Klinikum rechts der Isar
Technische Universität München

DIE DEUTSCHEN UNIVERSITÄTSKLINIKA®

Chirurgische Therapie des Ösophaguskarzinoms

Alexander Novotny
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Munich Masterclass of Gastroenterology (MucMAG), 27.03.2021

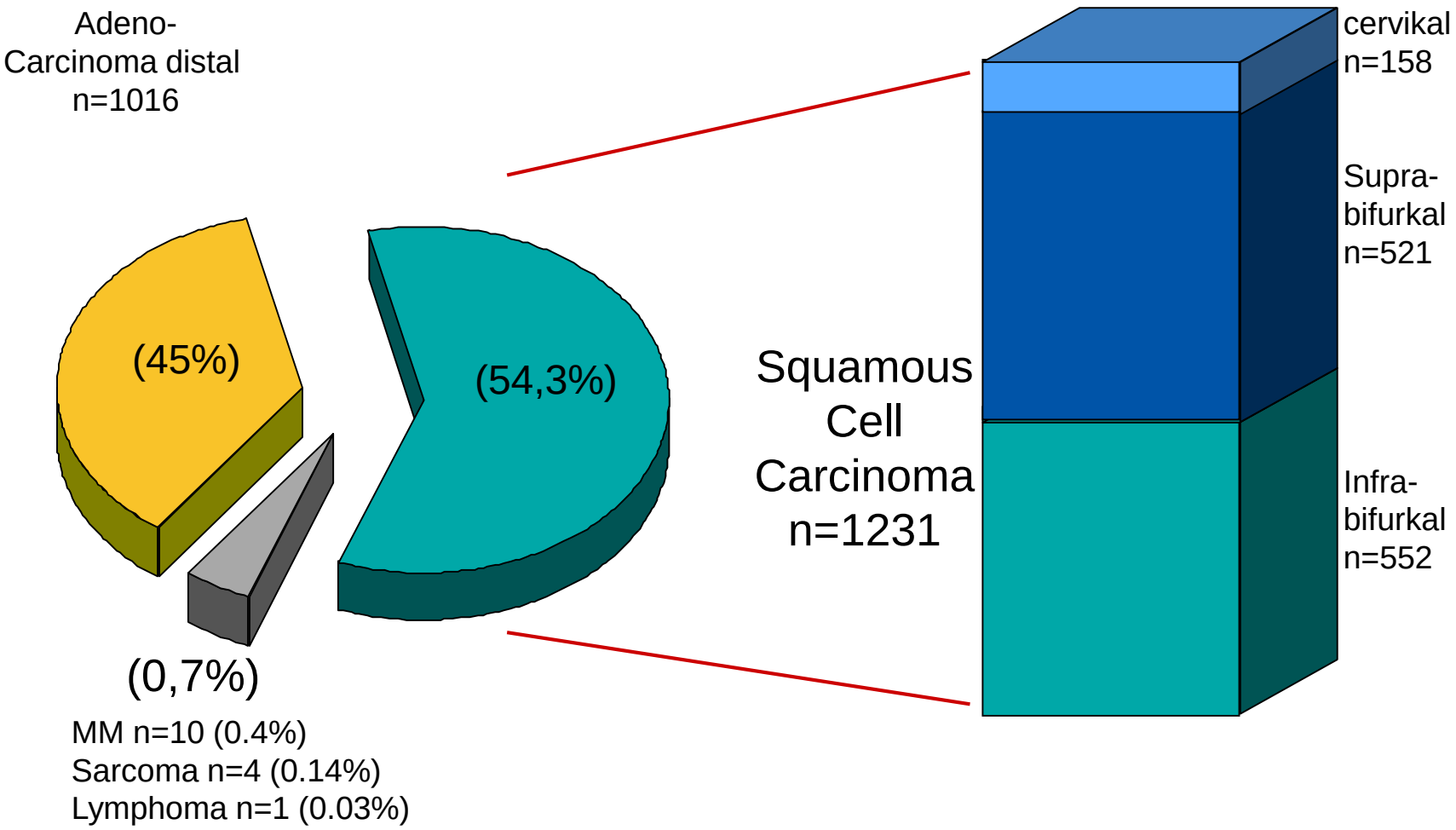
Offenlegung von Interessenskonflikten

- Referent: **Alexander Novotny**
- Ich habe keinerlei Verbindungen zu kommerziellen Unternehmen

- Allgemeines
  - Resektions- und Rekonstruktionsmethoden
  - Lymphadenektomie
- Vorgehen nach Tumorlokalisation
  - (zervikaler Ösophagus)
  - Proximaler / mittlerer Ösophagus
  - Distaler Ösophagus
  - AEG
- Minimalinvasive Chirurgie / Roboterassistierte Chirurgie
- Mindestmengen

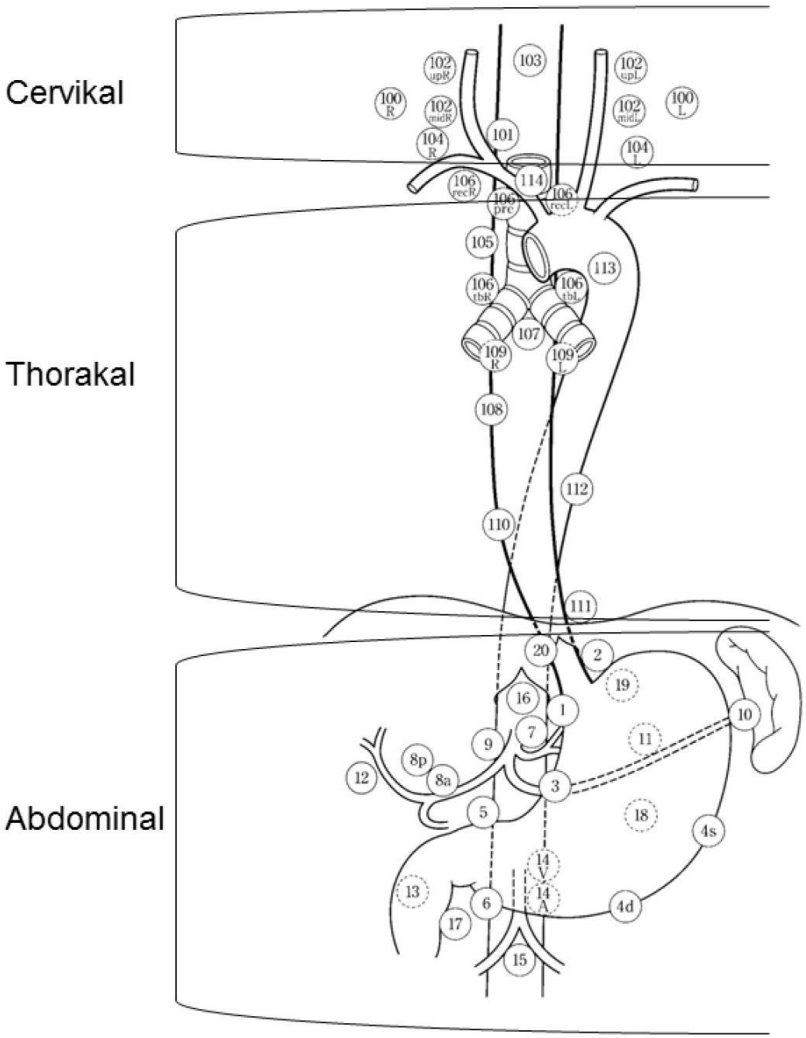
Chirurgische Therapie des Ösophaguskarzinoms - Allgemeines

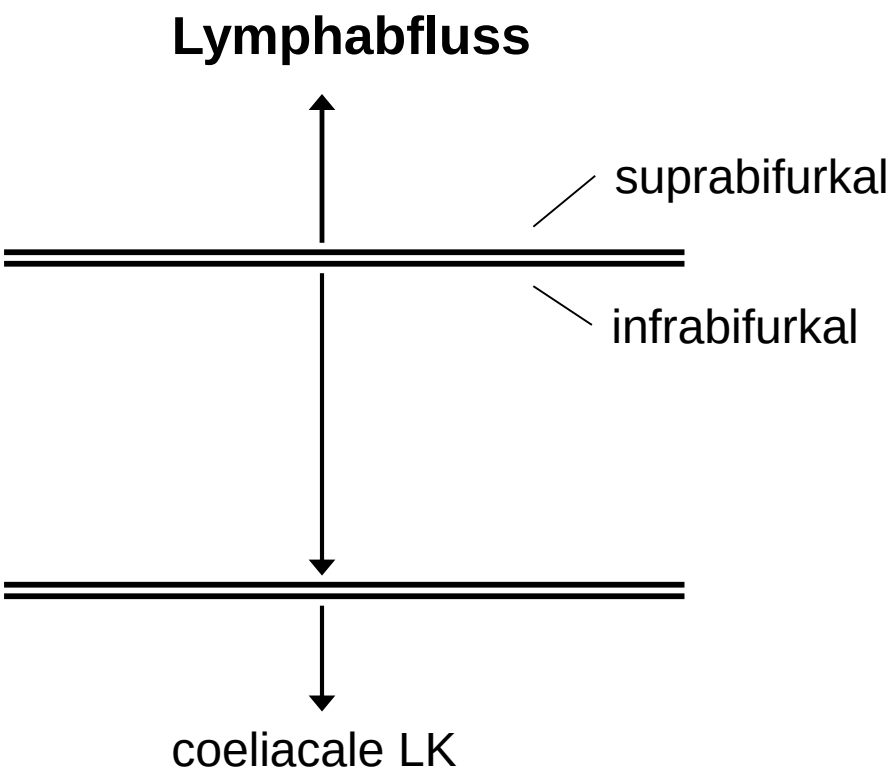
Resected Esophageal Cancers 1982 - 2017
Klinikum rechts der Isar , TU München
n=2262



Location
Location
Location

LK-Stationen Ösophagus

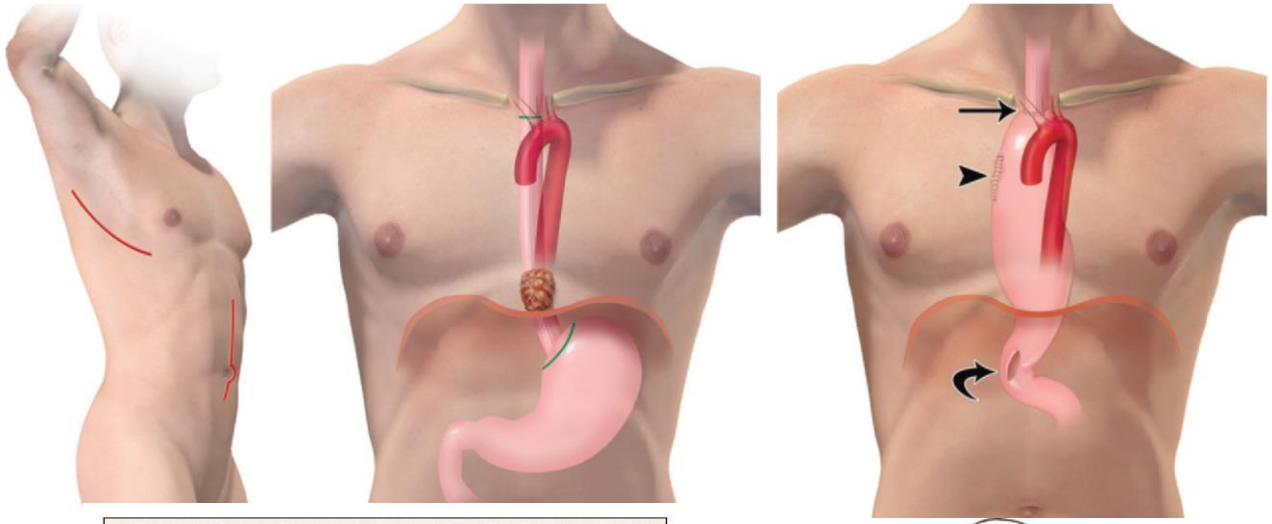


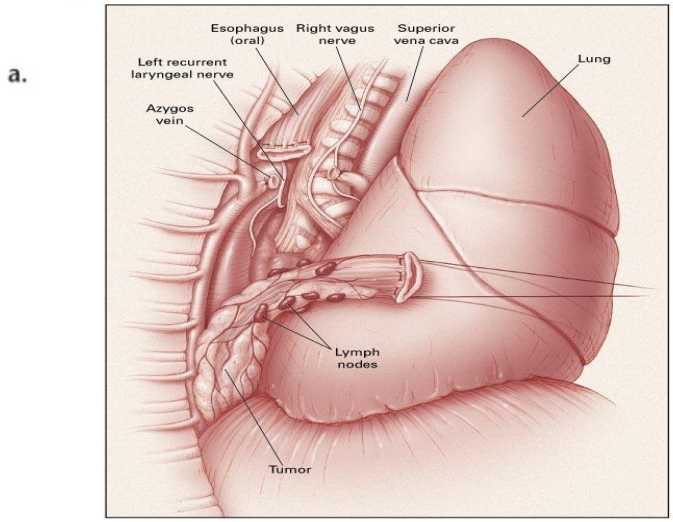


Guidelines for Clinical and Pathological Studies of Carcinoma of the Esophagus. Jap. Soc. For Esophageal Diseases, Tokyo 2011

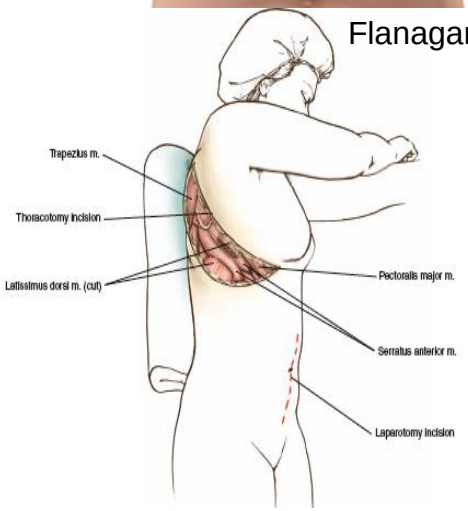
Abdominothorakale Resektion, MHZ, intrathorakale Anastomose

Ivor Lewis



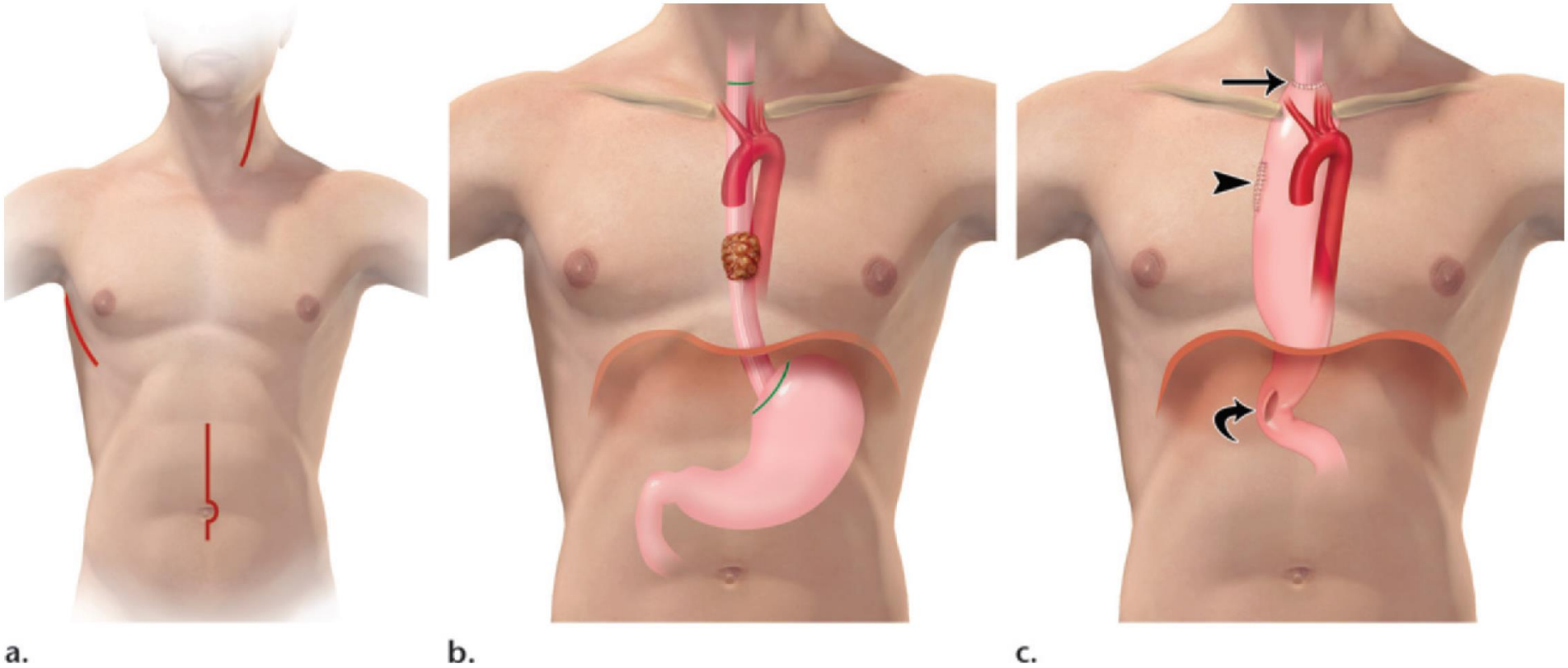


Flanagan JC et al., RadioGraphics 2015



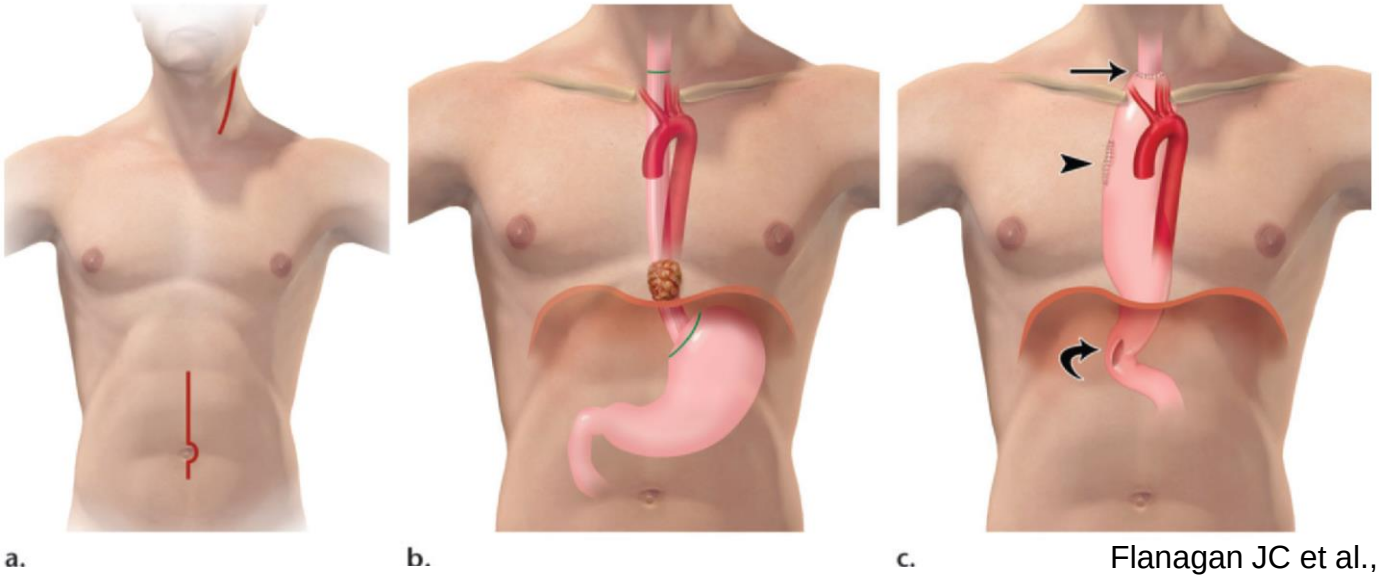
Abdominothorakale Resektion, MHZ, zervikale Anastomose

McKeown

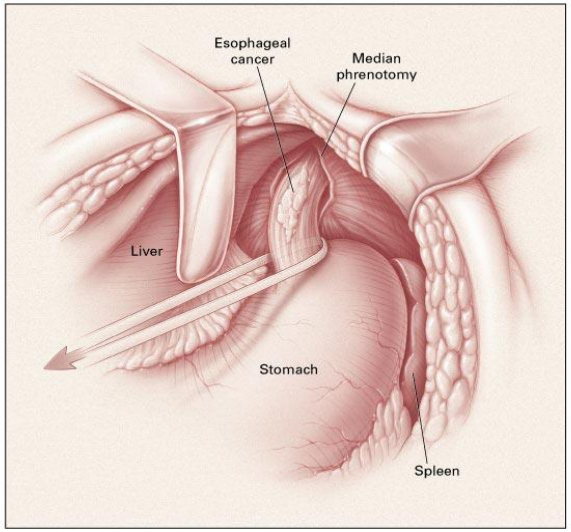


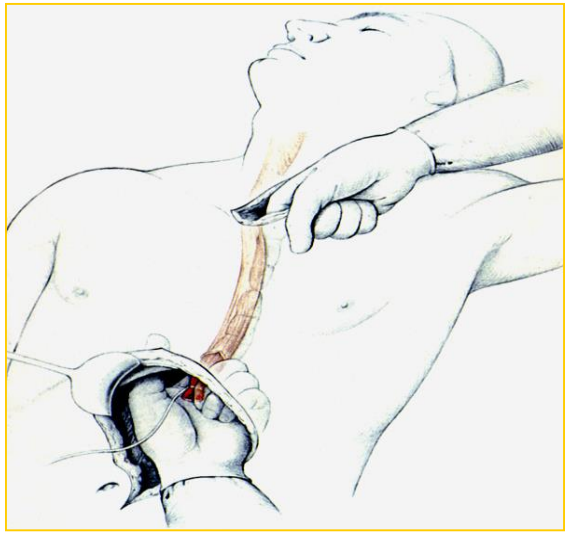
Flanagan JC et al., RadioGraphics 2015

Transmediastinale Ösophagektomie, MHZ, zervikale Anastomose



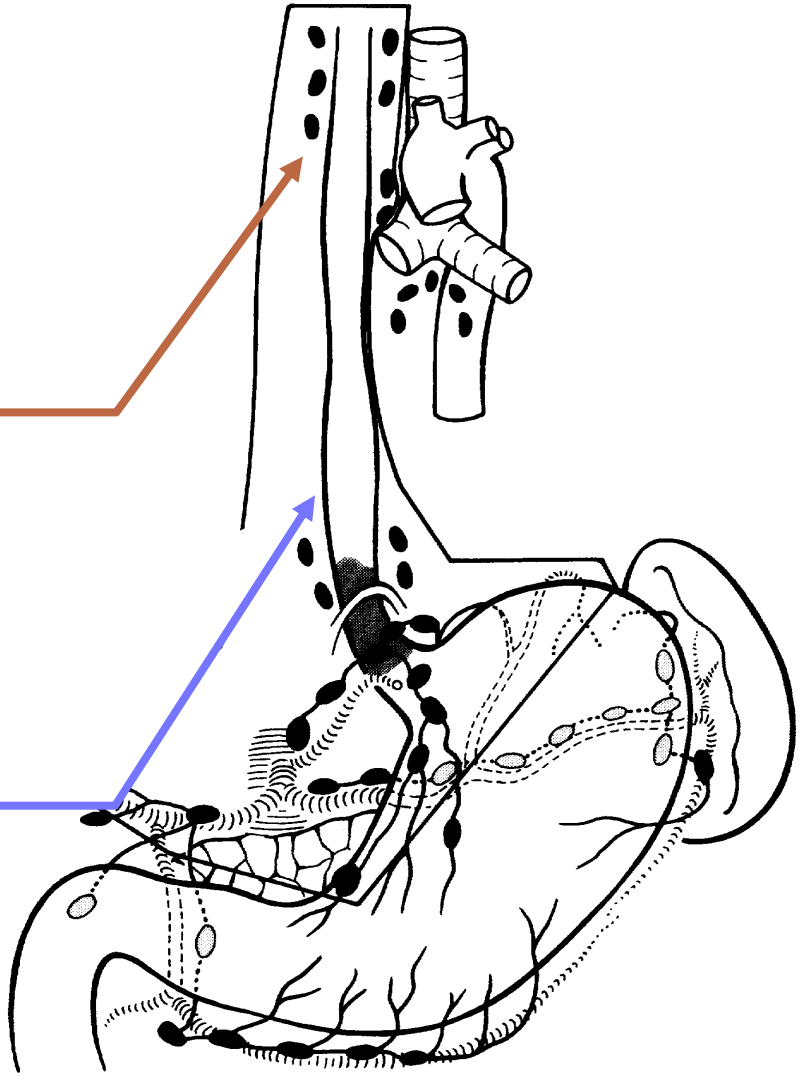
Flanagan JC et al., RadioGraphics 2015





Transthorakale Ösophagektoie mit intrath. Anastomose

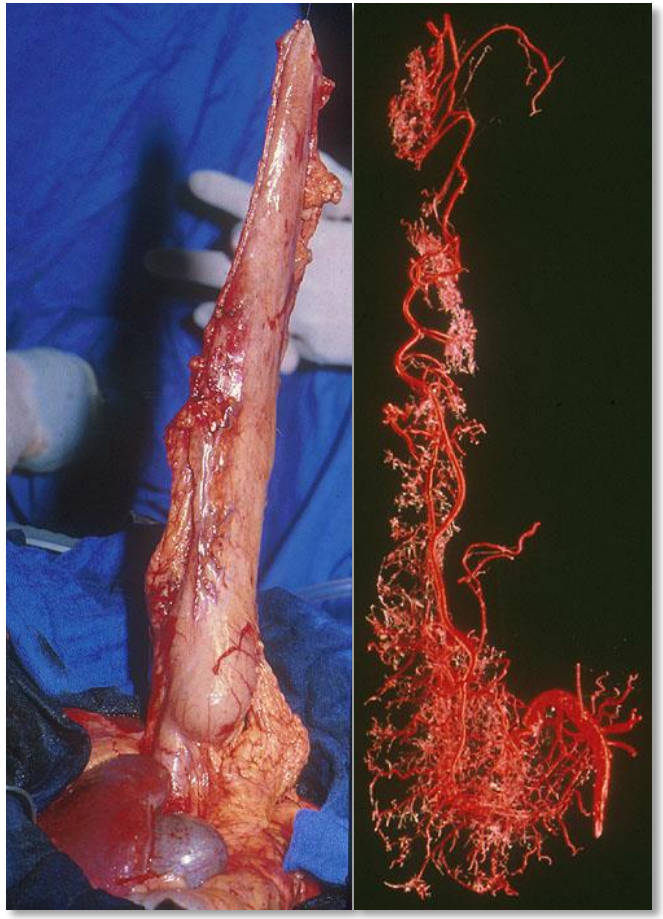
Transmediastinale Ösophagektomie mit cervikaler Anastomose

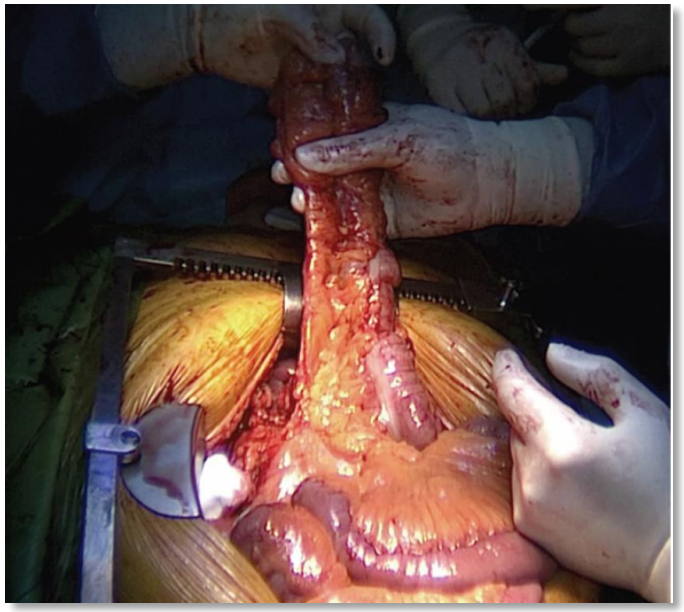


Standard-Rekonstruktion

(Schlauch-) Magenhochzug

- Intrathorakale vs. zervikale Anastomose
- Alternativen:
  - Coloninterponat
  - Jejunuminterponat gefäßgestielt, Roux-Y

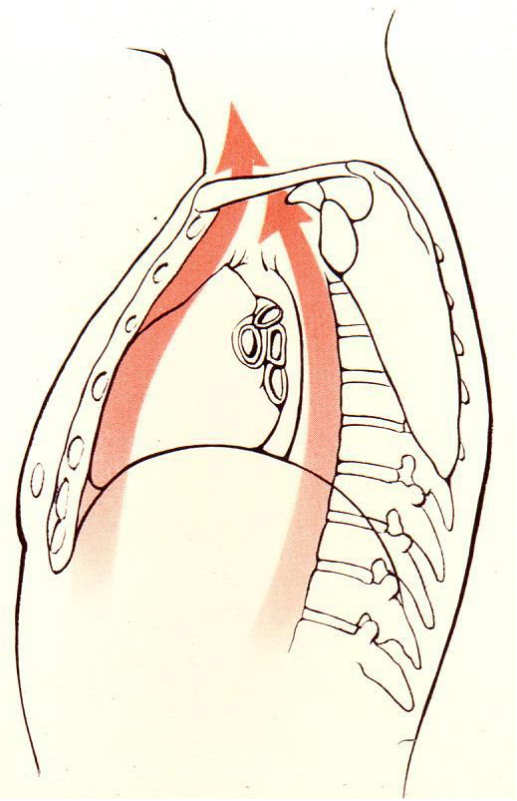


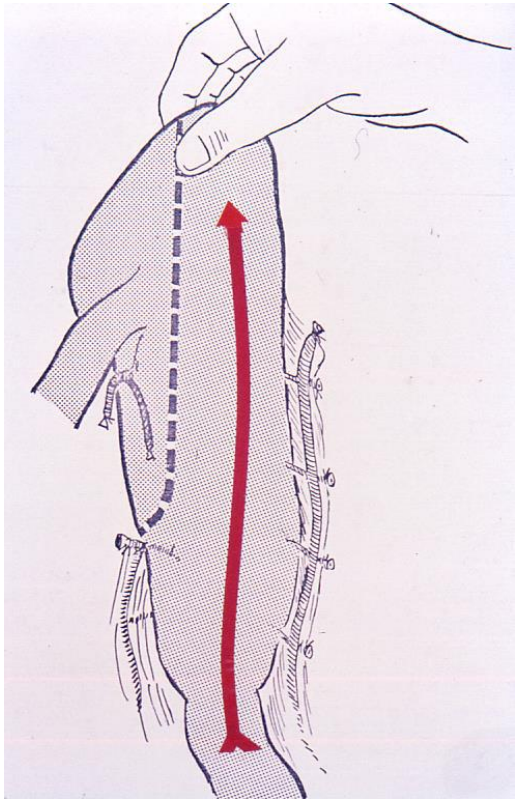


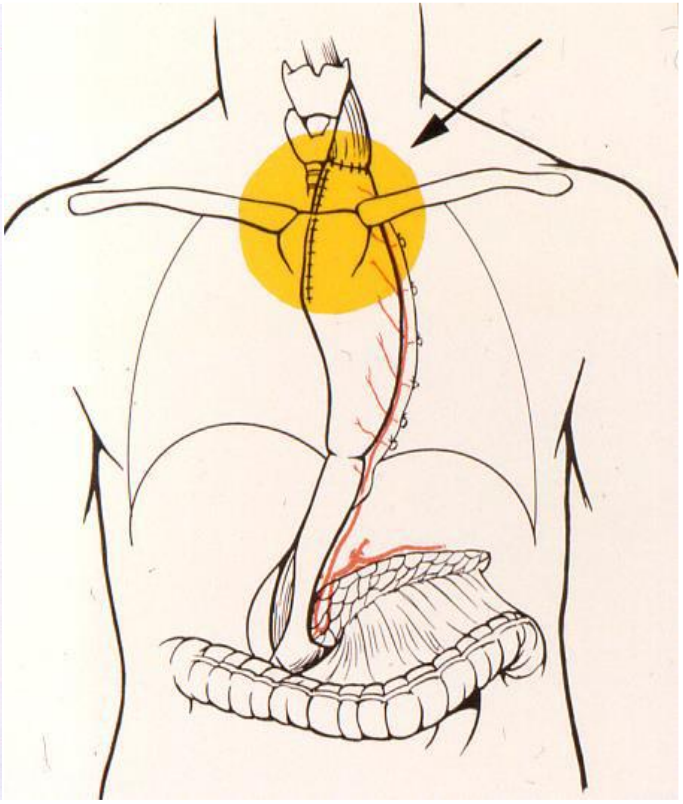
Gust L et al., Ann Transl Med 2018

Rekonstruktion mittels Magenhochzug

Hinteres oder vorderes Mediastinum







Chirurgische Therapie des zervikalen Ösophaguskarzinoms

REVIEW

Revisiting the Gastric Pull-Up for Pharyngoesophageal Reconstruction: A Systematic Review and Meta-Analysis of Mortality and Morbidity

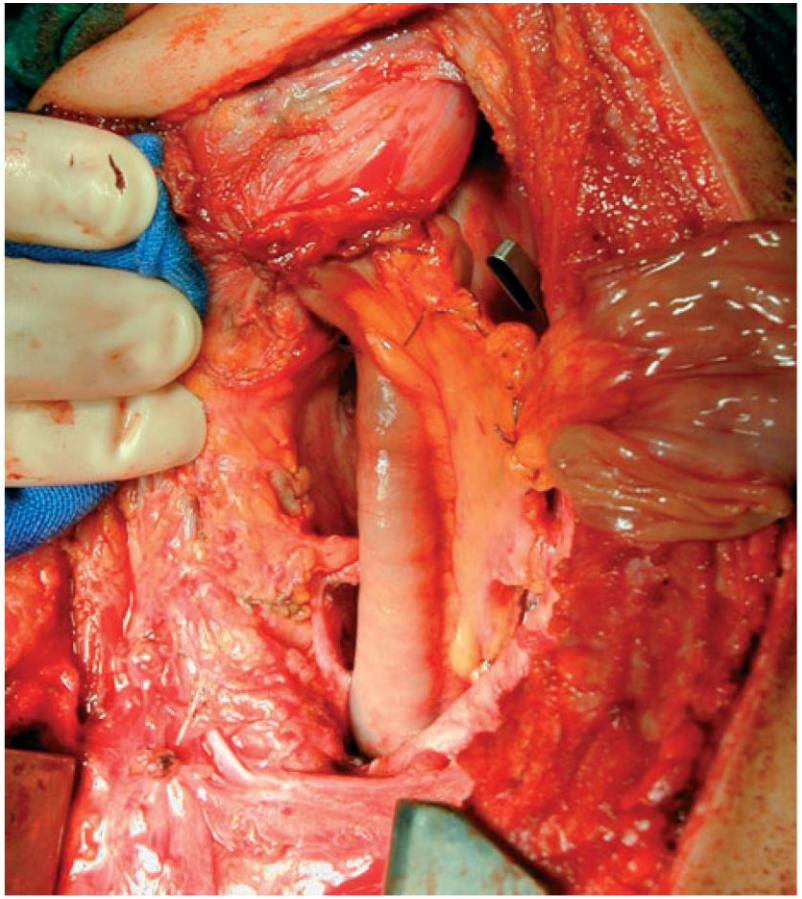
OLEKSANDR BUTSKIY, BSc, MD,[1,2]* RONAK RAHMANIAN, BSc, MD,[1,2] RICHARD A. WHITE, BSc, MSc,[3] SCOTT DURHAM, MD, FRCSC,[1,2] DONALD W. ANDERSON, MD, FRCSC,[1,2] AND EITAN PRISMAN, MD, FRCSC[1,2]
[1]Division of Otolaryngology—Head and Neck Surgery, Vancouver General Hospital, Vancouver, British Columbia, Canada
[2]University of British Columbia, Vancouver, British Columbia, Canada
[3]Statistical Consulting and Research Laboratory, Department of Statistics, University of British Columbia, Vancouver, British Columbia, Canada

TABLE II. Rate and Cause of Mortality Post-Gastric Pull-Up for Pharyngoesophageal Junction Reconstruction*

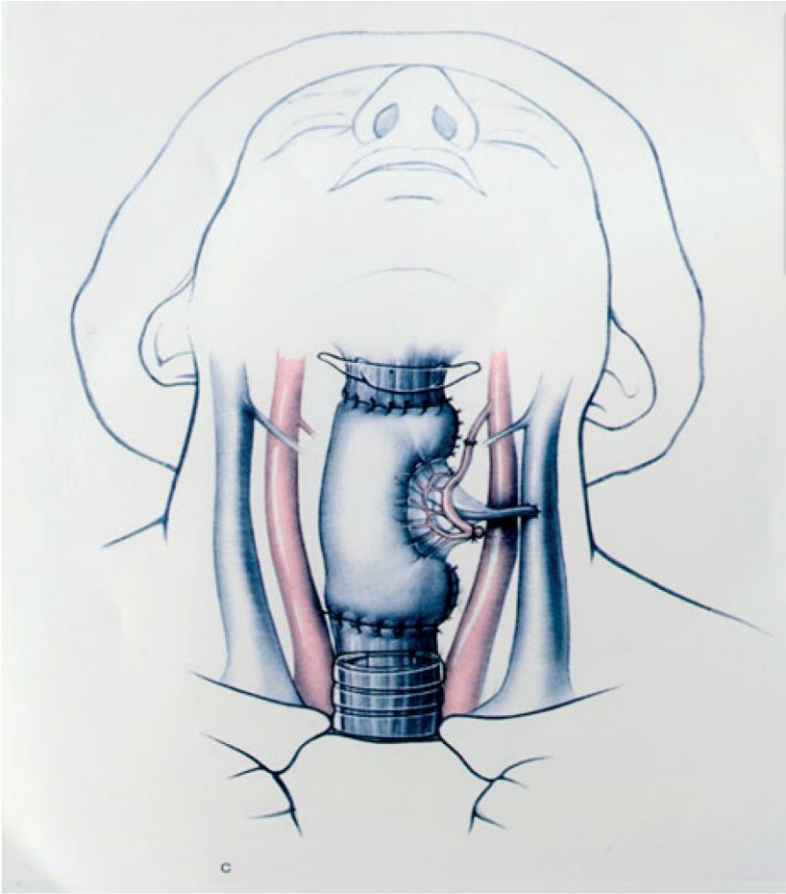
				Cause of mortality								
Year range	n	Mortality n (%)	Cause specified	Consequence of anastomotic leak n (%)	Carotid/innominate artery hemorrhage n (%)	Hemorrhage other n (%)	Neck wound sepsis n (%)	Resp n (%)	CV n (%)	GI n (%)	Intraop n (%)	Other n (%)
1959–1978	457	86 (19)	72	3 (4)	8 (11)	7 (2)	7 (10)	25 (35)	11 (15)	3 (4)	3 (4)	5 (7)
1979–1984	406	43 (11)	43	10 (23)	8 (19)	1 (2)	2 (5)	13 (30)	3 (7)	5 (12)	—	1 (2)
1985–1991	635	65 (10)	56	22 (39)	2 (4)	1 (2)	—	16 (29)	3 (5)	3 (5)	1 (2)	8 (14)
1992–1999	556	40 (7)	34	14 (41)	2 (6)	1 (3)	—	6 (18)	8 (24)	1 (3)	—	2 (6)
2000–2012	294	18 (6)	5	2 (40)	—	—	—	3 (60)	—	—	—	—
Total	2,348	252 (11)	210	51 (24)	20 (10)	10 (5)	9 (4)	63 (30)	32 (12)	12 (6)	4 (2)	16 (8)

J Surg Oncol 2016

Rekonstruktion mittels freiem DD-Interponat



a Operative photograph



b Diagram of technique

Ott K et al., Br J Surg 2008

Ergebnisse

- Niedrige Mortalität (30d: 1,8%, KH-Mortalität: 2,8%)
- Hohe Komplikationsrate (74,3% !)
- Hohe Re-OP Rate (29,4%)
- Funktionelle Ergebnisse mäßig
  - 15% Kombination mit totaler Laryngektomie nötig
  - 16% postop. bilaterale Recurrensparese
  - 42% Dysphagie (V.a. Anschluckstörungen)
  - 25% bougierungspflichtige Stenosen

→ LL: i.d.R. definitive RCTx beim zervikalen Ösophaguskarzinom gegenüber chirurgischem Vorgehen präferiert

Ott K et al., Br J Surg 2008

Chirurgische Therapie des Karzinoms im proximalen und mittleren Ösophagus

Ann Surg Oncol
https://doi.org/10.1245/s10434-019-07499-1

Annals of
SURGICAL ONCOLOGY
OFFICIAL JOURNAL OF THE SOCIETY OF SURGICAL ONCOLOGY

ORIGINAL ARTICLE – GASTROINTESTINAL ONCOLOGY

Prophylactic Cervical Lymph Node Dissection in Thoracoscopic Esophagectomy for Esophageal Cancer Increases Postoperative Complications and Does Not Improve Survival

Yasufumi Koterazawa, MD[1], Taro Oshikiri, MD[1], Gosuke Takiguchi, MD[1], Hiroshi Hasegawa, MD[1], Masashi Yamamoto, MD[1], Shingo Kanaji, MD[1], Kimihiro Yamashita, MD[1], Takeru Matsuda, MD[2], Tetsu Nakamura, MD[1], Yasuhiro Fujino, MD[3], Masahiro Tominaga, MD[3], Satoshi Suzuki, MD[4], and Yoshihiro Kakeji, MD[1]

2019

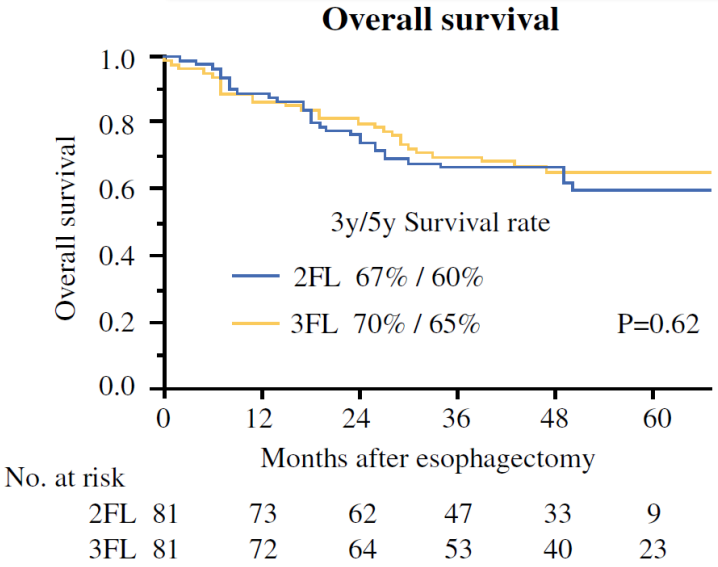


FIG. 1 There were no differences in the overall survival rates between the two-field lymphadenectomy (2FL) (red line) and three-field lymphadenectomy (3FL) groups in the matched cohort (blue line) ($p = 0.62$)

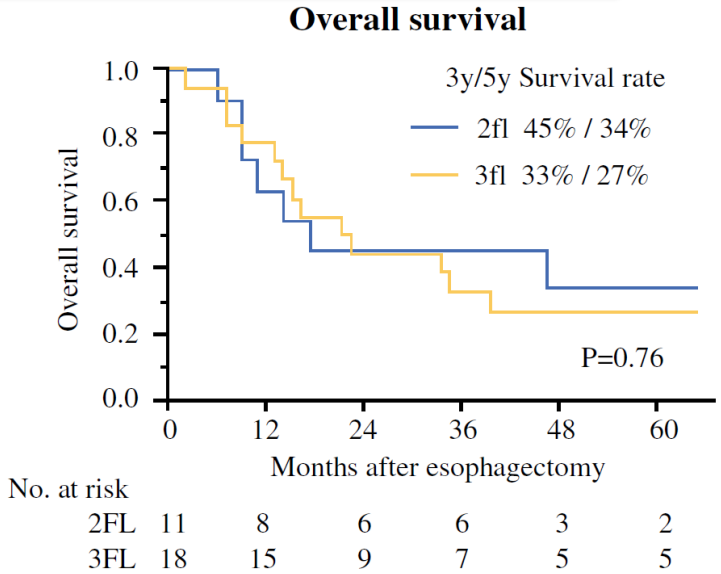


FIG. 2 There were no differences in overall survival rates between the two-field lymphadenectomy 2FL (red line) and three-field lymphadenectomy 3FL groups in the microscopic supraclavicular lymph node metastases or recurrence cohort (blue line) ($p = 0.76$)

Pragmatisches Vorgehen bei Tumoren des proximalen und mittleren Ösophagus

Ivor Lewis oder McKeown

Keine zervikalen LK-Metastasen im Staging

↓

Abdominothorakale Ösophagusresektion mit 2-Feld Lymphadenektomie
(z.B. Ivor-Lewis mit hoher intrathorakaler Anastomose)

↓

Lokalisiertes LK-Rezidiv zervikal

↓

Neck-dissection sekundär

Lewis I, Br J Surg 1946
McKeown KC, Br J Surg 1976
Nishihira et al., Am J Surg 1998
Koterazawa Y et al., Ann Surg Oncol 2019

Chirurgische Therapie des infrabifurkalen Ösophaguskarzinoms

Zervikale vs. intrathorakale Anastomose

(McKeow vs. Ivor Lewis)

Propensity Score–Matched Analysis Comparing Minimally Invasive Ivor Lewis Versus Minimally Invasive Mckeown Esophagectomy

Frans van Workum, MD, Annelijn E. Slaman, MD,† Mark I. van Berge Henegouwen, MD, PhD,† Suzanne S. Gisbertz, MD, PhD,† Ewout A. Kouwenhoven, MD, PhD,‡ Marc J. van Det, MD, PhD,‡ Frits J. H. van den Wildenberg, MD,§ Fatih Polat, MD,§ Misha D. P. Luyer, MD, PhD,¶ Grard A. P. Nieuwenhuijzen, MD, PhD,¶ and Camiel Rosman, MD, PhD**

- 4 High-Volume Zentren in Holland
- PS-matching (Alter, Geschlecht, BMI, ASA, CCI, Tumortyp, Lokalisation, cTNM, neoadjuvante Therapie, Zentrum)
- Nur Tumore des distalen Ösophagus (Adeno-Ca, SCC, keine AEG)
- 787 konsekutive Patienten, 420 nach PS-Matching

Ann Surg, 2020

TABLE 2. Comparison of Outcome Parameters Between McKeown and Ivor Lewis Esophagectomy

	Before Matching			After Matching		
Variables	**McKeown (n = 226)**	**Ivor Lewis (n = 561)**	***P***	**McKeown (n = 210)**	**Ivor Lewis (n = 210)**	***P***
Conversion abdomen	5 (2.2%)	6 (1.1%)	0.217	5 (2.4%)	1 (0.5%)	0.215
Conversion Thorax	0 (0.0%)	14 (2.5%)	**0.014**	0 (0%)	3 (1.4%)	0.248
Operating time (min)—median (IQR)	330 (72)	286.5 (138)	**<0.001**	349.0 (114)	410.5 (216)	**<0.001**
Anastomotic leakage grade ≥2	50 (22.1%)	70 (12.5%)	**0.001**	49 (23.3%)	26 (12.4%)	**0.003**
Anastomotic leakage	60 (26.5%)	81 (14.4%)	**<0.001**	59 (28.1%)	29 (13.8%)	**<0.001**
Leakage type 1	10 (4.4%)	11 (2.0%)	0.052	10 (4.8%)	3 (1.4%)	0.087
Leakage type 2	23 (10.2%)	36 (6.4%)	0.070	23 (11.0%)	13 (6.2%)	0.081
Leakage type 3	27 (11.9%)	34 (6.1%)	**0.005**	26 (12.4%)	13 (6.2%)	**0.029**
Chyle leakage	30 (13.3%)	49 (8.7%)	0.055	27 (12.9%)	19 (9.0%)	0.211
Pulmonary complications	102 (45.1%)	230 (41.0%)	0.288	98 (46.7%)	67 (31.9%)	**0.002**
Pneumonia	56 (24.8%)	156 (27.8%)	0.386	55 (26.2%)	40 (19.0%)	0.080
Cardiac complications	61 (27.0%)	117 (20.9%)	0.063	56 (26.7%)	41 (19.5%)	0.082
Atrial fibrillation	59 (26.1%)	96 (17.1%)	**0.004**	54 (25.7%)	35 (16.7%)	**0.023**
Myocardial infarction	23 (10.2%)	23 (4.1%)	**0.001**	19 (9.0%)	12 (5.7%)	0.191
Asystole	25 (11.1%)	25 (4.5%)	**0.001**	21 (10.0)	13 (6.2%)	0.152
RLN palsy	20 (9.0%)	3 (0.5%)	**<0.001**	20 (9.5%)	1 (0.5%)	**<0.001**
Overall complications	141 (62.4%)	345 (61.5%)	0.816	134 (63.8%)	117 (55.7%)	0.091
Severe complications (CD≥3)	58 (25.7%)	187 (33.3%)	**0.036**	56 (26.7%)	62 (29.5%)	0.515
Reoperation	40 (17.7%)	88 (15.7%)	0.489	39 (18.6%)	23 (11.0%)	**0.028**
Reintervention	58 (25.7%)	161 (28.7%)	0.390	56 (26.7%)	56 (26.7%)	1.000
Radiologic reintervention	40 (17.7%)	74 (13.2%)	0.104	39 (18.6%)	34 (16.2%)	0.520
Endoscopic reintervention	22 (9.7%)	48 (8.6%)	0.599	23 (11.0%)	32 (15.2%)	0.193
R0 resection	217 (96.0%)	535 (95.4%)	0.688	201 (95.7%)	199 (94.8%)	0.647
Examined LN (median/IQR)	21 (16)	22 (11)	0.082	21 (15)	26 (17)	**<0.001**
ICU length of stay (median/IQR)	2 (4)	1 (2)	**0.001**	2 (4)	1 (2)	**<0.001**
ICU readmission	50 (22.1%)	100 (17.8%)	0.165	48 (22.9%)	34 (16.2%)	0.085
Hospital length of stay (median/IQR)	12 (14)	11 (10)	**<0.001**	12 (18)	11 (9)	**0.046**
Hospital readmission	37 (16.4%)	83 (14.8%)	0.578	33 (15.7%)	37 (17.6%)	0.600
Textbook outcome	98 (43.4%)	264 (47.1%)	0.347	90 (42.9%)	106 (50.5%)	0.118
In-hospital mortality	11 (4.9%)	17 (3.0%)	0.208	11 (5.2%)	3 (1.4%)	**0.053**
30-Day mortality	5 (2.2%)	13 (2.3%)	0.929	5 (2.4%)	2 (1.0%)	0.253
90-Day mortality	16 (7.1%)	25 (4.5%)	0.134	15 (7.1%)	6 (2.9%)	**0.044**

Dichotomous variables are displayed as n (%), continuous parameters are displayed as median [interquartile range (IQR)].
CD indicates Clavien-Dindo grade; ICU, intensive care unit; R0 resection, radical resection; RLN, recurrent laryngeal nerve.
Bold *p*-values indicate that differences between the groups were statistically significant.

Van Workum F et al., Ann Surg, 2020

Chirurgische Therapie der Tumore des gastroösophagealen Übergangs

Adenokarzinome des ösophagogastralen Übergangs

AEG-Klassifikation

Typ I „Barrettkarzinom“

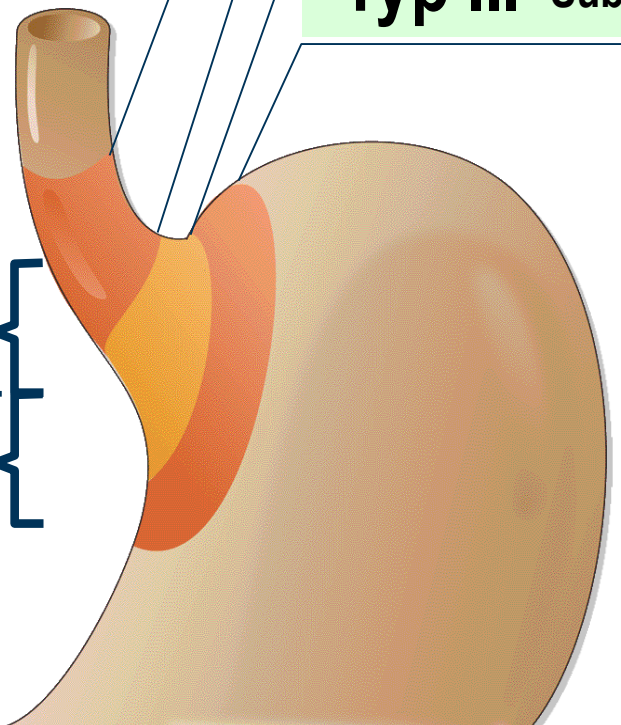
Typ II Kardiakarzinom

Typ III Subkardiales Magen-Ca

Endoskopische Kardia

5 cm

5 cm

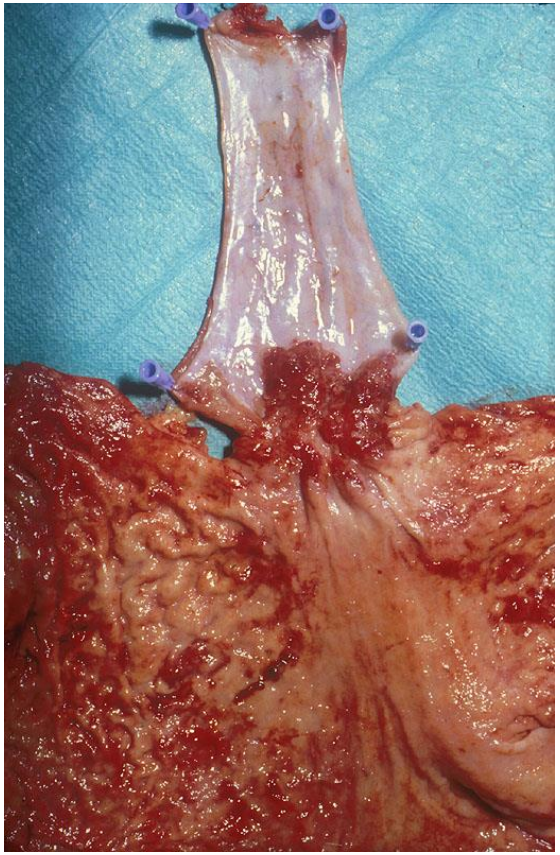


Siewert JR, Br J Surg 1998

AEG Klassifikation

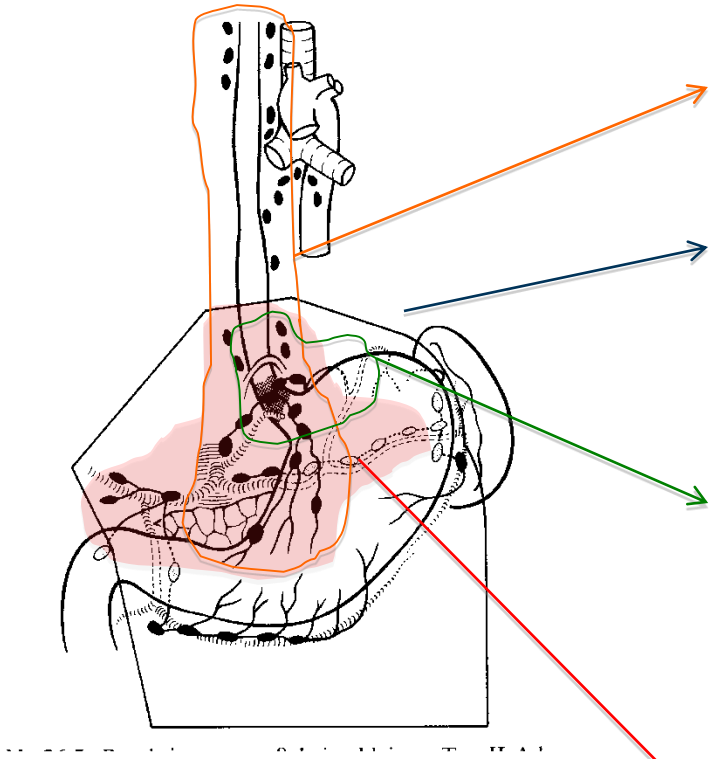
AEG Type I

AEG Type II



AEG Type III

Resektionsausmaß bei AEGs ?



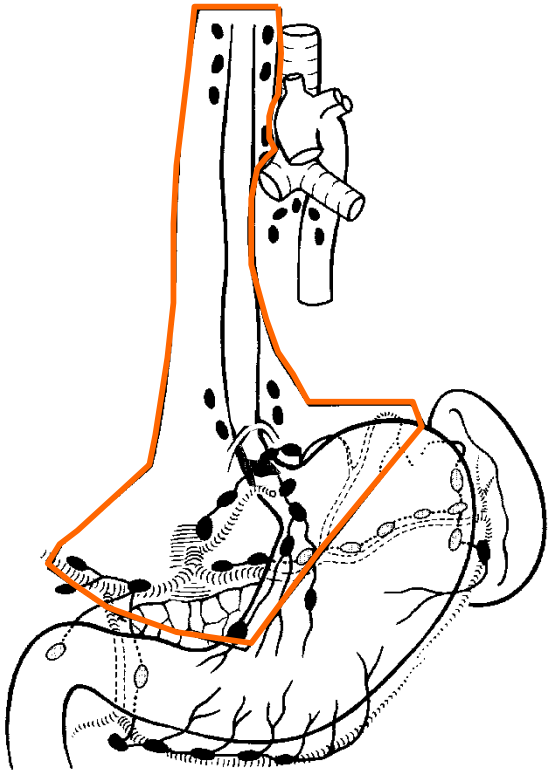
Ösphagektomie
(immer beim AEG I)

Transhiatal erweiteret Gastrektomie
Schnellschnitt des oralen Absetzungsrandes!
(immer beim AEG III)

Limitierte Cardiaresektion
(in uT1m)

+ adäquate Lymphadenektomie

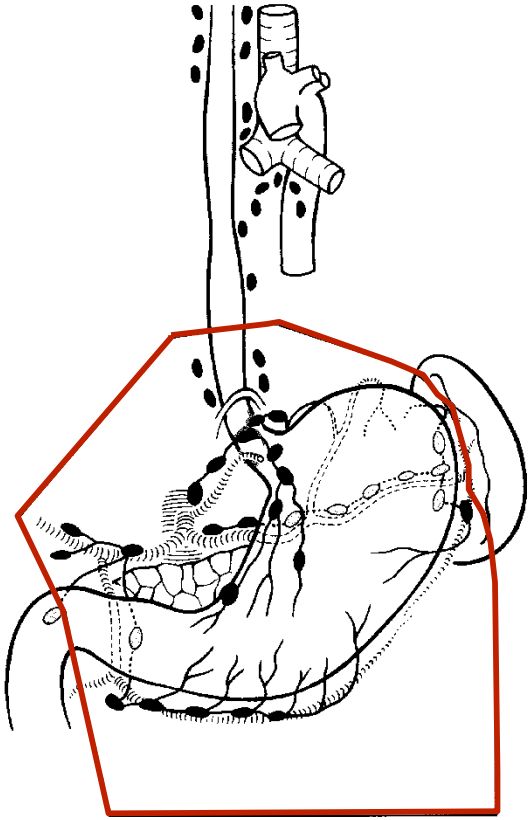
Resektionsausmaß



AEG II

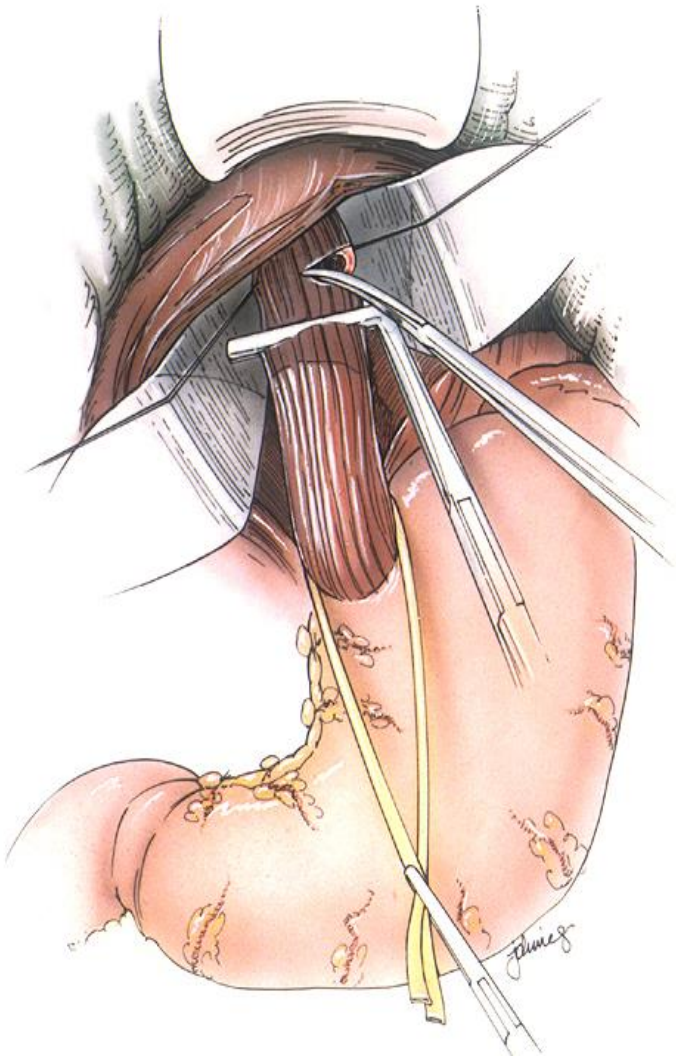
oder

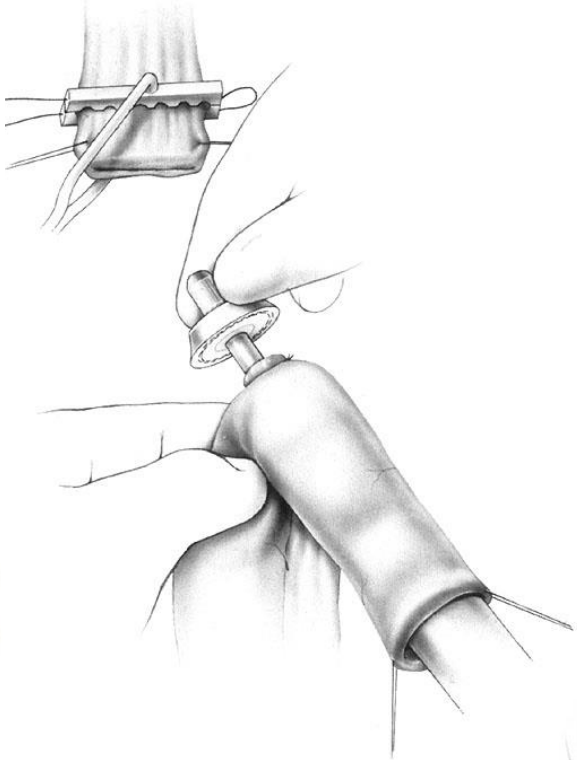
?

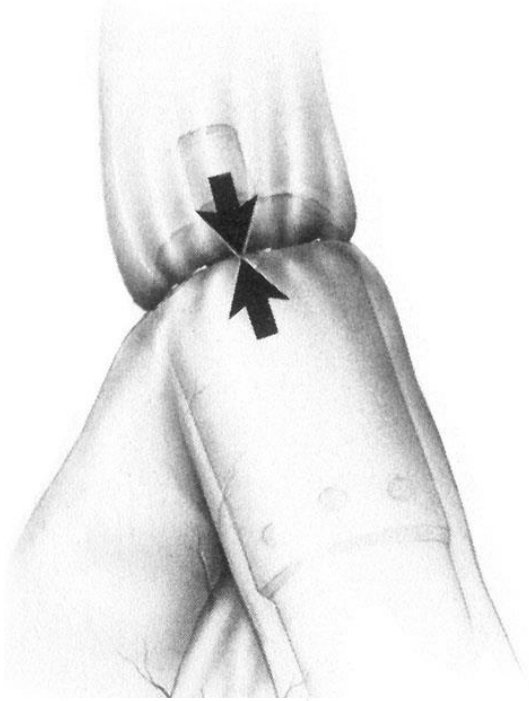


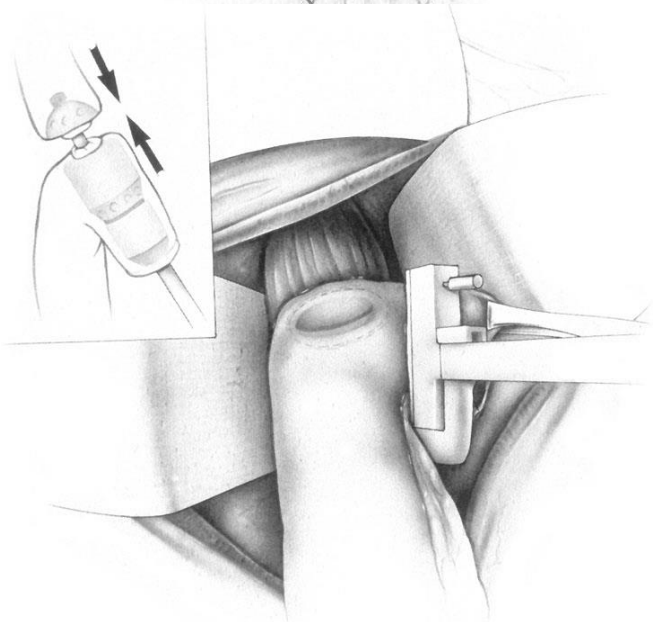
Ivor-Lewis

Transhiatal erweiterte Gastrektomie









Influence of the surgical technique on survival in the treatment of carcinomas of the true cardia (Siewert Type II) - Right thoracoabdominal vs. transhiatal-abdominal approach☆

C. Tosolini [a, b], D. Reim [a], R. Schirren [a], M. Feith [a], H. Friess [a], A.R. Novotny [a, *]

[a] *Klinik und Poliklinik für Chirurgie, Klinikum Rechts der Isar der Technischen Universität München, Germany*
[b] *Visceral- und Thoraxchirurgie, Kreisklinikum Erding, Germany*

- Pat. mit AEG II 2000-2013 (n=270)
  - 34% Ivor Lewis
  - 66% transhiatal erweiterte Gastrektomie
- PS-Matching (ASA, Alter, UICC-Stadium, R-Status, Grading, neoadjuvante Therapie, postoperative Komplikationen, Ausdehnung in den distalen Ösophagus): 62 vs. 62

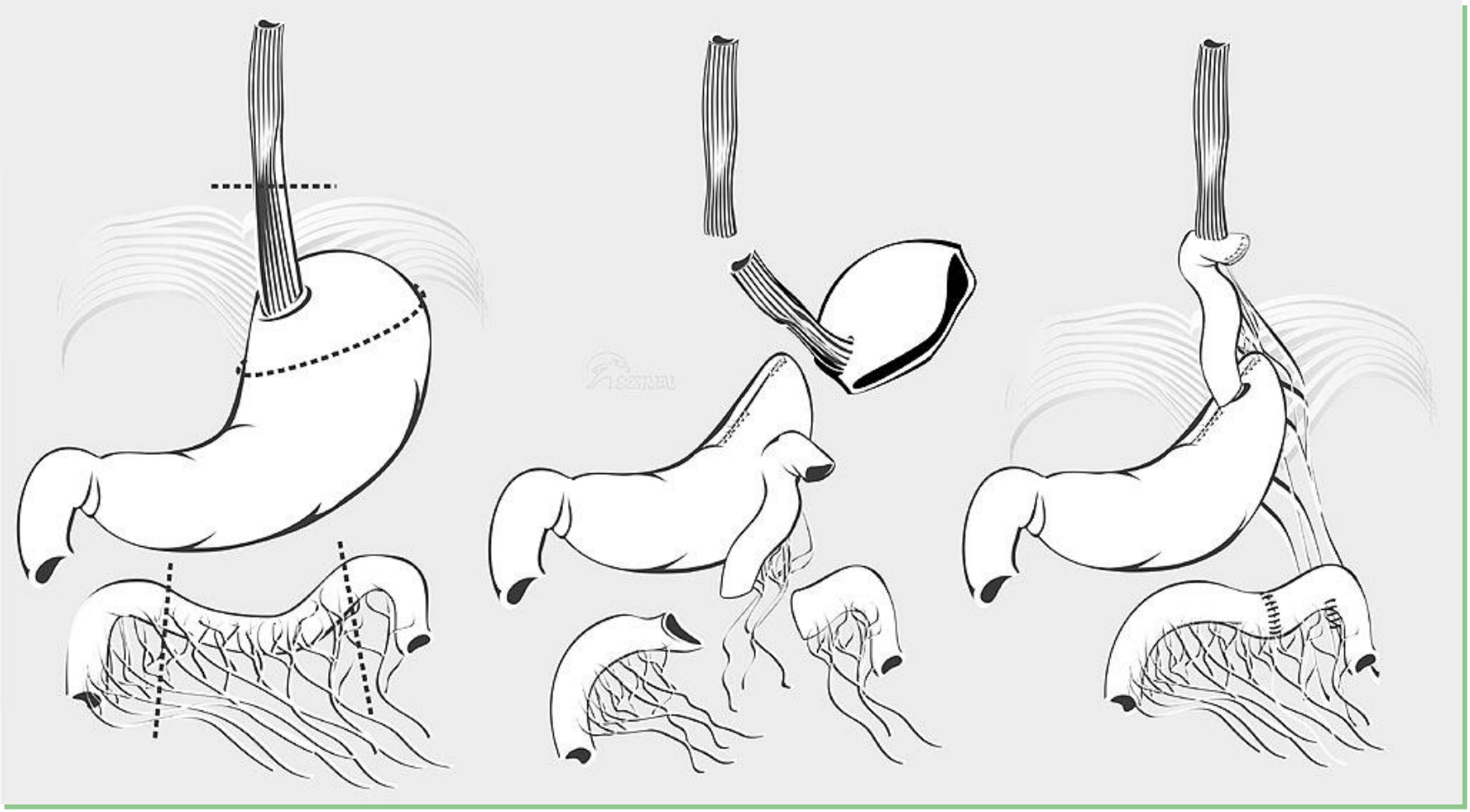
→ Keine Unterschiede in OS und DFS

EJSO 2018

Limitierte Kardiaresektion („OP n. Merendino“)

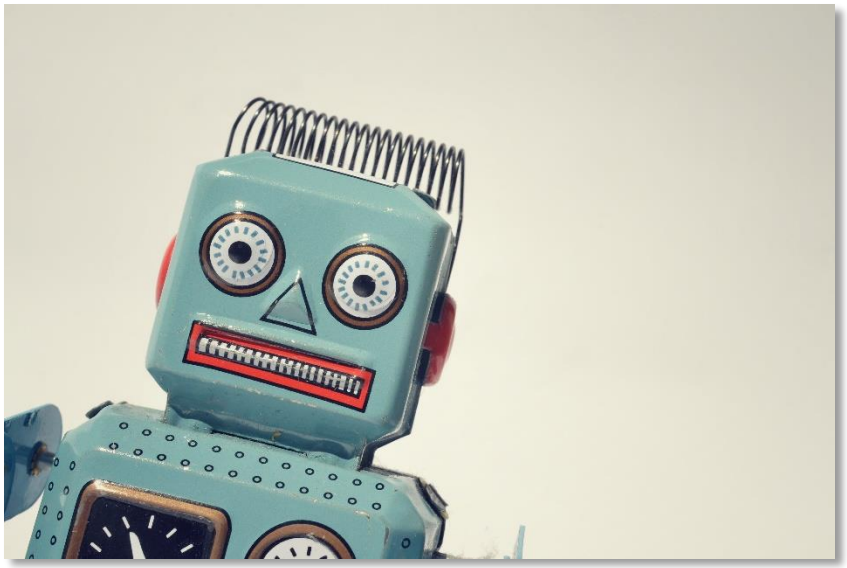
Alternative bei uT1m Tumoren

Rekonstruktion mittels gefäßgestieltem Jejunuminterponat



Stein HJ, Ann Surg 2000

MIC und Robotik



The NEW ENGLAND JOURNAL of MEDICINE

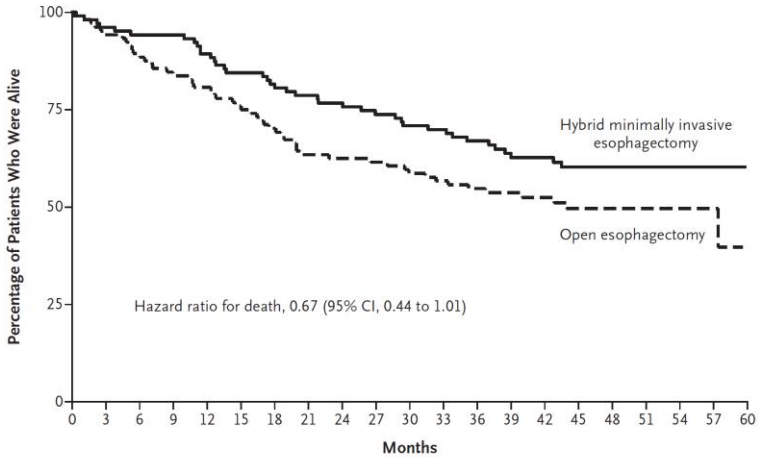
ORIGINAL ARTICLE

Hybrid Minimally Invasive Esophagectomy for Esophageal Cancer

C. Mariette,* S.R. Markar, T.S. Dabakuyo-Yonli, B. Meunier, D. Pezet, D. Collet, X.B. D'Journo, C. Brigand, T. Perniceni, N. Carrère, J.-Y. Mabrut, S. Msika, F. Peschaud, M. Prudhomme, F. Bonnetain,* and G. Piessen, for the Fédération de Recherche en Chirurgie (FRENCH) and French Eso-Gastric Tumors (FREGAT) Working Group†

- Multizentrisches RCT
- 102 vs. 103 Patienten (ITT)
- Major-Komplikationen (CDC≥2): 36% vs. 63%, p<0,001
- V.a. Reduktion pulmonaler Major-Komplikationen durch Hybrid-Verfahren um 50%

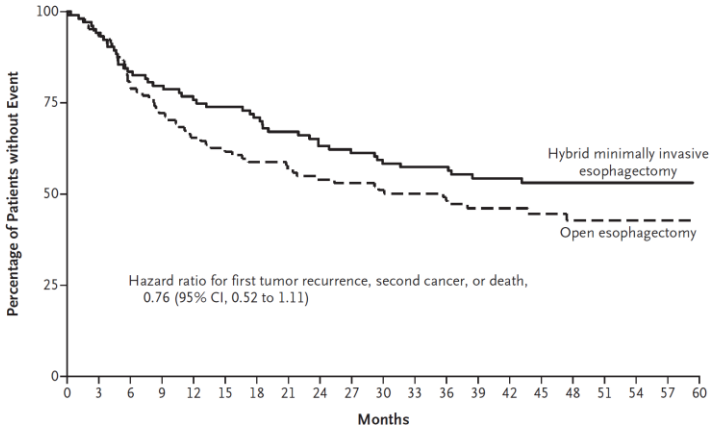
NEJM 2019



No. at Risk																					
Hybrid minimally invasive esophagectomy	103	99	97	97	92	87	84	81	79	76	73	72	69	58	54	43	37	33	27	20	7
Open esophagectomy	104	98	93	87	84	79	73	66	65	64	61	59	57	48	40	33	22	17	13	5	1

Figure 2. Overall Survival among Patients Undergoing Hybrid Minimally Invasive Esophagectomy, as Compared with Open Esophagectomy.

The number of patients at risk in each interval is shown in the table at the bottom of the figure.



No. at Risk																					
Hybrid minimally invasive esophagectomy	103	97	86	82	78	76	73	69	65	63	60	59	59	50	47	39	33	29	24	17	6
Open esophagectomy	104	97	83	75	68	64	61	59	56	55	53	52	50	40	34	28	19	15	12	4	1

Figure 3. Disease-free Survival among Patients Undergoing Hybrid Minimally Invasive Esophagectomy, as Compared with Open Esophagectomy.

Disease-free survival was defined as the time from randomization to the first tumor recurrence (local, regional, or distant), second cancer, or death from any cause. The number of patients at risk in each interval is shown in the table at the bottom of the figure.

Mariette C et al., NEJM 2019

Roboter-assistierte Laparoskopie

Steuerung eines drei- bis vierarmigen Systems (slave) zur Manipulation der Instrumente über eine Bedienkonsole (master)

https://www.intuitive.com/

1
2
3
4
1,3 mm Pb
da Vinci Xi

RANDOMIZED CONTROLLED TRIAL

Robot-assisted Minimally Invasive Thoracolaparoscopic Esophagectomy Versus Open Transthoracic Esophagectomy for Resectable Esophageal Cancer

A Randomized Controlled Trial

Pieter C. van der Sluis, MD, PhD, MSc, Sylvia. van der Horst, MSc,* Anne M. May, PhD,† Carlo Schippers, MSc,* Lodewijk A. A. Brosens, MD, PhD,‡ Hans C. A. Joore, MD,§ Christiaan C. Kroese, MD,¶ Nadia Haj Mohammad, MD, PhD,|| Stella Mook, MD, PhD,** Frank P. Vleggaar, MD, PhD,†† Inne H. M. Borel Rinkes, MD, PhD,* Jelle P. Ruurda, MD, PhD,* and Richard van Hillegersberg, MD, PhD**

- RCT unizentrisch
- 54 vs. 55 Patienten (ITT)
- Komplikationen (MCDC≥2): 59% vs. 80%, p=0,02
- V.a. Reduktion pulmonaler Komplikationen durch Roboter-assistiertes Verfahren um 46%, kardialer Komplikationen um 53%
- Geringerer postop. Schmerz (VAS)
- Bessere funktionelle Erholung und QOL bei Entlassung und 6 Wochen nach Entlassung
- Onkologisches Outcome identisch

Minimally invasive techniques for transthoracic oesophagectomy for oesophageal cancer: systematic review and network meta-analysis

Siaw-Acheampong et al. BJS Open 2020

Totally minimally invasive esophagectomy versus hybrid minimally invasive esophagectomy: systematic review and meta-analysis

Workum vS et al. Dis Esophag 2020

Postoperative short-term outcomes of minimally invasive versus open esophagectomy for patients with esophageal cancer: An updated systematic review and meta-analysis

Akhtar NM et al. Thorac Cancer 2020

Voteile minimalinvasiver Technik

- Weniger pulmonale Komplikationen
- Weniger Wundinfektionen
- Geringerer Blutverlust
- Kürzerer Krankenhausaufenthalt

Thema „Mindestmengen“

BAnz AT 25.01.2021 B6

Beschluss

Gemeinsamer Bundesausschuss

des Gemeinsamen Bundesausschusses über eine Änderung der Mindestmengenregelungen: Änderung der Nr. 3 der Anlage

Vom 17. Dezember 2020

Der Gemeinsame Bundesausschuss (G-BA) hat in seiner Sitzung am 17. Dezember 2020 beschlossen, die Regelungen gemäß § 136b Absatz 1 Satz 1 Nummer 2 des Fünften Buches Sozialgesetzbuch (SGB V) für nach § 108 SGB V zugelassene Krankenhäuser (Mindestmengenregelungen, Mm-R) in der Fassung vom 21. März 2006 (BAnz. Nr. 143, S. 5389), zuletzt geändert am 16. Juli 2020 (BAnz AT 12.08.2020 B1), wie folgt zu ändern:

I. Die Anlage wird wie folgt geändert:

Die Nummer 3 „Komplexe Eingriffe am Organsystem Ösophagus – jährliche Mindestmenge pro Standort eines Krankenhauses: 10“ wird wie folgt gefasst:

„**3. Komplexe Eingriffe am Organsystem Ösophagus für Erwachsene – jährliche Mindestmenge pro Standort eines Krankenhauses:** 26

Original Article

Hospital Volume, In-Hospital Mortality, and Failure to Rescue in Esophageal Surgery

An Analysis of German Hospital Discharge Data

Ulrike Nimptsch, Thomas Haist, Christian Krautz, Robert Grützmann, Thomas Mansky, Dietmar Lorenz

- DRG-Abrechnungsdaten 2010-2015
- 22700 Patienten mit komplexen Ösophaguseingriffen
- Fälle wurden auf KH-Ebene aggregiert und entsprechend des jährlichen Eingriffsvolumens der erbringenden Institutionen in Quintelen unterteilt

Dtsch Ärztebl Int 2018

TABLE 2

Characteristics of treatment cases with complex esophageal surgery in the period 2010 to 2015, by volume quintile

Variables		Volume quintile				
		Very low	Low	Inter-mediate	High	Very high
Treatment cases with complex esophageal surgery, 2010 to 2015	N	4517	4540	4494	4402	4728
Mean annual number of hospitals	Mean	260.3	75.2	48.0	26.5	11.5
Annual case volume per hospital	Median (IQR)	2 (1–4)	10 (9–11)	15 (14–17)	26 (23–32)	62 (49–76)
Demography						
Age 65 years or more	N (%)	2568 (56.9)	2475 (54.5)	2269 (50.5)	2098 (47.7)	2189 (46.3)
Female	N (%)	1131 (25.0)	1096 (24.1)	1026 (22.8)	904 (20.5)	1046 (22.1)
Underlying disease						
Malignant neoplasia (MN) of esophagus	N (%)	3333 (73.8)	3573 (78.7)	3748 (83.4)	3853 (87.5)	4200 (88.8)
MN of neighboring organs or secondary MN	N (%)	726 (16.1)	643 (14.2)	423 (9.4)	215 (4.9)	217 (4.6)
Esophageal perforation	N (%)	153 (3.4)	86 (1.9)	111 (2.5)	96 (2.2)	119 (2.5)
Benign neoplasia of upper gastrointestinal tract	N (%)	31 (0.7)	22 (0.5)	17 (0.4)	24 (0.5)	23 (0.5)
Diverticulosis, achalasia, or obstruction of esophagus	N (%)	80 (1.8)	63 (1.4)	57 (1.3)	73 (1.7)	75 (1.6)
Other	N (%)	193 (4.3)	153 (3.4)	138 (3.1)	141 (3.2)	93 (2.0)
Type of intervention						
Total esophageal resection	N (%)	1377 (30.5)	1938 (42.7)	2171 (48.3)	2416 (54.9)	3331 (70.5)
-- with abdominocervical (transmediastinal) access*[1]	n (%)	179 (13.0)	244 (12.6)	210 (9.7)	177 (7.3)	193 (5.8)
Gastrectomy with subtotal esophageal resection	N (%)	439 (9.7)	384 (8.5)	259 (5.8)	178 (4.0)	213 (4.5)
Partial esophageal resection	N (%)	2646 (58.6)	2165 (47.7)	1993 (44.3)	1734 (39.4)	1096 (23.2)
Reconstruction of esophageal lumen (as isolated surgery)	N (%)	55 (1.2)	53 (1.2)	71 (1.6)	74 (1.7)	88 (1.9)
With splenectomy	N (%)	430 (9.5)	373 (8.2)	226 (5.0)	180 (4.1)	190 (4.0)
With cholecystectomy	N (%)	973 (21.5)	1043 (23.0)	1045 (23.3)	1154 (26.2)	1668 (35.3)
With resection of other abdominal organs*[2]	N (%)	704 (15.6)	598 (13.2)	433 (9.6)	388 (8.8)	452 (9.6)
Length of stay (days)	Mean	30.2	29.8	30.8	31.1	27.9
	Median (IQR)	22 (16–36)	22 (16–34)	22 (16–36)	22 (16–37)	20 (16–31)
Died in hospital	N (%)	553 (12.2)	453 (10.0)	449 (10.0)	384 (8.7)	323 (6.8)
With at least one documented complication*[3]	N (%)	2540 (56.2)	2377 (52.4)	2448 (54.5)	2533 (57.5)	2519 (53.3)

The volume quintile classifies the relative case volume of the treating hospital in the treatment year. IQR, Interquartile range (25th to 75th percentile); N, number; n, number (included therein); the minimum and maximum hospital case volumes cannot be stated on grounds of data protection.

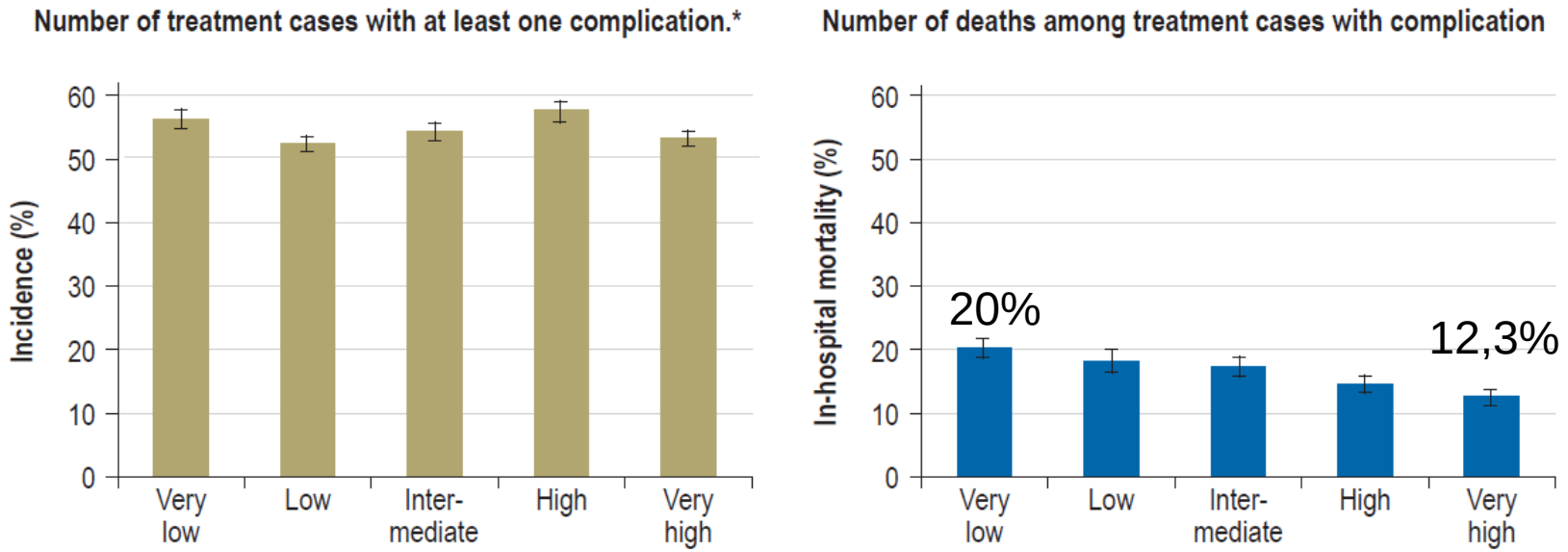
*[1] Percentage refers to total esophageal resection.

*[2] Small intestine, large intestine, liver, or pancreas

*[3] Surgical, septic, or cardiovascular complication *(eTables 3 and 4)*

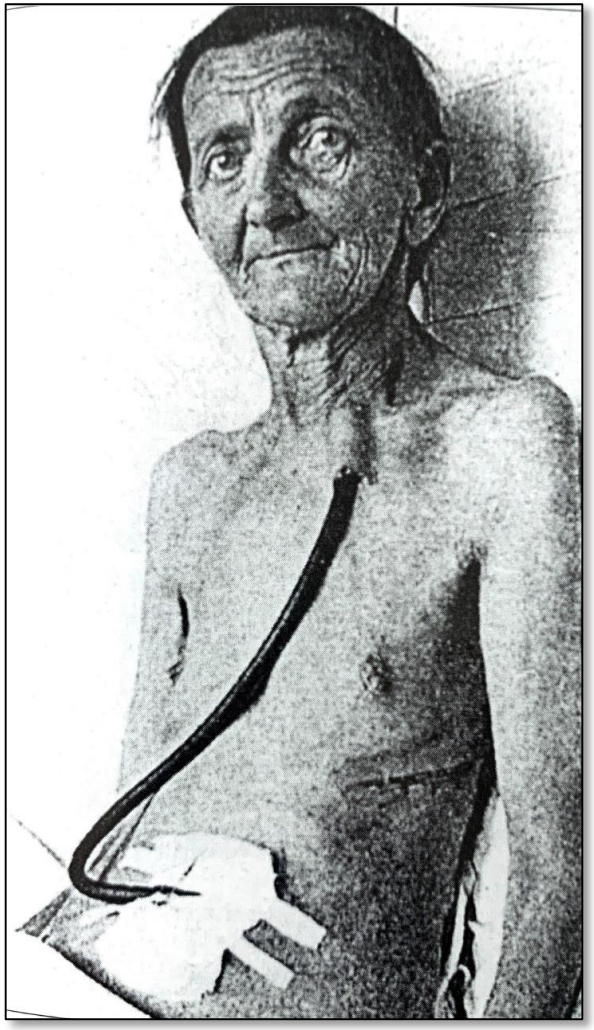
Nimptsch U et al., Dtsch Ärztebl Int 2018

FIGURE 3



Incidence of complications and in-hospital mortality in patients with complications ("failure to rescue"), by volume quintile
With 95% confidence interval. The volume quintile categorizes the relative case volume of the treating hospital in the treatment year. Median volumes per year and hospital: very low 2; low 10; intermediate 15; high 26; very high 62.

* Complications included: endoscopic intervention (as sign of anastomotic insufficiency), pleural drainage/aspiration, pleural surgery, chylothorax, relaparatomy/rethoracotomy, transfusion of six or more units of blood, mediastinitis, pleural empyema, peritonitis (except with esophageal perforation), pneumonia, sepsis, acute myocardial infarction, stroke, or pulmonary embolism (see also *eTables 2 and 4*)

Nimptsch U et al., Dtsch Ärztebl Int 2018

Vielen Dank für Ihre Aufmerksamkeit !