

Complications of surgery for deep endometriosis

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Definitions

Classification of Surgical Complications A New Proposal With Evaluation in a Cohort of 6336 Patients and Results of a Survey

Daniel Dindo, MD, Nicolas Demartines, MD, and Pierre-Alain Clavien, MD, PhD, FRCS, FACS

Clavien et al. Ann Surg 2014

...**complication** is defined as any deviation from the normal postoperative course

...**sequela** is an "after-effect" of surgery that is inherent to the procedure





Classification and Prevalence

Risk factors for complications and sequelae ?

Recognition and prevention ?





Classification and Prevalence





Clavien-Dindo Classification

TABLE 1. Classifica	tion of Surgical Complications				
Grade	Definition				
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions				
	Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside				
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications				
	Blood transfusions and total parenteral nutrition are also included				
Grade III	Requiring surgical, endoscopic or radiological intervention				
Grade IIIa	Intervention not under general anesthesia				
Grade IIIb	Intervention under general anesthesia				
Grade IV	Life-threatening complication (including CNS complications)* requiring IC/ICU management				
Grade IVa	Single organ dysfunction (including dialysis)				
Grade IVb	Multiorgan dysfunction				
Grade V	Death of a patient				
Suffix "d"	If the patient suffers from a complication at the time of discharge (see examples in Table 2), the suffix "d" (for "disability") is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.				

*Brain hemorrhage, ischemic stroke, subarrachnoidal bleeding, but excluding transient ischemic attacks. CNS, central nervous system; IC, intermediate care; ICU, intensive care unit.





Intestinal complications

Anastomosis type	Leak rate (%)
Enteroenteric ^{5,6}	1–2
lleocolic ⁶⁻¹⁰	1-4
Colocolic ^{7,9-11}	2–3
lleorectal ^{6,9}	3–7
Colorectal/coloanal ^{6,7,10,12,13}	5–19
lleoanal pouch ^{14,15}	4–7

Mc Dermott et al. BJS 2015





REVIEW



Outcomes after rectosigmoid resection for endometriosis: a systematic literature review

Andrea Balla¹ · Silvia Quaresima¹ · José D. Subiela² · Mostafa Shalaby³ · Giuseppe Petrella³ · Pierpaolo Sileri³

Balla et al. Int J Colorect Dis 2018

- 3079 patients undergoing bowel surgery for DE (90.8% laparoscopy,
 7.9% laparotomy, 1.7% robotic), bowel diversion rate 15.3%
- intraoperative complications 1%, postoperative complications 18.5% rectovaginal fistula 2.4% anastomotic leakage 2.2% bleeding 1.1% mortality 0.03% (pulmonary embolism)





Journal Pre-proof

Surgical outcomes after colorectal surgery for endometriosis: Systematic Review and Meta-Analysis

Sofiane Bendifallah MD, PhD , Anne Puchar MD , Elie Vesale MD , Gaby Moawad MD , Emile Daraï MD, PhD , Horace Roman MD, PhD



Bendifallah et al. JMIG 2020

17496 patients undergoing bowel surgery for DE (55.3% shaving, 8.6% disc excision, 36.1% segmental resection)

rectovaginal fistula 1.5% (shaving 0.3%, DR 2.7%, SR 3.3%) anastomotic leakage 1.2% (shaving 0.2%, DR 1%, SR 1.9%) bleeding 0.7% (shaving 0.1%, DR 1.1%, SR 1.0%) ureteral injury 0.1% (shaving 0.1%, DR 0.4%, SR 0.07%)

voiding dysfunction plus 30ds 2.6% (shaving 0.4%, DR 4.1%, SR 6.6%) anastomotic stenosis 2.3% (shaving 0%, DR 0.3%, SR 5.2%)





Are there risk factors for complications and sequelae ?





Risk factors ?

...Age, Smoking etc.

...vaginal opening

...technique - Shaving / DR/ SR - ileostomy ?



ORIGINAL ARTICLE Gynaecology

Conservative surgery versus colorectal resection in deep endometriosis infiltrating the rectum: a randomized trial

Horace Roman^{1,2,*}, Michael Bubenheim³, Emmanuel Huet⁴, Valérie Bridoux⁴, Chrysoula Zacharopoulou⁵, Emile Daraï^{5,6,7}, Pierre Collinet⁸, and Jean-Jacques Tuech⁴

Roman et al. Hum Reprod 2018

Table III Postoperative complications.

Complications	Conservative surgery (n=27)	Segmental resection (n=33)	Р
Clavien Dindo I	9 (33%)	7 (21.2%)	0.38
Clavien Dindo 2	12 (44%)	9 (27.3%)	0.19
Bladder atony requiring self-catheterization after Day 7	6 ^a (22%)	3 (9.1%)	0.28
Clavien Dindo 3	6 ^a (22%)	10 (3.3%)	0.57
Rectovaginal fistula	2 ^a (7.4%)	0	0.20
Stenosis of rectal lumen requiring additional procedure	0	5 (15.2%)	0.05
Pelvic abscess	0	I (3%)	1
Complications related to stoma repair (leakage, abdominal haemorrhage, hernia)	2 (7.4%)	I (3%)	0.58
Rectorrhage requiring endoscopy in emergency	0	l (3%)	I

Data are n(%) or median (Q1–Q3).

^aOne patient was managed by colorectal resection (conversion).



deep infiltrating endometriosis (DIE)			Pain a
	Segmental resection (n = 102)	Disk resection (n = 32)	dick
Duration of surgery (min; median, range)	210.5 (120-480)	199 (75-388)	uisk c
Laparoscopy, n (%)	101 (99)	32 (100)	endo
Laparotomy, n (%)	1 (0.98)	0 (0)	
Conversion to laparotomy, n (%)	2 (2)	0 (0)	
Protective stoma, n (%)	12 (11.8)	0 (0)	Gernot l
AFSr stage I, n (%)	4 (3.9)	2 (6.3)	Ursula S
AFSr stage II, n (%)	15 (14.7)	9 (28.1)	
AFSr stage III, n (%)	21 (20.6)	7 (21.9)	L
AFSr stage IV, n (%)	63 (61.8)	14 (43.8)	0.08
ENZIAN A (Vagina/RVS), n (%)	85 (83.3)	28 (87.5)	0.55
ENZIAN B (USL, Parametrium), n (%)	84 (82.4)	31 (96.9)	0.004
ENZIAN C (Rectum/Sigmoid), n (%)	102 (100)	32 (100)	1
C1 (< 1 cm)	2/102 (1.9)	24/32 (75)	< 0.0001
C2 (1-3 cm)	19/102 (18.7)	8/32 (25)	0.46
C3 (> 3 cm)	81/102 (79.4)	0/32 (0)	< 0.0001
Height of stapler anastomosis			
< 7 cm	28/102 (27.4)	14/32 (43.8)	0.11
7-25 cm	63/102 (61.8)	18/32 (56.3)	0.25
> 25 cm	11/102 (10.8)	0/32 (0)	< 0.0007
FA, n (%)	52 (51)	11 (34.3)	0.10
FB, n (%)	9 (8.8)	3 (9.3)	0.92
FU. n (%)	6 (5.9)	3 (9)	0.66
Ureterolysis, n (%)	41 (40.2)	14 (43.8)	0.73
Ureteral reimplantation, n (%)	2 (2)	1 (3)	0.74
Partial cystectomy, n (%)	9 (8.8)	3 (9.4)	0.92
Endometrioma surgery > 3 cm, n (%)	38 (37.3)	9 (28.1)	0.34
Vaginal opening & resection	28 (27.5)	15 (46.9)	0.057
Hospital stav (days, mean ± SD)	7.6 ± 3.0	6.8 ± 3.0	0.16
Hemoglobin level g/dL difference (mean ± SD)	1.76 ± 1.06	1.87 ± 1.84	0.75
Postoperative complications (Clavien-Dindo Grade I-IV: n.	%)		
Grade I			
Hematoma (subcutaneous)	1 (0.98)	0 (0)	0.32
Urinary retention	6 (5.9)	3 (9.4)	0.54
Grade II			
Colpectomy infection	1 (0.98)	1 (3.1)	0.52
Compartment syndrome	1 (0.98)	0 (0)	0.32
Grade III	- ()	- (-)	
Hematoma (subcutaneous)	1 (0.98)	0 (0)	0.32
Anastomotic leakage	2 (1.9)	0 (0)	0.16
Hemoperitoneum	3(2.9)	1 (3.1)	0.953
Rectovaginal fistula	1 (0.98)	0 (0)	0.32
Grade IV	= (00.0)	0 (0)	
	O (0)	0 (0)	1

TABLE 2 Intraoperative findings and perioperative morbidity data of women undergoing segmental and discoid resectic

ORIGINAL RESEARCH ARTICLE

Pain and fertility outcomes of nerve-sparing, full-thickness disk or segmental bowel resection for deep infiltrating endometriosis—A prospective cohort study

Gernot Hudelist¹ | Mee Kristine Aas-Eng² | Tudor Birsan³ | Franz Berger⁴ | Ursula Sevelda¹ | Lisa Kirchner¹ | Mohamad Salama⁵ | Bernhard Dauser³

Moon duration of postoporative follow-up	Segmental resection (n = 81) 36.5 ± 21.9			Disk resection (n = 31) 34.3 ± 24.3			
in months (mean ± SD) Symptom score (NAS)							
	Presurgical	Postsurgical	P-value	Presurgical	Postsurgical	P-value	
Dysmenorrhea (mean ± SD)	8.3 ± 1.7	2.1 ± 2.1	<0.0001	7.8 ± 1.7	2.5 ± 2.2	< 0.0001	
Dyspareunia (mean ± SD)	3.5 ± 3.0	0.7 ± 1.5	< 0.0001	4.9 ± 2.5	1.2 ± 1.5	< 0.0001	
Dyschezia (mean ± SD)	4.2 ± 3.5	0.7 ± 1.5	< 0.0001	3.0 ± 3.5	0.6 ± 1.4	0.0001	
Dysuria (mean ± SD)	0.7 ± 1.9	0.09 ± 0.5	0.009	0.6 ± 1.7	0.1 ± 0.3	0.18	
Quality of life score (mean ± SD)	2.8 ± 1.5	8.5 ± 1.5	< 0.0001	42 ± 2.2	8.3 ± 1.2	< 0.0001	
Would patient repeat surgery? (yes/no)		76 (93.8)			28 (90.3)		
LARS						0.68	
No LARS (0-20)		75 (92.6)			28 (90.3)	0.71	
Minor LARS (21-29)		5 (6.2)			1 (3.2)	0.48	
Major LARS (30-42)		1 (1.2)			2 (6.4)	0.66	
Bowel stenosis (symptomatic)		1 (1.2)			0 (0.0)	0.32	



AOGS

Hudelist et al. AOGS 2018



AOGS

ORIGINAL RESEARCH ARTICLE

Low anterior resection syndrome following different surgical approaches for low rectal endometriosis: A retrospective multicenter study

Attila Bokor ¹ * 💿	Gern
Marilena Farella ⁴	Réka

not Hudelist²* 💿 | Noémi Dobó¹ | Bernhard Dauser³ ı Brubel¹ | Jean-Jacques Tuech⁵ | Horace Roman^{4,5} 💿

Bokor & Hudelist et al. AOGS 2020

AOGS

	LTADE		NVSSR	NVSSR	
Clavien-Dindo complications	n	%	n	%	
	66	32.2	139	67.8	P value ^a
Grade I	3	4.5	7	5.03	.098
Grade II					
Bladder atony after 7 d requiring self-catheterization	11	16.7	9	6.49	.001
Grade III-IV					
Rectovaginal fistula	7	10.6	5	3.6	.04
Stenosis of rectal lumen, requiring additional procedure	1	1.5	0	0	.14
Anastomosis leakage	0	0	2	1.4	.3
Pelvic abscess	6	9	3	2.1	.007
Pyosalpinx	0	0	1	0.7	.5
Stenosis of the ureteral anastomosis	0	0	1	0.7	.5
Ureteral fistula	0	0	1	0.7	.5

TABLE 4 Bowel function after laparoscopic-transanal disk
 excision and nerve- and vessel-sparing segmental resection

LTAD	E	NVSSI	۲	
n	%	n	%	Р
66	32.2	139	67.8	value ^a

LARS score ^b					
No LARS	41	62.1	95	68.3	.6
Minor LARS	14	21.2	27	19.4	
Major LARS	11	16.7	17	12.2	
LARS score, median	19		20		





Journal Pre-proof

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- Shaving less associated with RV fistula versus DR (OR=0.19; 95% CI [0.10-0.36], p<0.00001) and SR (OR=0.26, 95% IC [0.15-0.44], p< 0.00001).
 No difference was found in the occurrence of rectovaginal fistula between DR and SR.
- Shaving was less associated with leakage than DR (OR=0.22, 95% IC [0.06-0.73], p=0.01). No difference was found in the occurrence of leakage between rectal shaving and SR (OR=0.32, 95% IC [0.10-1.01], p=0.05 or between DR and SR (OR=0.32 95% IC [0.30-1.58], p=0.38).
- DR was less associated with anastomotic stenosis than SR (OR=0.15, 95% IC [0.05-0.48], p=0.001).
- No statistical was found in the occurrence of voiding dysfunction







"...use of a defunctioning stoma and/or an omentoplasty to isolate the anastomosis may reduce the adverse consequences of AL, but does not appear to reduce the likelihood of AL per se"





Risk factors ...

...age, smoking etc.

...vaginal opening

...resection technique, ileostomy

... height of anastomosis







Risk factors...

ORIGINAL CONTRIBUTION

Management of Low Colorectal Anastomotic Leakage in the Laparoscopic Era: More Than a Decade of Experience

Stephen Alexander Boyce, B.A., M.B.B.S., Ph.D., F.R.C.S.(Ed.), M.Ed¹ Craig Harris, B.Sc., M.B.B.S., F.R.A.C.S., F.C.S.S.A.N.Z.² Andrew Stevenson, M.B.B.S., F.R.A.C.S., F.C.S.S.A.N.Z² John Lumley, M.B.B.S., F.R.A.C.S., F.C.S.S.A.N.Z.³ David Clark, M.B.B.S., F.R.A.C.S., F.C.S.S.A.N.Z.²

Boyce et al. Dis Colon Rectum 2017

...(n=555) anastomosis below 5 cm ab ano 12.9% versus 2.3%





Risk factors ...

...Age, Smoking etc.

...vaginal opening

...technique - Shaving / DR/ SR - ileostomy ?

...height of anastomosis

...number of stapler magazines used





Influence of multiple stapler firings used for rectal division on colorectal anastomotic leak rate

Variable	Patients with anastomotic leak	Leakage (%)	p value
Anterior resection	2/57	3.5	
Low anterior resection	8/85	9.4	
Number of cartridges			
1	6/223	2.7	0.002
2	6/128	4.7	
≥3	6/31	19.4	
Anastomotic device			
Stapler	7/212	3.3	0.226
Compression	11/170	6.5	
Anastomotic height			
Low (≤ 6 cm)	7/83	8.4	0.204
Middle (>6-12 cm)	2/74	2.7	
High (>12-16 cm)	9/225	4.0	
Duration of operation			



Braunschmid et al. Surg Endosc 2017



Influence of multiple stapler firings used for rectal division on colorectal anastomotic leak rate





DFR



Risk factors ...

- ...Age, Smoking etc.
- ...vaginal opening
- ...technique Shaving / DR/ SR ileostomy ?
- ...height of anastomosis
- ...number of stapler magazines used
-and finally experience and caseload!





Impact of hospital and surgeon case volume on morbidity in colorectal endometriosis management: a plea to define criteria for expert centers

 $\begin{array}{l} \text{Sofiane Bendifallah}^{1,2,3} \cdot \text{Horace Roman}^{4,5} \cdot \text{Chrystel Rubod}^{6,7} \cdot \text{Pierre Leguevaque}^8 \cdot \\ \text{Antoine Watrelot}^9 \cdot \text{Nicolas Bourdel}^{10,11} \cdot \text{Marcos Ballester}^{1,2,3} \cdot \text{Emile Darai}^{1,2,3} \end{array}$

Bendifallah et al. Surg Endosc 2017

Complication rates	Volume of activity (number of procedures per center and per year)							
	Less than 10	Between 10 et 19	Between 20 et 29	Between 30 et 39	Over 40			
	26 centers	9 centers	8 centers	5 centers	8 centers			
Overall	11.88% (12/101)	8.40% (10/119)	5.15% (10/194)	7.73% (14/181)	6.66% (36/540)			
Rectovaginal fistula	4.95% (5/101)	1.68% (2/119)	2.06% (4/194)	2.76% (5/181)	2.77% (15/540)			
Anastomotic leakage	1.98% (2/101)	0% (0/119)	0.51% (1/194)	0.55% (1/181)	0.92% (5/540)			
Pelvic abscess	1.98% (2/101)	3.36% (4/119)	2.57% (5/194)	4.97% (9/181)	3.51% (19/540)			
Fistula of ureter	0% (0/101)	0.84% (1/119)	1.03% (2/194)	2.20% (4/181)	0.18% (1/540)			





Impact of hospital and surgeon case volume on morbidity in colorectal endometriosis management: a plea to define criteria for expert centers

Sofiane Bendifallah ^{1,2,3} · Horace Roman ^{4,5} · Chrystel Rubod ^{6,7} · Pierre Leguevaque ⁸ ·	
Antoine Watrelot ⁹ · Nicolas Bourdel ^{10,11} · Marcos Ballester ^{1,2,3} · Emile Darai ^{1,2,3}	

Bendifallah et al. Surg Endosc 2017

....centers with more than 40 procedures per year RV fistula and AL rate

2.8% and 0.9%

....centers with fewer than 10 procedures per year RV fistula and AL rate

5% and 2%

....optimal cut-off value of 20 cases a year per centre and

7-13 procedures a year per surgeon for significant reduction

of grade III and IV complication rates





EEL Webiwa 202

CC+ () Europe

OCR: 21/683, 3%



% Clavien Dindo III/IV complications





Risk stratification, recognition & prevention





Estimation of surgical risks ...







Estimation of surgical risks ...



... type and intensity of pain symptoms

...operating time

...Clavien-Dindo I/II versus III/IV complications and disease extent by C compartment

...postoperative voiding dysfunction and disease extent by B compartment

Keckstein et al. AOGS 2021



Estimation of surgical risks ...



Hudelist et al. JMIG 2021

... TVS and DE localisation and lesion size in compartments A,C and FB, less accurate in B compartment

TVS ^a	PPV ^b	NPV ^c
Enzian FB (urinary bladder)	91%	98%
Enzian A (vagina, rectovaginal septum)	91%	73%
Enzian B (USLs ^d , parametria)	96%	56%
Enzian C (rectum, sigmoid colon)	96%	89%
Enzian A0	73%	91%
Enzian A1	52%	87%
Enzian A2	67%	84%
Enzian A3	86%	93%
Enzian B0	56%	96%
Enzian B1	42%	94%
Enzian B2	71%	69%
Enzian B3	33%	81%
Enzian C0	89%	96%
Enzian C1	67%	96%
Enzian C2	60%	93%
Enzian C3	86%	87%

Recognition ...

Improved diagnosis and treatment of anastomotic leakage after colorectal surgery

M. den Dulk ^{a,b}, S.L. Noter ^{a,1}, E.R. Hendriks ^{a,2}, M.A.M. Brouwers ^a, C.H. van der Vlies ^c, R.J. Oostenbroek ^c, A.G. Menon ^{a,3}, W.H. Steup ^{a,*}, C.J.H. van de Velde ^b

> ⁸ Department of Surgery, Haga Hospital, The Hague, The Netherlands ⁹ Department of Surgery, Leiden University Medical Center, Leiden, The Netherlands ⁶ Department of Surgery, Albert Schweitzer Hospital, Dordrecht, The Netherlands

> > (points)

Item	Normal value	Score (points)	Abnormal value	Score
General				
Fever	≤38.0 °C	0	>38.0 °C	1
Heart rate	≤100/min	0	>100/min	1
Respiratory rate	\leq 30/min	0	>30/min	1
Urinary production	\geq 30 ml/h or 700 ml/day	0	<30 ml/h or 700 ml/day	1
Mental status	Normal mental status	0	Agitation or lethargic	2
Clinical condition	Stable or improving condition	0	Deterioration	2
Local physical examination				
Signs of ileus	No ileus	0	Ileus	2
Gastric retention	No gastric retention	0	Gastric retention	2
Fascial dehiscence	No fascial dehiscence	0	Fascial dehiscence	2
Abdominal pain, other than wound pain	No pain other than wound pain	0	Pain other than wound pain	2
Laboratory investigation				
Signs of infection	No increase in leukocyte number or CRP	0	Increase of $\geq 5\%$ in leukocyte number or CRP	
Kidney function	No increase in urea or creatinine	0	Incre or ci	
Diet			5	a atamati
Nutritional status	Normal diet	0		tomotic le

AL was diagnosed in 7.0% of patients in the historical control group

and 9.4% of patients in the standardised surveillance group,

mortality decreased from 39% to 24%

Recognition

303 patients

7.9% AL/pelvic abscess; 2% RVF cut off value 100 mg/l day 4 -PPV, NPV: 30.2% and 90.4% DOI: 10.1111/1471-0528.15812 www.bjog.org **Gynaecological surgery**

C-reactive protein assessment to predict early septic complications after laparoscopic bowel resection for endometriosis: a diagnostic study

A Scattarelli,^a M Carriou,^a L Boulet,^b R Chati,^c J Coget,^a V Bridoux,^c J-J Tuech,^c H Roman^d

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Recognition

183 patients: 2.7% AL, 1.1% RVF Cut off value 100 mg/I day 4 (AUC 0.94, CI 0.88-1.0) PPV, NPV: 31.8% and 99.3% decrease in CRP from day 1-3 not specific

Montanari et al..; submitted for publication

Gutes tun und es gut tun!

postoperative day

Tech Coloproctol (2017) 21:709–714 DOI 10.1007/s10151-017-1689-6

ORIGINAL ARTICLE

Colorectal anastomotic leak: delay in reintervention after falsenegative computed tomography scan is a reason for concern

C. C. M. Marres $^1\cdot A.$ W. H. van de Ven $^{1.2}\cdot L.$ G. J. Leijssen $^1\cdot P.$ C. M. Verbeek $^1\cdot$ W. A. Bemelman $^2\cdot C.$ J. Buskens 2

CrossMark

	Overall $N = 35$	True-positive CT $N = 24$	False-negative CT $N = 11$	p value
Mortality (%)	6 (17.1%)	1 (4.2%)	5 (45.5%)	.003*
Length of hospital stay, median (IQR)	30.5 (31)	28 (26)	54 (20)	.014**
Days in ICU, median (IQR)	3 (10)	3 (10)	2 (14)	.094**
Days from operation to CT, median (IQR)	7 (5)	7 (4)	4 (4)	.121**
Days from CT to reintervention, median (IQR)	0(1)	0(1)	1 (2)	.011**

... SDD (selective decontamination digestive tract) (leak rate 5.7% to 2.8%) with oral aminoglycosides

...stratification of "high risk" and "low risk" patients

....standardized surveillance postoperatively

...the right patient at the right time treated by the right surgeon

Classification and Prevalence

Are there risk factors for complications ?

Recognition and prevention ?

When things go wrong, it is usually because a series of failures conspires to produce disaster.

