☐ Other Non-operative options ☐ None

Please enter as much of the following information as you can to receive the best risk estimates.
A rough estimate will still be generated if you cannot provide all of the information below.

Age Group

Under 65 years

Sex

Female

Functional Status **i**

Independent

Emergency Case **i**

No

ASA Class **i**

Healthy patient

Steroid use for chronic condition **i**

No

Ascites within 30 days prior to surgery **i**

No

Systemic Sepsis within 48 hours prior to surgery **i**

None

Ventilator Dependent **i**

No

Disseminated Cancer **i**

No

Diabetes **i**

No

Hypertension requiring medication **i**

No

Congestive Heart Failure in 30 days prior to surgery **i**

No

Dyspnea **i**

No

Current Smoker within 1 Year **i**

No

History of Severe COPD **i**

No

Dialysis **i**

No

Acute Renal Failure **i**

No

BMI Calculation: **i**

Height: in / cm

Weight: lb / kg

Enter Patient and Surgical Information



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No

Disseminated Cancer **i**

No

Functional status

The best functional status/level of self-care demonstrated by the patient within the 30 days prior surgery.

- Independent: The patient does not require assistance from another person for any activities of daily living. This includes a person who is able to function independently with prosthetics, equipment, or devices.
- Partially dependent: The patient requires some assistance from another person for activities of daily living.
- Totally dependent: The patient requires total assistance for all activities of daily living.

Other options ☐ None

estimates.
low.

prior to surgery **i**

Current Smoker within 1 Year **i**

No

History of Severe COPD **i**

No

Dialysis **i**

No

Acute Renal Failure **i**

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BMI Calculation: **i**

Height: in / cm

Weight: lb / kg

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Dialysis **i**

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Acute Renal Failure **i**

No

BMI Calculation: **i**

Height: in / cm

Weight: lb / kg



[Risk Calculator Home Page](#)

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[FAQ](#)

[ACS Website](#)

[ACS NSQIP Website](#)

Procedure: 49205 - Excision or destruction, open, intra-abdominal tumors, cysts or endometriomas, 1 or more peritoneal, mesenteric, or retroperitoneal primary or secondary tumors; largest tumor greater than 10.0 cm diameter

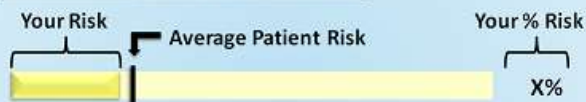
Risk Factors: 65-74 years, Diabetes (Oral), HTN

[Change Patient Risk Factors](#)

Note: Your Risk has been rounded to one decimal point.



How to Interpret the Graph Above:



Surgeon Adjustment of Risks ⓘ

This will need to be used infrequently, but surgeons may adjust the estimated risks if they feel the calculated risks are underestimated. This should only be done if the reason for the increased risks was NOT already entered into the risk calculator.

1 - No adjustment necessary



[Risk Calculator Home Page](#)

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Procedure: 49205 - Excision or destruction, open, intra-abdominal tumors, cysts or endometriomas, 1 or more peritoneal, mesenteric, or retroperitoneal primary or secondary tumors;
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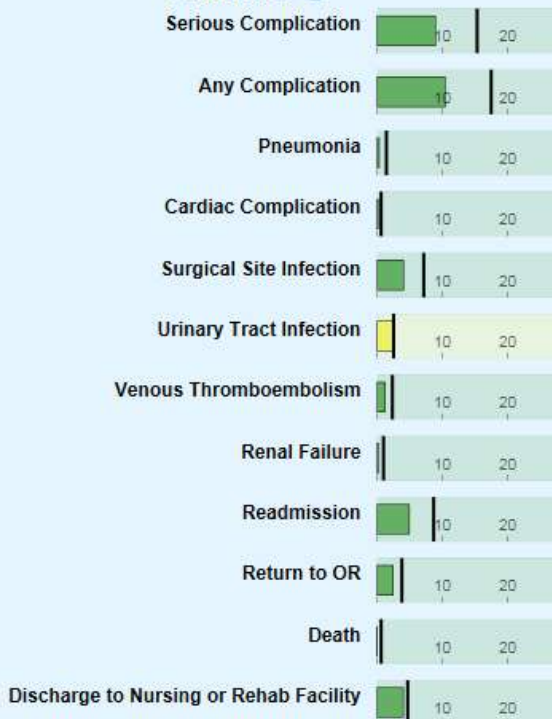
Risk Factors: 65-74 years, Diabetes (Oral), HTN

[Change Patient Risk Factors](#)



Note: [Your](#)

Outcomes ⓘ



Surgeon Adjustment

The risks estimated by the Risk Calculator may not capture every potential comorbidity; the Surgeon Adjustment feature was created to provide an opportunity for surgeons to adjust the risks within a reasonable interval. The Surgeon Adjustment should be used with caution and only in cases where the surgeon feels that the actual risk is much higher than the predicted risk based on risk factors not entered on previous screen into the Risk Calculator.

How it works:

Increasing to a Surgeon Adjustment Score of 2 will move the predicted risk to the 1st standard deviation from the mean for that CPT code; increasing to a Surgeon Adjustment Score of 3 will move the predicted risk to the 2nd standard deviation from the mean for that CPT code. If the patient's baseline risk is estimated by the Risk Calculator to be greater than 2 standard deviations above the mean for the CPT code, the displayed risks will remain unchanged.

Predicted Length of Hospital Stay: 4.5 days

How to Interpret the Graph Above:



Surgeon Adjustment of Risks ⓘ

This will need to be used infrequently, but surgeons may adjust the estimated risks if they feel the calculated risks are underestimated. This should only be done if the reason for the increased risks was NOT already entered into the risk calculator.

1 - No adjustment necessary

Surgical Complexity Score

Surgical complexity scoring system based upon complexity and number of surgical procedures performed	
	Points
<i>Procedure</i>	
TH-BSO	1
Omentectomy	1
Pelvic lymphadenectomy	1
Para-aortic lymphadenectomy	1
Pelvic peritoneum stripping	1
Abdominal peritoneum stripping	1
Recto-sigmoidectomy – T–T anastomosis	3
Large bowel resection	2
Diaphragm stripping/resection	2
Splenectomy	2
Liver resection/s	2
Small bowel resection/s	1
<i>Complexity score groups</i>	
1 (low)	≤3
2 (intermediate)	4–7
3 (high)	≥8

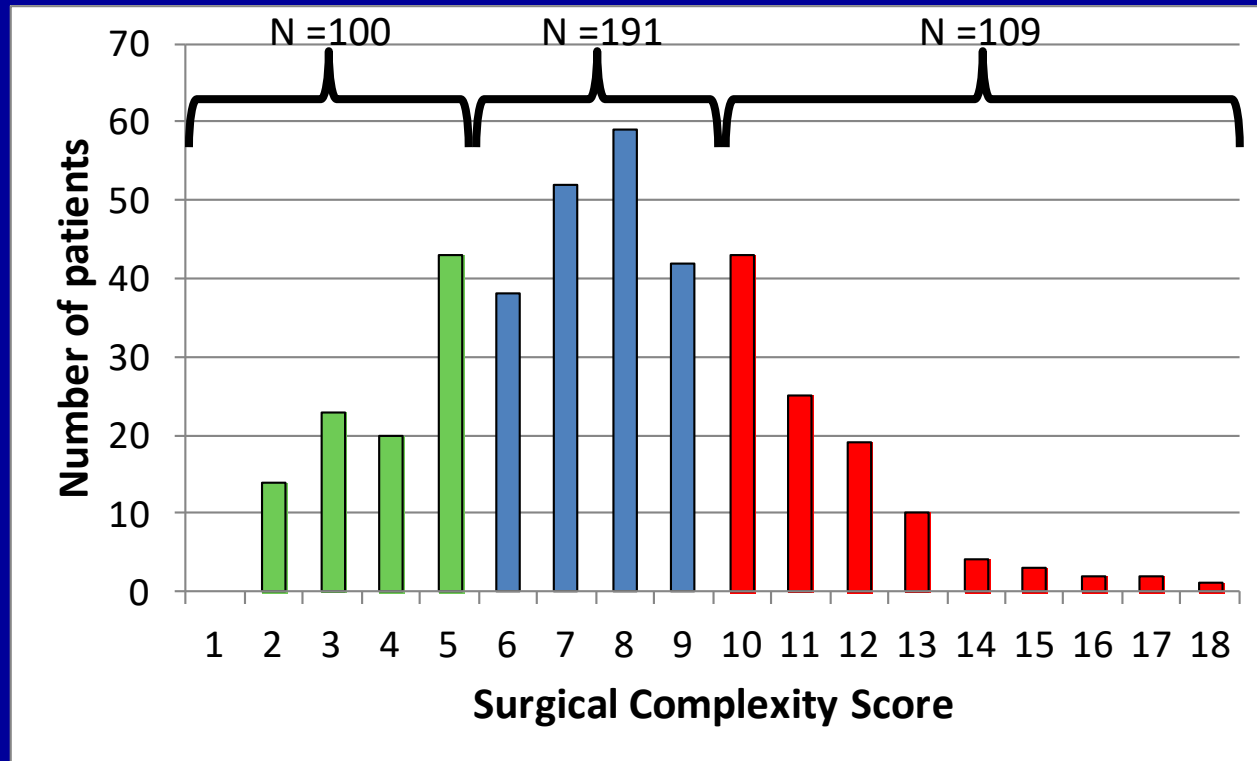
Surgical complexity score independent predictor of postoperative morbidity for advanced ovarian cancer

Surgical Complexity Score

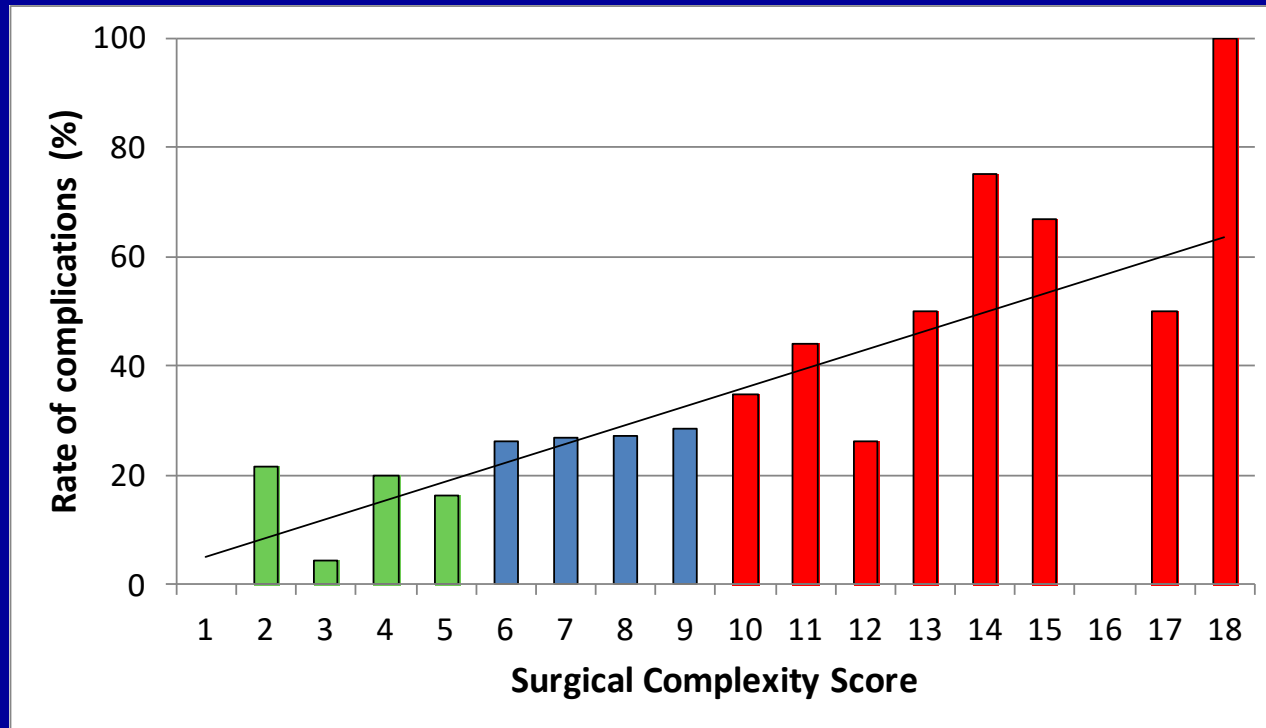
Patient/Operative Factors	
Age ≥ 65	1
Diabetic	1
Current smoker	1
Prior abdominal surgery	1
Emergency	2
Clean-contaminated case	1
Surgical Procedure	
Abdominoperineal resection	3
Low anterior resection	2
Bowel anastomosis	1
Liver lobectomy	3
Liver wedge resection	1
Left lateral segmentectomy	1
Caudate resection	2
Whipple	3
Distal pancreatectomy	2
Lysis of adhesions (>45 min)	1
Duodenectomy	2
Total gastrectomy	3
Subtotal gastrectomy	2
Gastric wedge resection	1
Laparoscopic approach	1
Vascular dissection/repair	1
Vascular reconstruction	2
Hysterectomy	2
Nephrectomy	1
Complex bladder repair	1

Organs Resected	
Stomach	1
Duodenum	1
Small bowel	1
Right colon	1
Left colon	1
Pancreas	1
Liver	1
Diaphragm	1
Spleen	1
Peritoneum/abdominal wall	1
Adrenal gland	1
Kidney	1
Gallbladder	1
Bladder	1
Ovary	1
Uterus	1
Omentum	1
Other	1
Disease Burden (cumulative size of resected tumor)	
Low (<10 cm)	0
Medium (10-20 cm)	1
High (>20 cm)	2
Surgical Complexity Score	
Low	≤ 5
Intermediate	6-9
High	≥ 10

Surgical Complexity Score

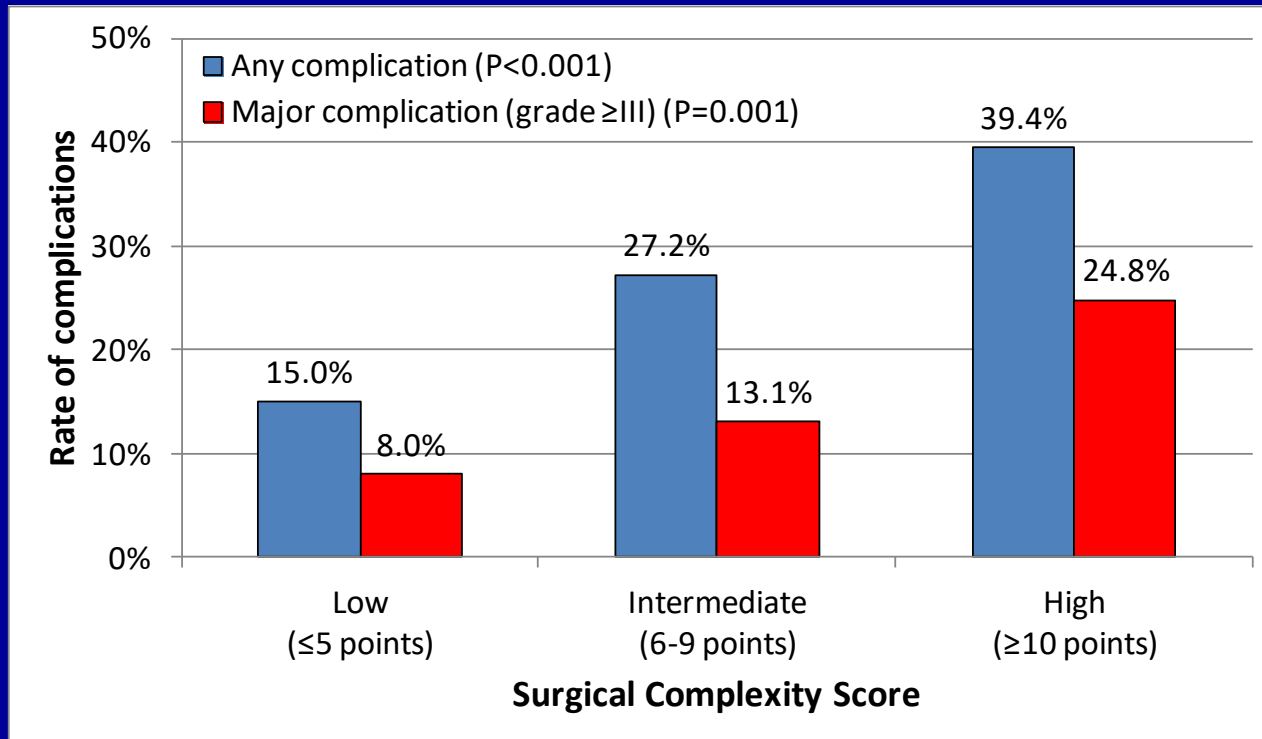


Morbidity Rates



Increasing surgical complexity score is associated with increasing rates of morbidity

Morbidity Rates

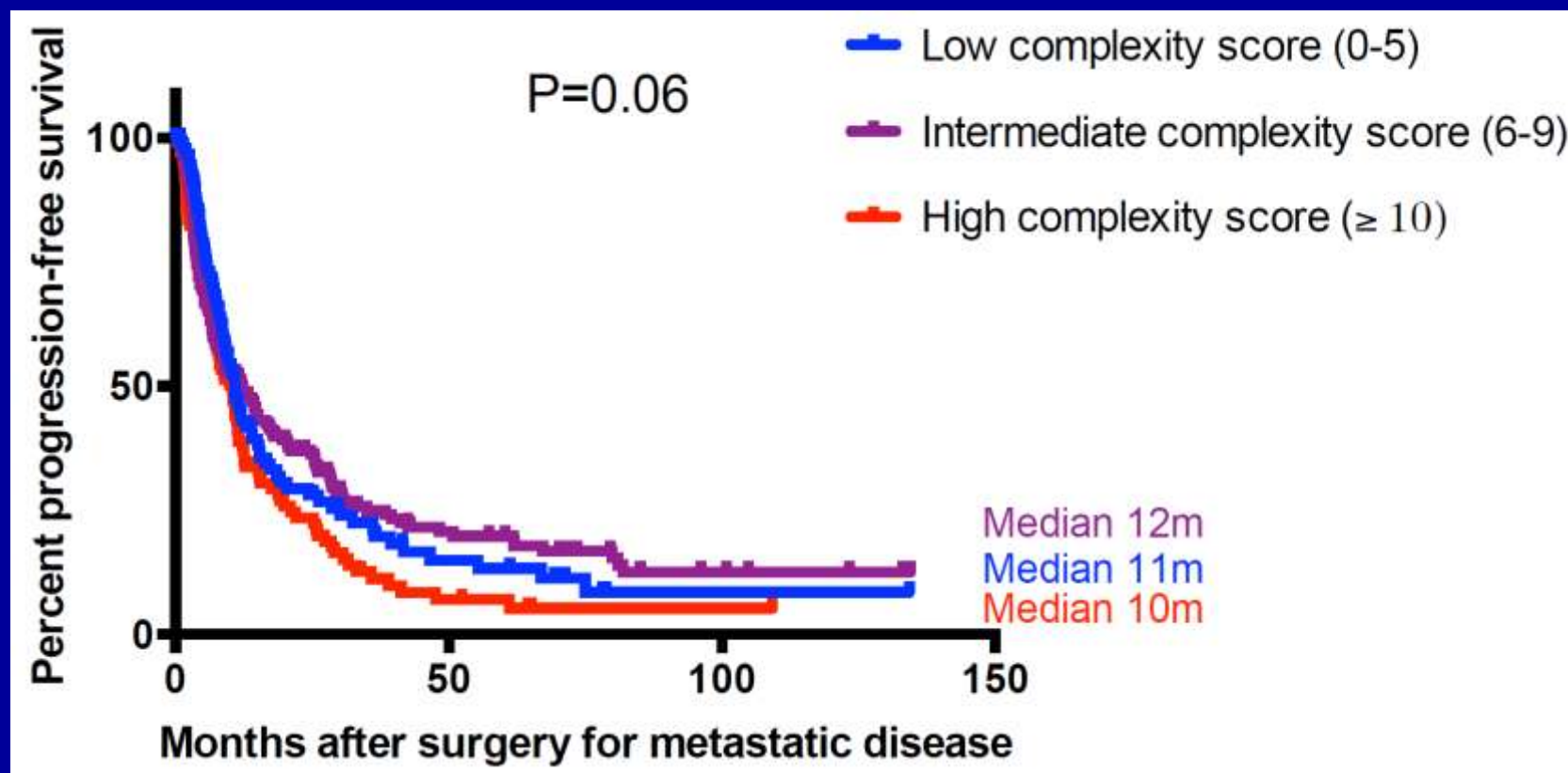


Surgical complexity scoring groups predict postoperative morbidity rates

Predictors of Morbidity

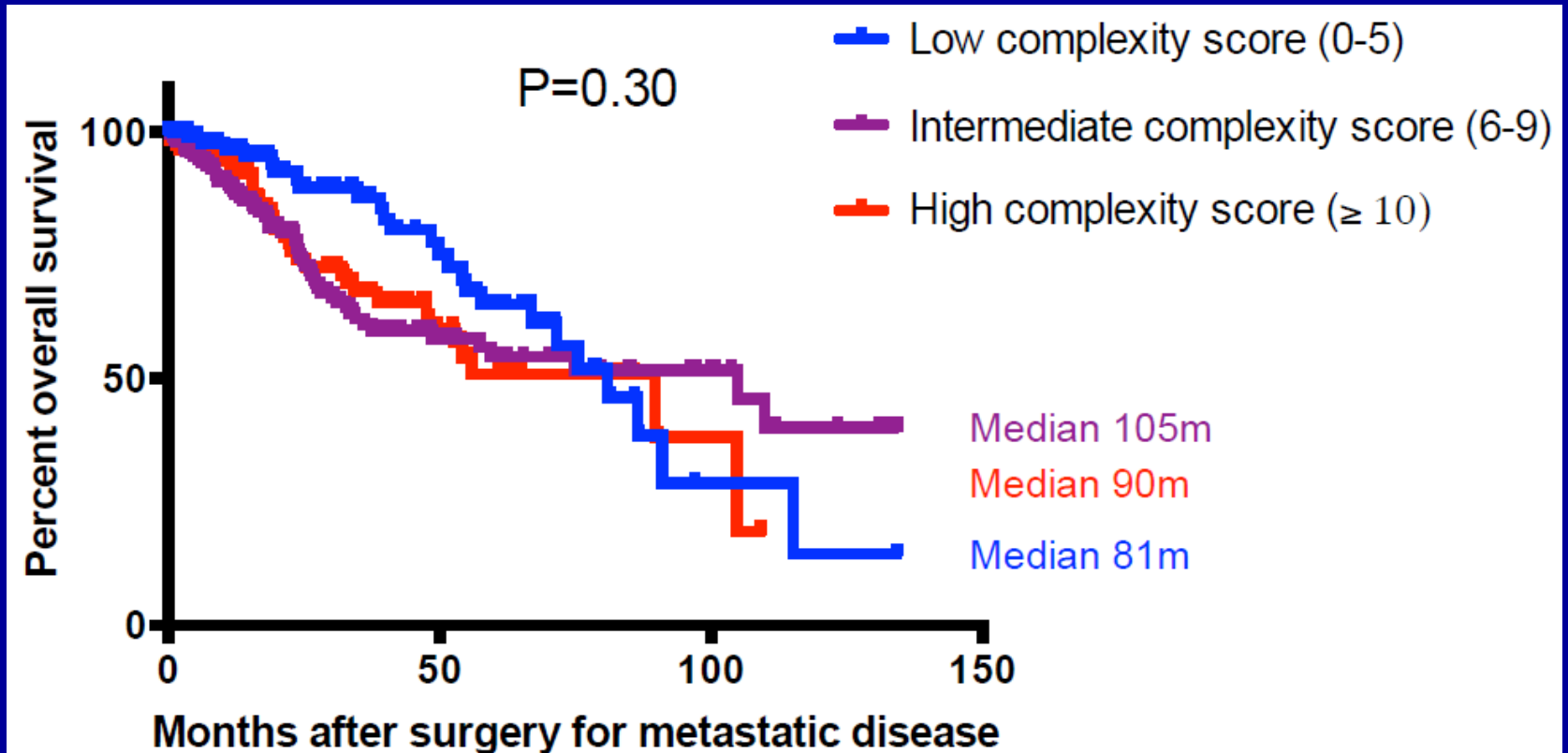
Prognostic factor	Any complication (I-V)		Major complication (III-V)	
	Odds Ratio (CI)	P-value	Odds Ratio (CI)	P-value
TKI at time of metastasectomy				
Imatinib	Ref	-	Ref	-
Sunitinib	1.2	NS	1.7	NS
Other	1.1	NS	2.2	NS
Duration of preoperative TKI				
≤24 months	Ref	-	Ref	-
>24 months	1.2	NS	1.2	NS
Radiographic response				
Stable	Ref	-	Ref	-
Responsive	1.4	NS	0.7	NS
Unifocal progression	0.5	NS	0.5	NS
Multifocal progression	1.2	NS	1.2	NS
Metastatic mitotic index				
<5/50 HPF	Ref	-	Ref	-
≥ 5/50 HPF	2.6 (1.0-6.4)	0.05	2.2	NS
Extent of resection				
R0	Ref	-	Ref	-
R1	0.6	NS	0.6	NS
R2	1.0	NS	0.7	NS
Number of metastases				
≤5	Ref	-	Ref	-
>5	0.6	NS	0.7	NS
Number of organs resected				
≤2	Ref	-	Ref	-
>2	0.6	NS	0.7	NS
Surgical complexity score				
Low	Ref	-	Ref	-
Intermediate	2.9 (1.3-6.3)	0.008	2.0	NS
High	3.5 (1.8-6.9)	<0.001	3.7 (1.3-10.7)	0.02

Progression-Free Survival



Surgical complexity score does not predict progression-free survival

Overall Survival



Surgical complexity score does not predict overall survival

Postoperative Morbidity After Radical Resection of Primary Retroperitoneal Sarcoma

A Report From the Transatlantic RPS Working Group

Andrea J. MacNeill, MD,*† Alessandro Gronchi, MD,† Rosalba Miceli, PhD,‡ Sylvie Bonvalot, MD, PhD,§ Carol J. Swallow, MD, PhD,* Peter Hohenberger, MD,¶ Frits Van Coevorden, MD,|| Piotr Rutkowski, MD,** Dario Callegaro, MD,† Andrew J. Hayes, MD, PhD,†† Charles Honoré, MD,‡‡ Mark Fairweather, MD,§§ Amanda Cannell, BSc,¶¶ Jens Jakob, MD,¶ Rick L. Haas, MD,||| Milena Szacht, MD,** Marco Fiore, MD,† Paolo G. Casali, MD,*** Raphael E. Pollock, MD, PhD,††† Francesco Barretta, PhD,‡ Chandrajit P. Raut, MD, MSc,§§ and Dirk C. Strauss, MD††

Objective: To investigate the safety of radical resection for retroperitoneal sarcoma (RPS).

Background: The surgical management of RPS frequently involves complex multivisceral resection. Improved oncologic outcomes have been demonstrated with this approach compared to marginal excision, but the safety of radical resection has not been shown in a large study population.

Methods: The Transatlantic Retroperitoneal Sarcoma Working Group (TARPSWG) is an international collaborative of sarcoma centers. A combined experience of 1007 consecutive resections for primary RPS from January 2002 to December 2011 was studied retrospectively with respect to adverse events. A weighted organ score was devised to account for differences in surgical complexity. Univariate and multivariate logistic regression analyses were performed to investigate associations between adverse events and number and patterns of organs resected. Associations between adverse events and overall survival, local recurrence, and distant metastases were investigated.

Results: Severe postoperative adverse events (Clavien-Dindo ≥ 3) occurred in 165 patients (16.4%) and 18 patients (1.8%) died within 30 days. Significant predictors of severe adverse events were age ($P = 0.003$), transfusion requirements ($P < 0.001$), and resected organ score ($P = 0.042$). Resections involving pancreaticoduodenectomy, major vascular resection, and splenectomy/pancreatectomy were found to entail higher operative risk (odds ratio >1.5). There was no impact of postoperative adverse events on overall survival, local recurrence, or distant metastases.

Conclusions: A radical surgical approach to RPS is safe when carried out at a specialist sarcoma center. High-risk resections should be carefully considered on an individual basis and weighed against anticipated disease biology. There appears to be no association between surgical morbidity and long-term oncologic outcomes.

Keywords: adverse events, morbidity, radical resection, retroperitoneal sarcoma, safety

(Ann Surg 2018;267:959–964)

Resected organ score

Recognizing that resection of some organs or structures entails a higher risk of morbidity than others, a weighted resected organ score was devised as follows:

Weighted 0: Adrenal gland, aortocaval lymph nodes, appendix, gallbladder, inguinal ligament, omentum, psoas fascia, and skin.

Weighted 1: Adnexa and/or uterus, bladder, bone, diaphragm, distal pancreas, duodenum or duodenojejunal flexure, femoral/sciatic/obturator nerve or lumbar/sacral nerve root, iliac artery and/or aorta, iliac vein and/or IVC, kidney, left colon and/or rectum, liver, lung, parietal muscles, pericardium, posterior vaginal wall, prostate (with or without seminal vesicle), psoas muscle, right colon, small bowel, spleen, stomach, testis and/or spermatic cord and/or vas deferens, and ureter (complete or partial resection not associated with nephrectomy).

Weighted 2: Pancreaticoduodenectomy

Patterns of resection

Patterns of resection were analyzed in association with morbidity. These were categorized as follows in order of presumed ascending morbidity:

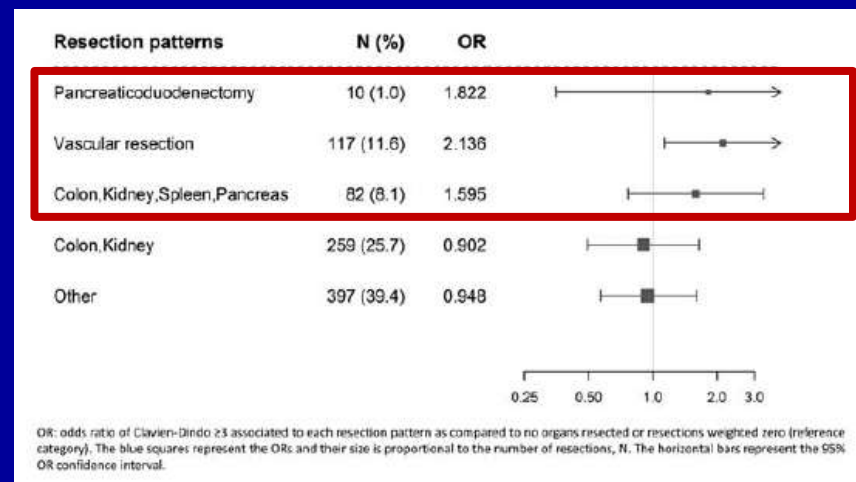
- No organs resected or only organs weighted 0
- Other (organs weighted 1 or 0 but not included in subsequent categories)
- Colon (left/right), kidney +/- other
- Colon (left/right), kidney, spleen, pancreas +/- other
- Vascular resection (inferior vena cava or iliac vein resection) +/- other
- Pancreaticoduodenectomy +/- other

Procedures were classified according to the component of the resection conferring the highest morbidity. Thus, a “pancreaticoduodenectomy +/- other” or a “vascular resection +/- other” may include concomitant kidney and colon resection.

Complications within 30 days of surgery and death up to 90 days after surgery

TABLE 3. Type and Incidence of All Severe Complications (Clavien-Dindo ≥ 3) Within 30 Days of Surgery

	N	%
Postoperative bleeding/hematoma	29	2.9
Bowel anastomotic leak/bowel fistula/gastric fistula	26	2.6
Death	18	1.8
Abscess	17	1.7
Respiratory failure/pneumonia/pneumothorax/pleural effusion	14	1.4
Wound infection/wound healing complications	11	1.1
Bowel obstruction/ileus	10	1.0
Sepsis	10	1.0
Dehiscence/evisceration	9	0.9
Abdominal/retroperitoneal collection	8	0.8
Chylous fistula/lymphatic collection	8	0.8
Pancreatic leak/fistula/pancreatitis	8	0.8
Renal failure	7	0.7
Cardiac ischemia/infarct/failure	5	0.5
Bile leak/fistula	4	0.4
Urine leak	4	0.4
Venous thromboembolism	4	0.4
Others	45	4.5
Patients with severe postoperative adverse event (s)	165	16.4



No impact of postoperative adverse events on overall survival or rates of LR or DM

TABLE 4. Results From the Univariate and Multivariate Logistic Models for Severe Complications (Clavien-Dindo ≥ 3 vs <3)

	Univariate Models			Multivariate Model		
	OR	95% CI	P	OR	95% CI	P
Age, yrs			0.003			0.012
67 vs 48*	1.52	1.20–1.93		1.42	1.11–1.83	
Tumor size, cm			0.354			0.653
30 vs 13*	1.24	0.93–1.67		0.91	0.65–1.28	
Resected organs score			0.042			0.007
4 vs 1*	1.51	1.10–2.07		1.21	0.85–1.73	
8 vs 0†	4.33	1.96–9.57		3.00	1.24–7.29	
Transfusion requirement (blood units)			<0.001			<0.001
1–3 vs 0	2.74	1.68–4.46		2.56	1.53–4.26	
3+ vs 0	5.80	3.52–9.54		5.59	3.30–9.46	
Unknown vs 0	2.02	0.94–4.37		1.44	0.59–3.55	
Radiotherapy			0.997			0.622
Preintraoperative‡ vs no	1.16	0.74–1.82		1.19	0.73–1.94	
Only postoperative vs no	0.85	0.45–1.57		0.89	0.46–1.74	
Chemotherapy			0.201			0.209
Prepostoperative§ vs no	0.88	0.54–1.44		0.81	0.47–1.38	
Only postoperative vs no	0.16	0.02–1.18		0.19	0.02–1.45	

CI indicates confidence interval; DD LPS, dedifferentiated liposarcoma; FNCLCC, French National Federation of the Centers for the Fight Against Cancer; LMS, leiomyosarcoma; OR, odds ratio; WD LPS, well differentiated liposarcoma.

*Third versus first quartile.

†Maximum versus minimum value.

‡including patients with preoperative, intraoperative, pre- and intraoperative and intra- and postoperative radiotherapy.

§including patients with preoperative or pre- and postoperative CT.

TABLE 1. Surgical complexity scoring system based on the sum of points determined from patient factors, resection pattern, organs resected, and disease burden.

Patient Factors	Score	Organs resected	Score
Age ≥ 65	1	Liver	1
Diabetes	1	Psoas muscle	1
Body mass index ≥ 30	1	Psoas fascia	0
Hypertension/coronary artery disease	1	Femoral/sciatic nerve	1
ECOG score ≥ 2	1	Colon (left, right, transverse)	1
Chronic obstructive pulmonary disease	1	Rectum	1
Chronic kidney disease	1	Adnexa or spermatic cord	1
Neoadjuvant chemotherapy/radiation	1	Uterus	1
Resection Pattern		Parietal muscle	1
Vascular resection	4	Diaphragm	1
Pancreaticoduodenectomy ^a	4	Kidney	1
Colon, kidney, spleen, pancreas +/- other	1	Adrenal gland	0
Disease Burden (cumulative size of resected tumors)		Bone	1
Low (<10cm)	0	Pancreas	1
Medium (10-20cm)	1	Spleen	1
High (>20cm)	2	Iliac vein	1
Surgical Complexity Score		Inferior vena cava	1
Low	≤ 5	Small bowel	1
Intermediate	6-9	Stomach	1
High	≥ 10	Duodenum	1
		Iliac artery	1

^aPancreaticoduodenectomy organ count includes duodenum/pancreas only.

TABLE 1. Surgical complexity scoring system based on the sum of points determined from patient factors, surgical procedure performed, organs resected and disease burden.

Patient Factors	Score	N	(%) ^a	Organs resected	Score	N	(%) ^a
Age ≥65	1	97	24	Stomach	1	64	7
Diabetic	1	12	3	Duodenum	1	16	2
Current smoker	1	22	6	Small bowel	1	112	12
Prior abdominal surgery	1	336	84	Right colon	1	38	4
Emergency	2	25	6	Left colon	1	67	7
Clean-contaminated case	1	333	83	Pancreas	1	30	3
Surgical Procedure				Liver	1	153	17
Abdominoperineal resection	3	3	0.4	Diaphragm	1	32	4
Low anterior resection	2	19	2	Spleen	1	40	4
Bowel anastomosis ^b	1	222	28	Peritoneum/abdominal wall	1	151	17
Liver lobectomy	3	48	6	Adrenal gland	1	7	1
Liver wedge resection ^b	1	184	23	Kidney	1	1	0.1
Left lateral segmentectomy	1	14	2	Gallbladder ^d	1	48	5
Caudate resection	2	8	1	Bladder	1	16	2
Whipple ^c	3	4	1	Ovary	1	16	2
Distal pancreatectomy	2	21	3	Uterus	1	9	1
Lysis of adhesions (>45 min)	1	163	20	Omentum	1	109	12
Duodenectomy	2	12	2	Other	1	5	1
Total gastrectomy	3	3	0.4	Disease Burden			
Subtotal gastrectomy	2	9	10	(cumulative size of resected tumors)			
Gastric wedge resection ^b	1	50	6	Low (<10cm)	0	190	48
Laparoscopic approach	1	5	1	Medium (10-20cm)	1	109	27
Vascular dissection/repair	1	18	2	High (>20cm)	2	101	25
Vascular reconstruction	2	1	0.1	Surgical Complexity Score			
Hysterectomy	2	6	1	Low	≤5	100	25
Nephrectomy	1	1	0.1	Intermediate	6-9	191	48
Complex bladder repair	1	17	2	High	≥10	109	27

^aDenominators vary by section: patient factors, disease burden, surgical complexity score-total operations (N=400); surgical procedures-total procedures (N=808); organs resected-total organs resected (N=914).

^bIf performed more than once, 1 point earned each time procedure performed.

^cWhipple organ count includes duodenum/pancreas only.

^dGallbladder removal not counted if part of hepatectomy or whipple.