



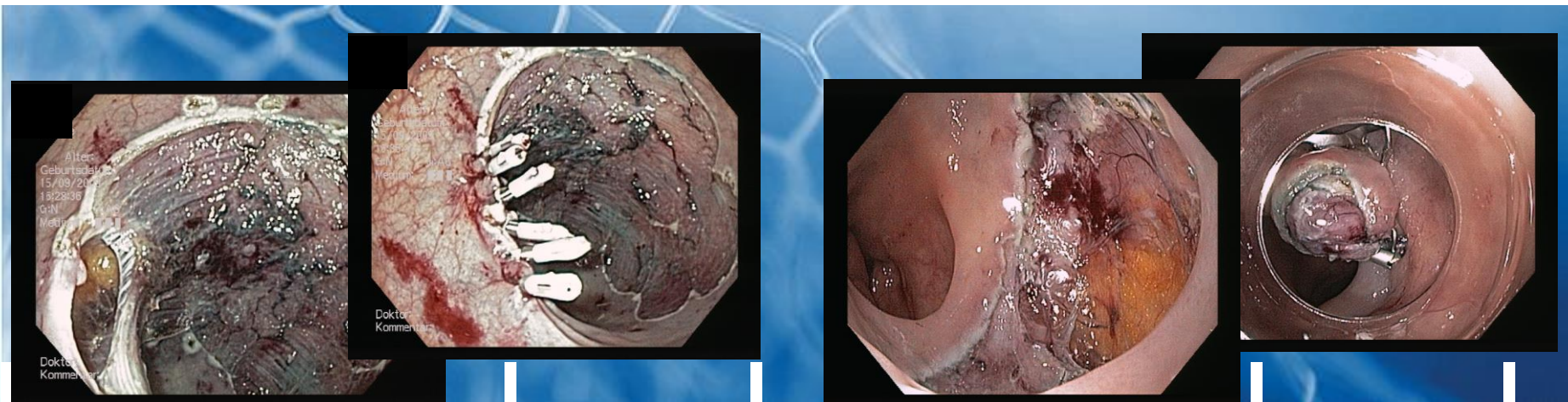
Perforation bei der Endoskopie: call the surgeon?

Komplikationen und Katastrophen

39. Schweizerische Koloproktologie-Tagung. Bern, 13.1.2018

Karel Caca

Klinikum Ludwigsburg, Deutschland



Colonoscopic perforation: Incidence, risk factors, management and outcome

Table 1 Incidence of CP, management and outcomes from recent series with sample size > 30000 cases

Author	Year	Number of patients	CP rate	Death rate in CP cases	CPT rate in CP cases	Surgical treatment (%)
Araghizadeh <i>et al</i> ^[14]	2001	34 620	0.090	3.2	NA	74
Gatto <i>et al</i> ^[9]	2003	74 584	0.145	5.6	NA	NA
Korman <i>et al</i> ^[17]	2003	116 000	0.032	0.0	NA	95
Cobb <i>et al</i> ^[16]	2004	43 609	0.032	0.0	21.4	93
Lüning <i>et al</i> ^[4]	2007	30 366	0.115	8.6	40.0	100
Rabeneck <i>et al</i> ^[18]	2008	97 091	0.085	NA	NA	NA
Iqbal <i>et al</i> ^[2]	2008	258 248	0.070	7.0	36.0	92
Teoh <i>et al</i> ^[3]	2009	37 971	0.113	25.6	48.7	91
Arora <i>et al</i> ^[15]	2009	277 434	0.082	NA	NA	NA

CP: Colonoscopic perforation; CPT: Complication; NA: Not available.

Inzidenz 0,02-5% (diagnostische/therapeutische Koloskopie), **Letalität bis >10%**

Some investigators have suggested that predisposing factors for poor outcomes of CP patients include .. **a delayed diagnosis**, ..

Lohsiriwat, WJG, 2010



Promptness of diagnosis is the main prognostic factor after colonoscopic perforation

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Extent of intraperitoneal contamination	Time to diagnosis				Type of procedure		
	< 12 h	12–24 h	> 24 h	<i>P</i>	Single stage	Faecal diversion	<i>P</i>
Minimal	9	1	0	< 0.01	9	1	< 0.01
Moderate	3	1	1		1	4	
Faeculent	1	2	4		0	7	

Morbidity and mortality rates were 31% and 13.6%

Prompt diagnosis was the most powerful predictor of outcome of CP. Multiple logistic regression analysis showed that morbidity and mortality were significantly related to a delay in diagnosis of more than 24 h ($P = 0.03$ and $P = 0.04$)

Factor	Odds ratio (95% CI)	<i>P</i> value
Delay in diagnosis (> 24 h)	5.8934 (1.0937–15.3163)	0.0326
Age > 60 years	0.1250 (0.0072–2.1765)	0.1537
Sex	1.2500 (0.1180–13.2407)	0.8530
ASA status ≥ 3	1.1805 (0.3631–3.8380)	0.7826

Original Article

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Prompt Management Is Most Important for Colonic Perforation After Colonoscopy

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Department of Surgery, St. Vincent's Hospital, The Catholic University of Korea College of Medicine, Suwon, Korea

...if the diagnosis of colon perforation is **delayed for more than 24 hours, most patients will require a colectomy or fecal diversion**. Therefore, if the morbidity and the mortality associated with colon perforation are to be reduced, prompt diagnosis and management are very important

Auch für die endoskopische Therapie gelten **die gleichen Zeitintervalle (6-12h)**

**Endoskopie sogar noch zeitkritischer !
(keine Lavage, Neubesiedelung des Darms)**



Klinikum Ludwigsburg

Im Verbund der Regionalen
Kliniken Holding RKH

Table 1. Risk factors of major treatment for colon perforation after colonoscopy

Variable	Minor treatment (n = 18)	Major treatment (n = 9)	P-value
Age (yr), mean $\pm$ SD	61.0 $\pm$ 10.1	64.1 $\pm$ 9.8	0.455
Sex			0.166
Male	9	7	
Female	9	2	
Comorbidity			
Crohn's disease	1	0	0.471
Hypertension	5	4	0.386
Diabetes mellitus	3	1	0.702
History of cerebrovascular disease	2	2	0.444
Purpose of colonoscopy			0.083
Diagnostic	14	4	
Therapeutic	4	5	
Location			0.136
Sigmoid colon	11	8	
Other	7	1	
Intervals of diagnosis of colon perforation			0.003
Within 24 hours	16	3	
After 24 hours	2	6	
Length of hospital stay, mean $\pm$ SD	10.0 $\pm$ 6.5	14.0 $\pm$ 6.5	0.017

SD, standard deviation.

Kolonperforation - Chirurgie



Table 4. Multiple Logistic Regression Analysis for Predictors of Mortality

Factor	Relative Risk (95% CI)	P Value
ASA class ≥ 3	11.73 (1.35-102.20)	.009 ^a
Antiplatelet therapy	8.28 (1.26-54.71)	.001 ^a
Age >60 y	1.43 (0.14-14.35)	.45
Time to presentation >48 h	0.32 (0.04-2.93)	.21
Fair to poor bowel preparation	3.25 (0.59-18.03)	.35
Moderate to severe contamination	12.67 (1.32-121.47)	.16

- Morbidität 39-63 %
- Mortalität 0-50 %
- Stomarate 38,5 %



Kolonperforation

Potentiell lebensbedrohliche Komplikation, die eine **umgehende Behandlung** erfordert !

Umgehend = sofort?

Was heißt „umgehende Behandlung“?





Je früher operiert wird, desto besser ist das Ergebnis

Kritische 6h nach stattgehabter Perforation (chirurgische Studien)

... vorausgesetzt, der Patient muss operiert werden!

Wenn operiert werden muss, dann möglichst zeitnah !

Frage:

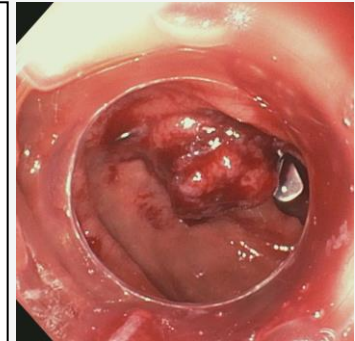
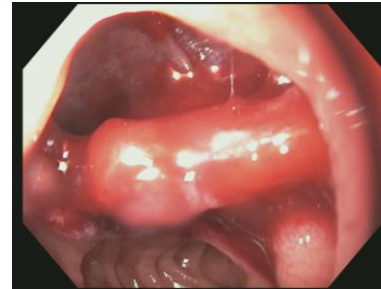
Muss jeder Patient operiert werden ?



Perforation vs. Leckage/Insuffizienz vs. Fistel

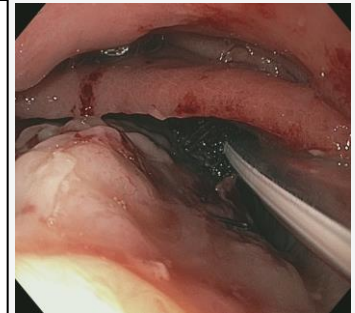
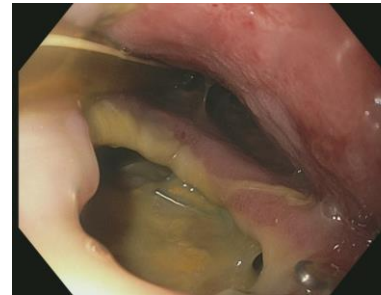
Perforation

- i.d.R. iatrogen i.R. nach endoskopischen Intervention
- selten spontan (Boerhave Syndrom)
- i.d.R. rasche Diagnose, meist noch während Intervention



Leckage

- i.d.R. Anastomosensinsuffizienzen nach chir. Therapie
- Diagnose meist später
- meist mit (infizierter) Flüssigkeitskollektion



Fisteln

- i.d.R. nach chir. Therapie
- interne vs externe Fisteln

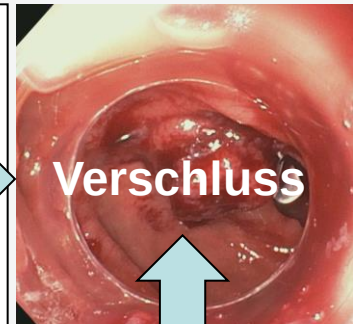
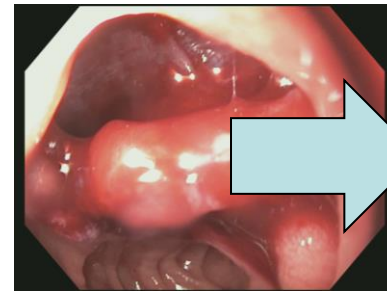


Drainage

Perforation vs. Leckage/Insuffizienz vs. Fistel

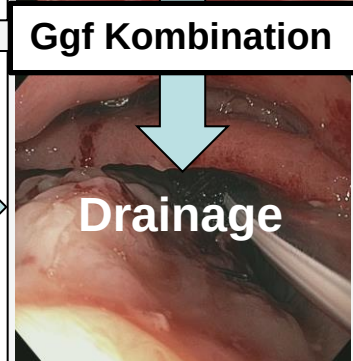
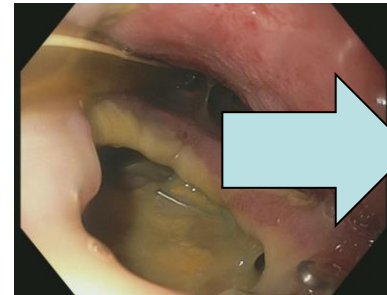
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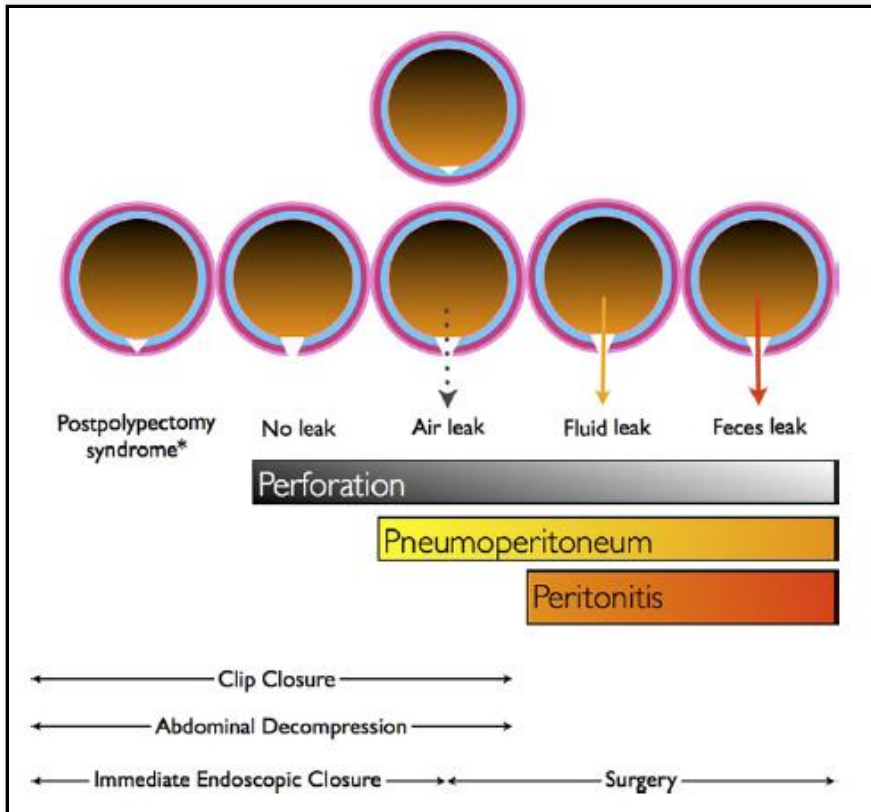
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Drainage

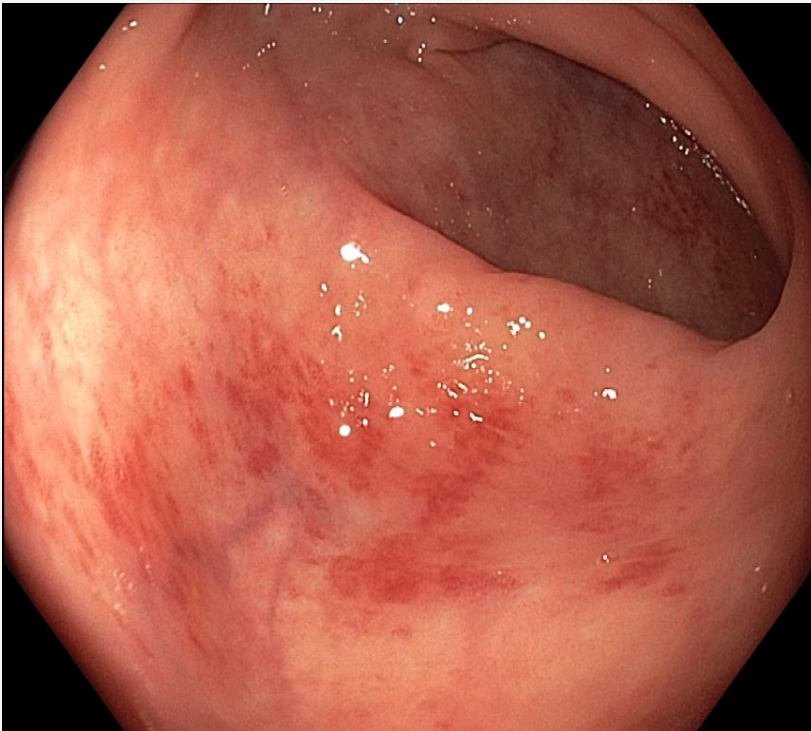
Endoskopischer Perforationsverschluss - Prinzipien -



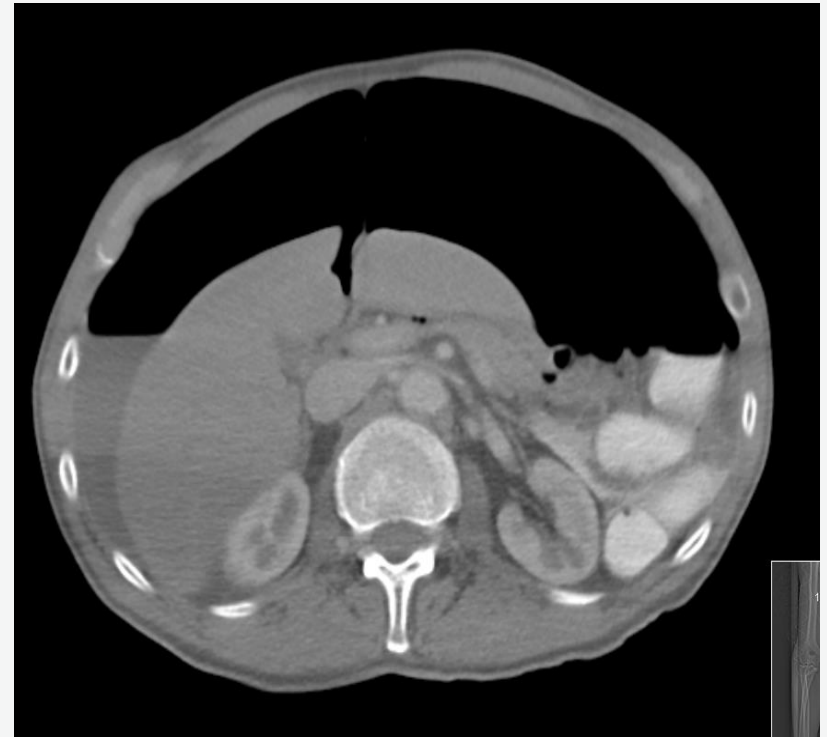
10 + 1 Gebote

1. Sofortige Identifikation der Perforation
2. „Freie Luft“ ≠ Chirurgie
3. Menge „freier Luft“
≠ proportional zur Perforationsgröße
4. „Freie Luft“ ≠ infektiös
5. „Freie Luft“ unter Spannung
= medizinischer Notfall
6. „Freie Luft“ disseziert = „Emphysem“
7. „Freie Luft“ kann persistieren
ohne klinische Konsequenz
8. Perforationen verschließen sich
in der Regel nach Drainage o. Diversion
9. Leckage von Kontrastmittel
→ unmittelbare Intervention erforderlich
10. Frustranter endoskopischer Verschluss
→ Chirurgie
11. Frühzeitige Antibiotikagabe

... einer von Tausend



Persönliche Zuweisung zur Vorsorgekoloskopie.



Was nun ?
Wann nun ?

TECHNICAL ADVANCE

Open Access

Emergency percutaneous needle decompression for tension pneumoperitoneum

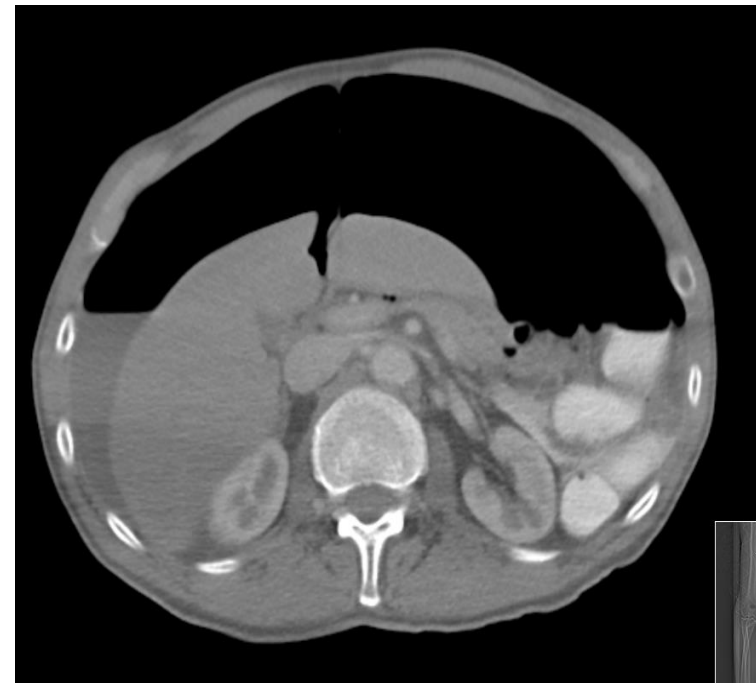
Costanza Chiapponi^{1*}, Urban Stocker^{1†}, Markus Körner^{2†} and Roland Ladurner^{1*}

.. tension pneumoperitoneum due to iatrogenic bowel perforation is a rare but life threatening condition and it can be managed in a preclinical and clinical setting with emergency percutaneous needle decompression like tension pneumothorax ...

Keine Ausdruck des Perforationsausmaßes,
sondern der stattgehabten Luftinsufflation

Umgehende Dekompression bei
Kreislaufbeeinträchtigung

Umgehend = Sofort





Endoskopische Verschlusstechniken im GI-Trakt

Clips

QuickClip2 (Olympus)

Resolution Clip (BS)

Instinct Clip (Cook)

SureClip (Micro-Tech)

OTSC (Ovesco)



Nahtverfahren

T-Tags (Ethicon)

Purse string modified T-Tags (Cook)

Eagle Claw VIII (Olympus)

Purse string-suturing device (LSI)

EndoStitch (Apollo)

Flexible EndoStitch (Covidien)

EndoCinch (Bard)

SurgAssist (Power Medical)

ESD (Cook)

G-Prox (USGI)

GERDX(G-Surg)

Esophyx (Endogastr. Sol.)

Stents

Plastik

Metall

+/- Cover



„Schwämme“

E-VAC

ETVARD



Perforationsverschluß - Through-The-Scope Clips

Technik:

**Linearer Verschluß –
(„Reißverschluß“)**

**Sichere Adaptation der
Perforationsränder unter Druck
essentiell**

Limitationen:

- Größe der Perforation
- Form – „nahezu“ linear
- Lokalisation
- „Qualität“ der Ränder





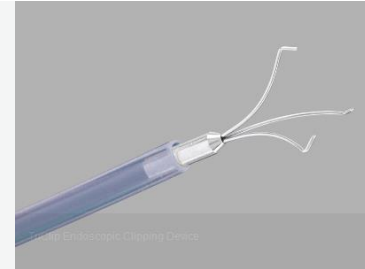
Through-The-Scope Clips



Olympus Quick Clip 2 (7.5 mm)
Olympus Quick Clip 2 Long (9 mm)



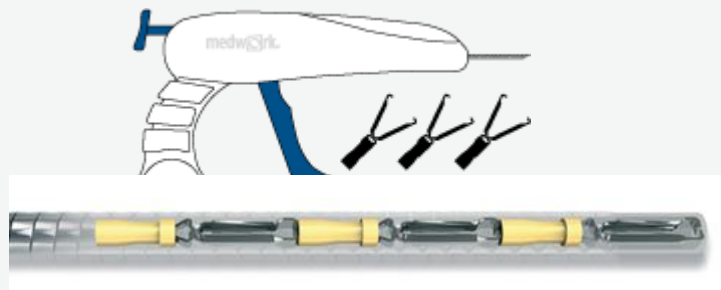
Olympus EZ Clip
(4, 6, 7.5, 9 mm; 90°+135°)



Cook TriClip



**Boston
Resolution Clip**



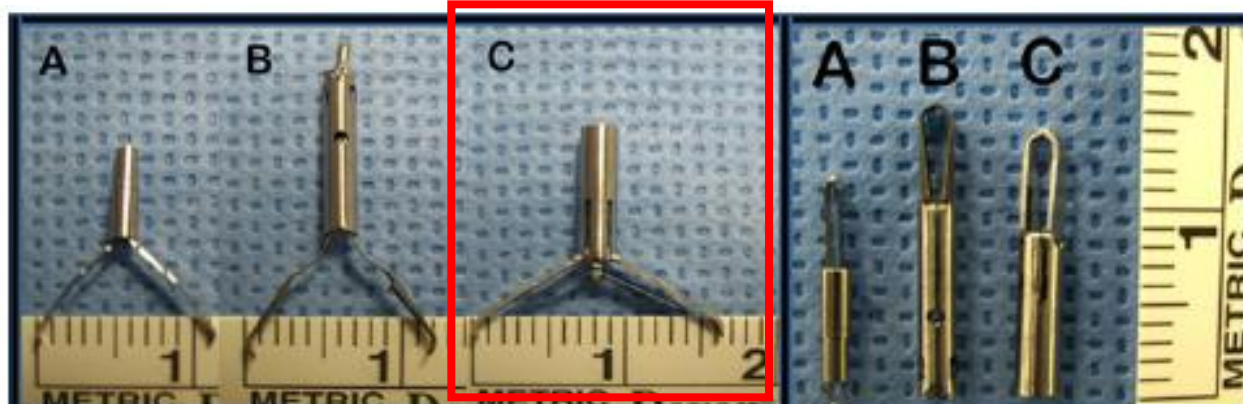
Medwork Clipmaster



Cook Instinct Clip

Through-The-Scope Clips

QuickClip2, Resolution Clip, Instinct Clip



	A	B	C
Features	QuickClip2 long (Olympus)	Resolution clip (Boston Scientific)	Instinct clip (Cook Medical)
Sheath diameter (French)	7	7	7
Sheath length (cm)	235	230	230
Jaw opening width (mm)	11	11	16
Inside measurements of the closed clip (mm)	$1.25 \times 5.09 \times 0.96$	$1.53 \times 4.74 \times 1.57$	$1.59 \times 5.5 \times 1.72$
Reopening and repositioning ability	No	Yes	Yes
Rotation ability	Yes	No	Yes
Clip material	Stainless steel	Stainless steel	Stainless steel and nitinol
Deployment	Two-step	Three-step	Two-step
MRI approval	No	No	Up to 3 tesla



Through-The-Scope Clips

Biomechanic ex-vivo comparison

QuickClip2, Resolution Clip, Instinct Clip

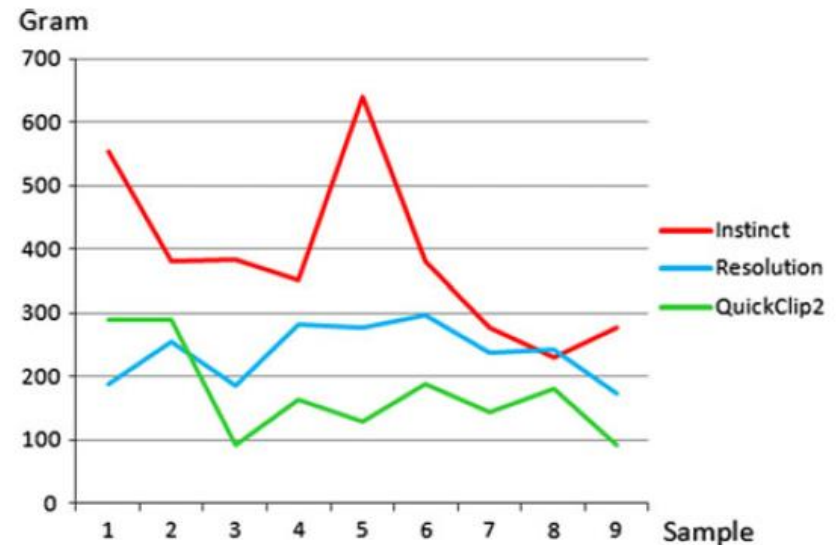
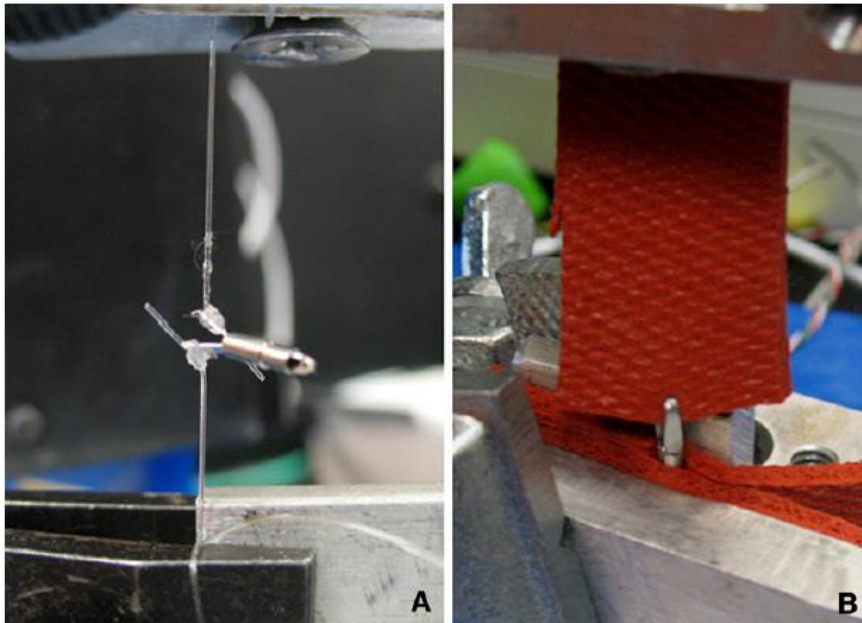


Fig. 8 Graph showing different opening strengths needed to open a closed clip

Perforationsverschluß Through-The-Scope Clips

Retrospektive Studie

7589 Koloskopien

30 Perforationen

-> 28/30 endoskop. Verschluß erfolgreich

-> 2/30 Chirurgie

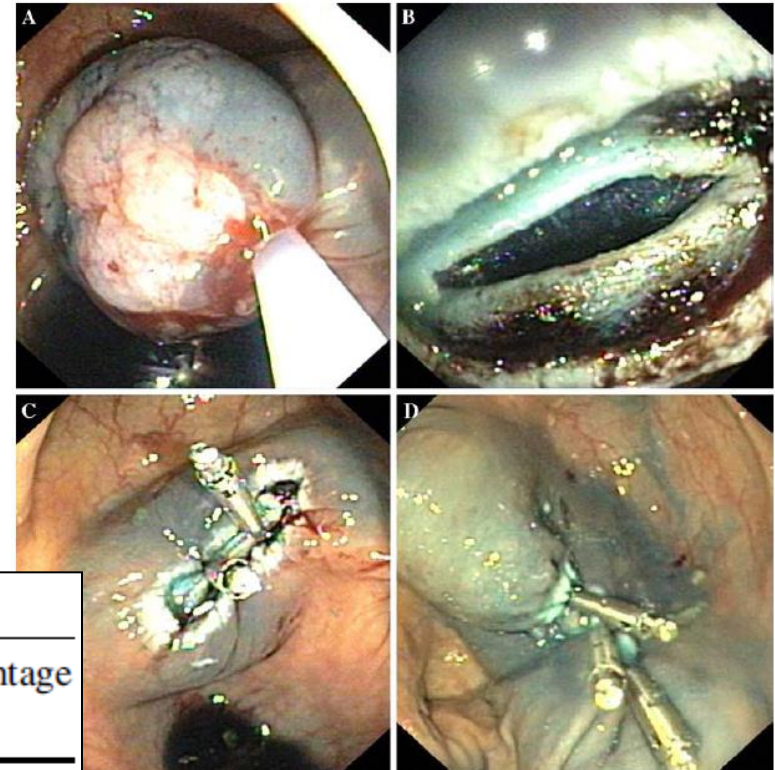


Table 4 Endoluminal repair of perforation with clips

	Number of Patients	Percentage
Perforation recognized within endoscopy	28/30	93.3%
Clip application not possible	1/28	3.6%
Initial surgery	1/1	100%
Clip application possible	27/28	96.4%
Conservative treatment	25/27	92.6%
Surgery after clip application	2/27	7.4%

Endoscopic clip closure versus surgery for the treatment of iatrogenic colon perforations developed during diagnostic colonoscopy: a review of 115,285 patients

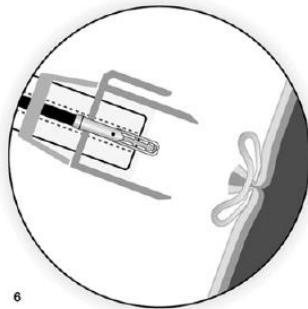
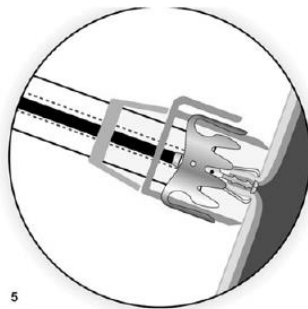
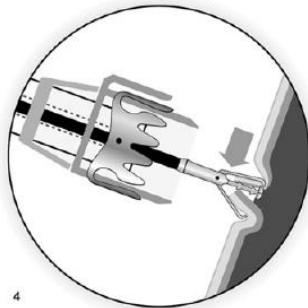
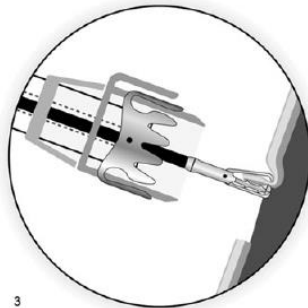
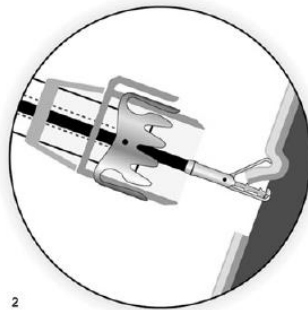
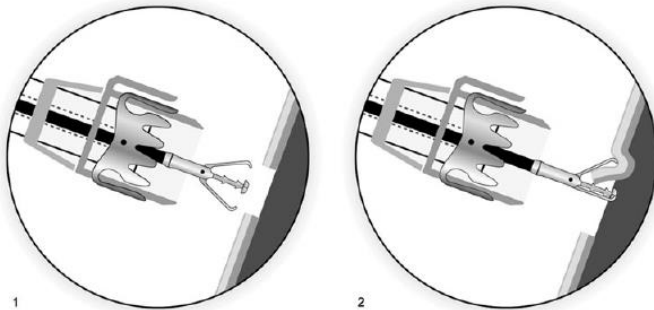
Joon Sung Kim · Byung-Wook Kim ·
Jin Il Kim · Jeong Ho Kim · Sang Woo Kim ·
Jeong-Seon Ji · Bo-In Lee · Hwang Choi

	Total (n = 27)	Clipping (n = 13) ^a	Surgery (n = 11) ^b	P value
Age (years)	67 (44–83)	66.9 (44–82)	68.1 (56–83)	0.96
Male:female	10:17	5:8	5:6	0.53
History of abdominal operation	11/27	4/13	6/11	0.22
Operator				
Staff/fellow	5/22	3/10	2/9	0.59
Size of defect (long axis, cm) (range)	1.1 (0.3–2.5)	1.0 (0.3–1.6)	1.4 (0.6–2.5)	0.04
Location of perforation				0.61
Sigmoid colon	16	7	7	
Rectum	8	5	3	
Descending colon	3	1	1	
Fasting (days) (range)	4.7 (1–8)	4.2 (1–7)	5.1 (2–8)	0.34
Intravenous antibiotics (days) (range)	7.9 (3–18)	6.8 (4–10)	9 (3–18)	0.40
Hospital stay (days) (range)	11.3 (5–55)	9 (5–19)	14.5 (6–55)	0.41



In summary, endoscopic closure of iatrogenic perforations showed a **success rate of 81.7 %**. No further surgical management after successful closure was required. These results suggest that endoscopic closure may be an important alternative to surgery in the near future.

Over-The-Scope Clips (OTSC, Ovesco)



Perforationsverschluß – OTSC – animal in-vivo study



Randomized
in vivo animal study
Kolon Perforationen
(n=24)

Burst pressure

Kolon nativ: 140 mmHg

Perforationsverschluß – OTSC – animal in-vivo study



Randomized
in vivo animal study
Kolon Perforationen
(n=24)

Burst pressure

Kolon nativ: 140 mmHg

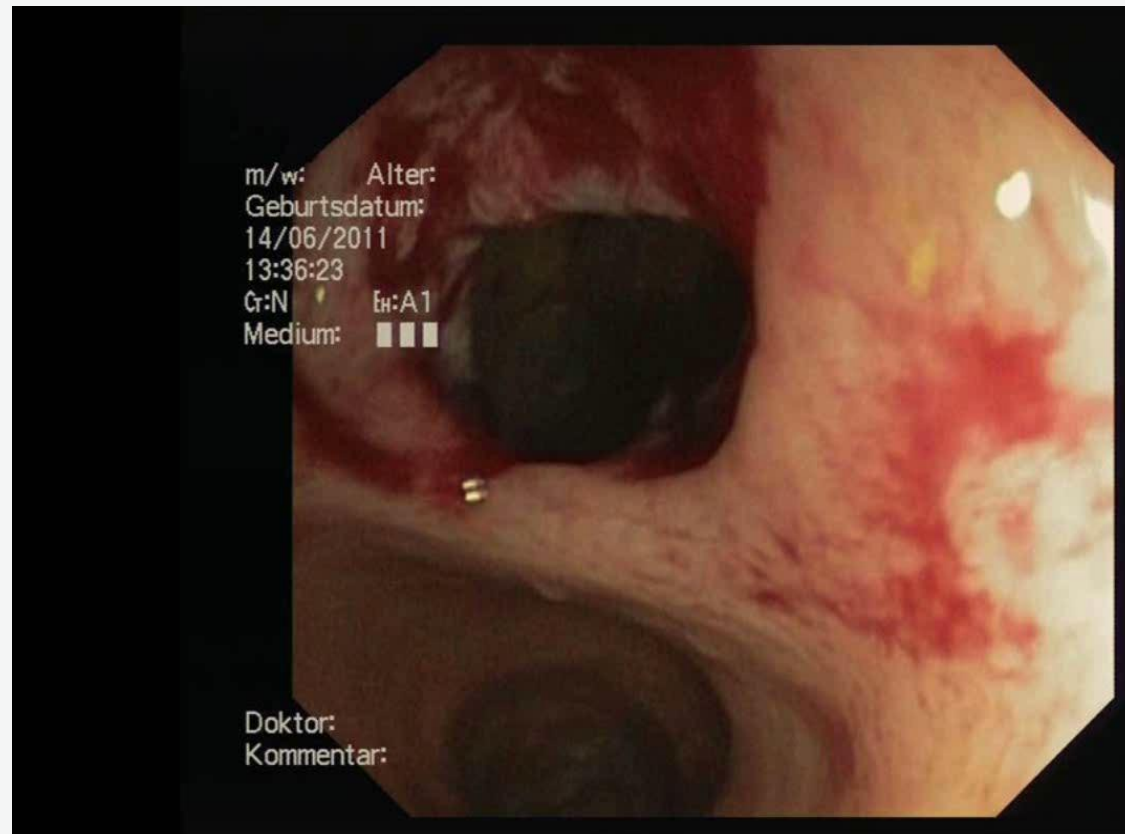
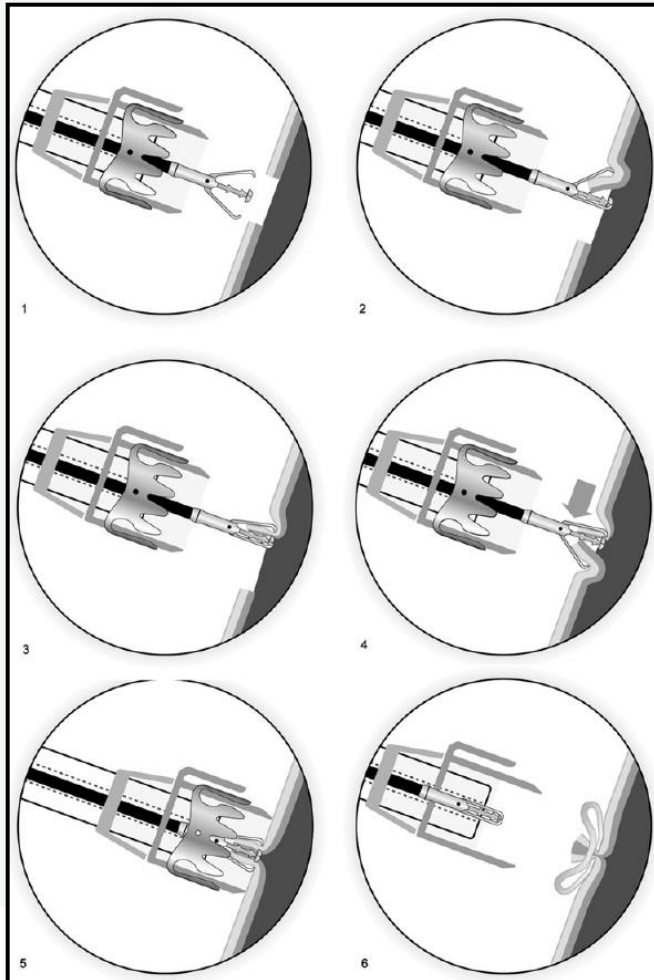
OTSC: 62,8 mmHg

Surgical sutures: 67,4 mmHg

(p=0,693)



Perforationsverschluß – Kolon - OTSC





Perforationsverschluß OTSC: Prospektive Multicenter-Studie

Design:

- Prospektiv, international, multi-zentrisch
- Primäre Endpunkte: erfolgreicher Verschluß, adverse events < 30d

Patienten:

- Akute iatrogene Perforationen (5x Oesoph.; 6x Magen; 12x Duodenum; 13 Kolon)

Ergebnisse:

- **Erfolgreicher Verschluß: 92%**
- OP erforderlich: 3 Patienten
- 1 Todesfall innerhalb von 36 Stunden nach erfolgreichem Verschluß einer Kolonperforation
- **Gesamt-Erfolgsrate: 89%**
- Dauer des Eingriffs: 5 min

Location	Total (n = 36)	Successful endoscopic closure (%)
Esophagus	5 (14)	5 (100)
Stomach	6 (17)	6 (100)
Duodenum	12 (33)	9 (75)
Colon	13 (36)	12 (92)

Literaturübersicht zum Perforationsverschluss durch „over the scope“-Clips *Nur iatrogene akute Perforationen

Autor, Jahr	Art der Studie	Patientenanzahl ^{*1}	Lokalisation	technischer Erfolg	klinischer Erfolg	Follow-up (Wochen)	Größe der Perforation	OTS-Clip assoziierte Komplikationen
Baron, 2012 (40)	retrospektive Fallserie	5	Ösophagus (n=1), Magen (n=2), Jejunum (n=1), Colon (n=1)	100 %	75 %	k. A.	k. A.	Lumenobstruktion Jejunum durch Clip (n=1)
Gubler, 2012 (40)	prospektive Fallserie	14	Duodenum (n=2), Magen (n=3), Colon (n=9)	93 %	78 %	4 bis 92	6–30 mm	keine
Hagel, 2012 (e1)	retrospektive Fallserie	4	Ösophagus (n=2) Rektum (n=2)	50 %	0 %	k. A.	4–14 mm	keine
Kirschniak, 2007 (e2)	retrospektive Fallserie	4	Magen (n=1) Colon (n=3)	100 %	100 %	1–4	4–8 mm	keine
Kirschniak, 2011 (e3)	retrospektive Fallserie	11	oberer Gastrointestinaltrakt (n=7) Colon (n=4)	100 %	100 %	1–4	k. A.	keine
Nishiyama, 2013 (e4)	retrospektive Fallserie	10	Ösoph. (n=1) Magen (n=3) Duodenum (n=2) Colon (n=2) Rektum (n=2)	100 %	90 %	1–30	25–50 mm	keine
Sandmann, 2011 (e5)	retrospektive Fallserie	3	Magen (n=1) Duodenum (n=1) Colon (n=1)	100 %	100 %	4–32	k. A.	keine
Seebach, 2010 (e6)	retrospektive Fallserie	4	Magen (n=1) Colon (n=3)	75 %	50 %	10–37	k. A.	keine
Voermans, 2012 (e7)	prospektive, nicht-kontrollierte Studie	31	Ösophagus (n=4) Magen (n=4) Duodenum (n=11) Colon (n=12)	92 %	89 %	4	bis 30 mm	eine Ösophagusperforation durch OTS-Clip beim Einführen
Haito-Chavez, 2014 (e8)	retrospektive multizentrisch Studie	48	Ösophagus (n=10) Magen (n=13) Duodenum/Dünndarm (n=12) Colorektum (n=12)	97,5 %	90 %	30	4–11,5	keine
Farnik, 2015 (e10)	retrospektive Studie	15	oberer Gastrointestinaltrakt	97,1 % ^{*2}	71 % ^{*2}	38	bis 30 mm	keine

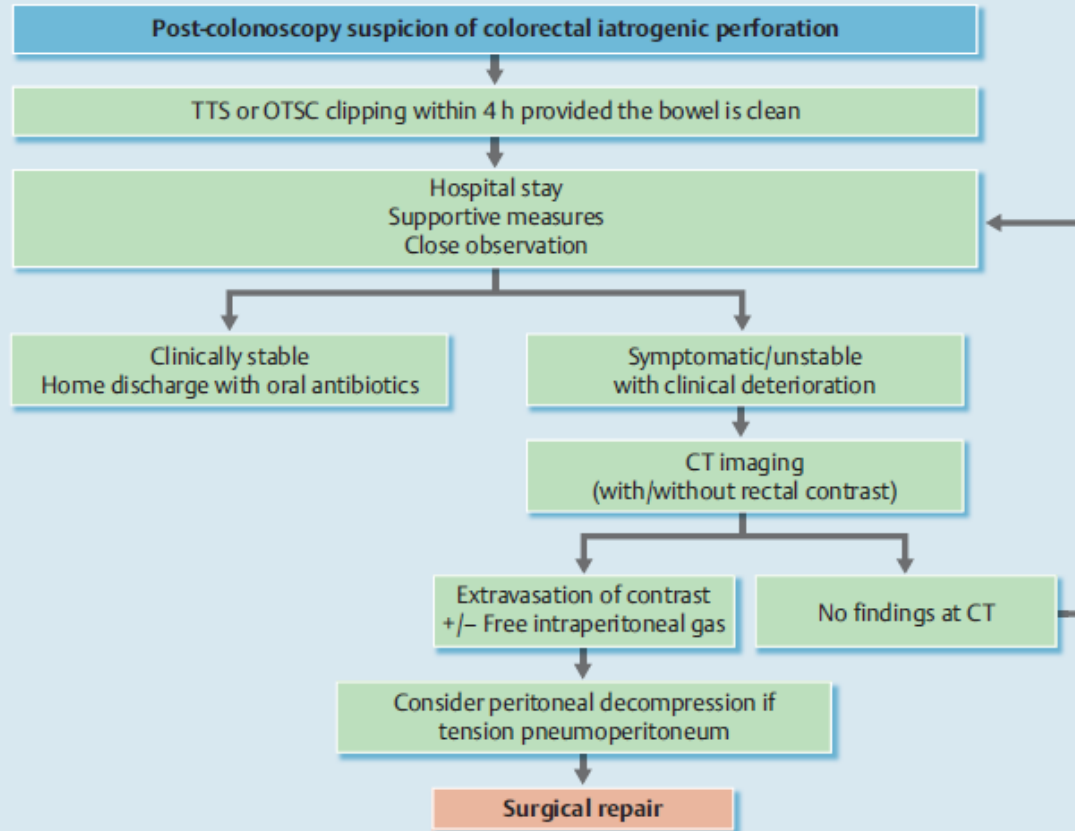


Diagnosis and management of iatrogenic endoscopic perforations: European Society of Gastrointestinal Endoscopy (ESGE) Position Statement



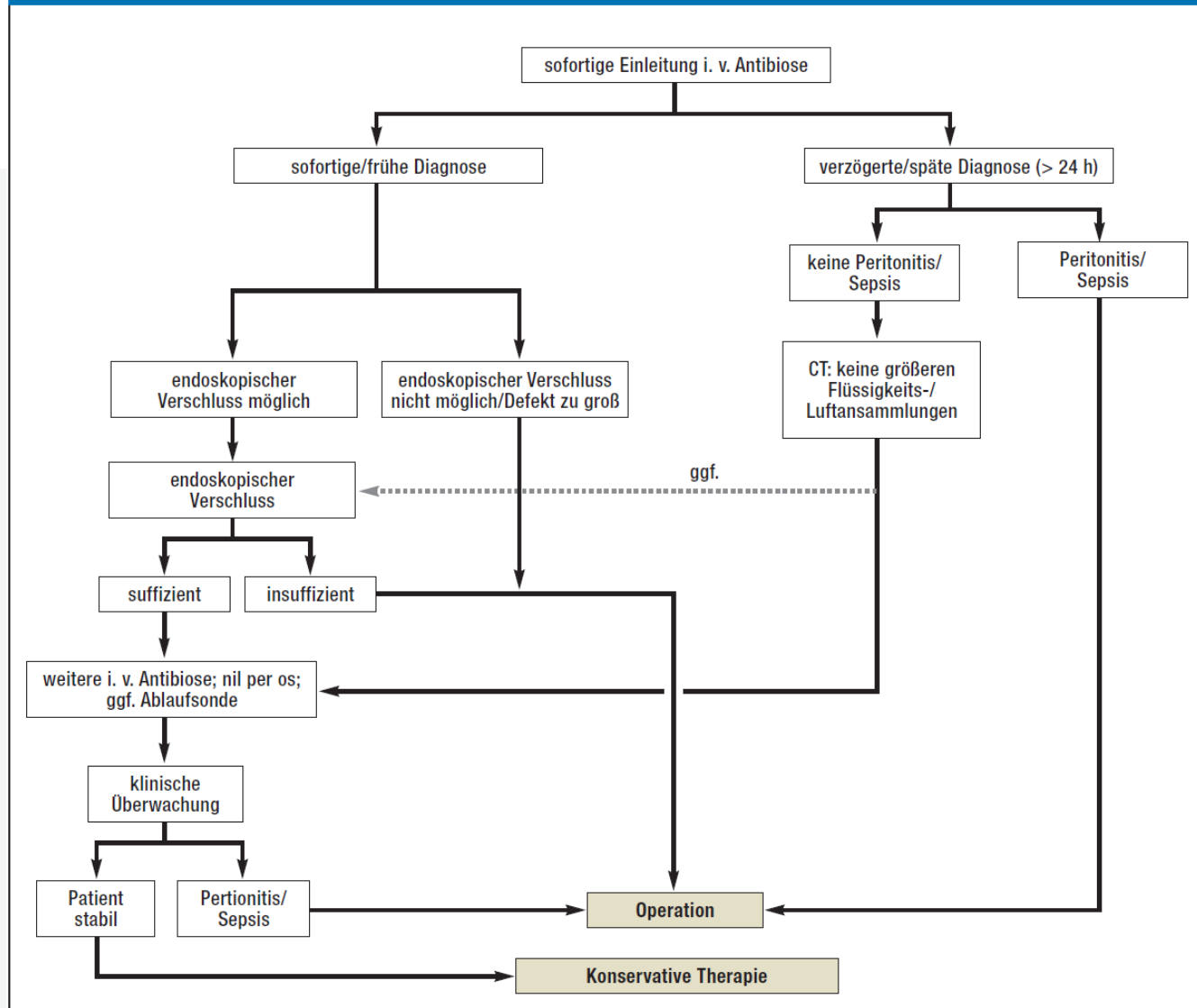
Authors

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GRAFIK 2





Komplikationen – Prävention

„hope for the best – prepare for the worst!“

Expertise! – Endoskopiker & Team

- Fallzahl, Expertise, Ausrüstung

Indikation & Krankengeschichte überprüfen

- vorangegangene Endoskopien, Chirurgie
- Plättchenhemmer (ASS etc.), Anticoagulation (DOAK's etc.)
- Nebendiagnosen

Sedierung/Anästhesie optimieren

“Prophylaktisch“ Antibiotikum?



Zusammenfassung

- Endoskopische Therapie mit modernen Techniken ist hoch effektiv, chirurg. Therapie oft nicht notwendig (Paradigmenwechsel)
 - ⇒ **Primat der endoskopischen Therapie**
- Verschlußtechnik abhängig von Anatomie, Defekt und lokaler Expertise
 - ⇒ **Clipverschluß = Standarttechnik**
- Zeitfaktor! Antibiose und Verschluß! Periinterventionelles Management!
- Drainage (endoskopisch/perkutan) bei verzögertem Verschluß
- Indikation zur chirurgische Therapie bei insuff. Verschluss, Sepsis/Peritonitis/Mediastinitis i.R. einer **interdisziplinären** Entscheidung