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Role of Surgery for SAP in Minimally-invasive Era

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The MIS Era of Surgical Treatment for SAP

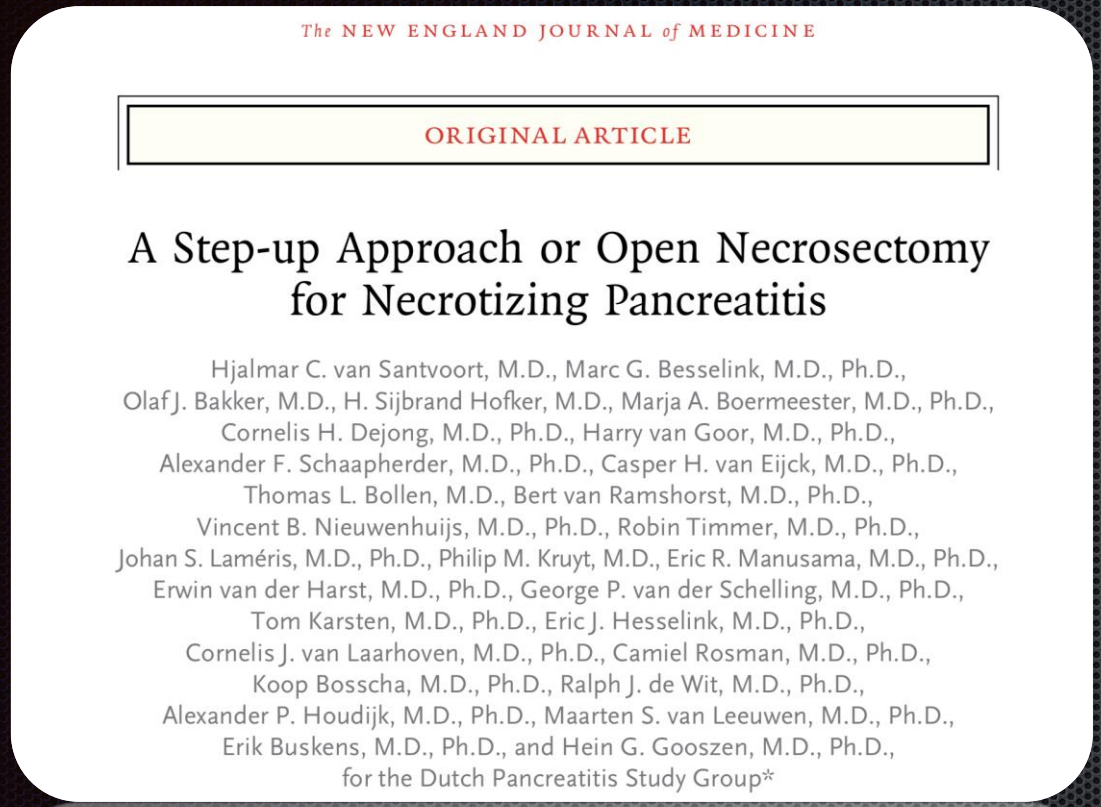
Surgical treatment pattern in SAP

The Journey of Odessey

Early surgery Simple drainage	Non-surgical treatment	Pancreatic resections	Debridement & Drainage	Delayed Surgery	Debridement & Drainage with MIS approach
1886 -1929	1930 -1950	1960 -1970s	1970 -1980s	1990s	2000s

Bradley EL 3rd, et al. Ann Surg 2010

Surgical treatment pattern in SAP



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Step-up Approach or Open Necrosectomy for Necrotizing Pancreatitis

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THE LANCET

Volume 391 · Number 10115 · Pages 1–94 · January 6–12, 2018 www.thelancet.com

Endoscopic or surgical step-up approach for infected necrotising pancreatitis: a multicentre randomised trial

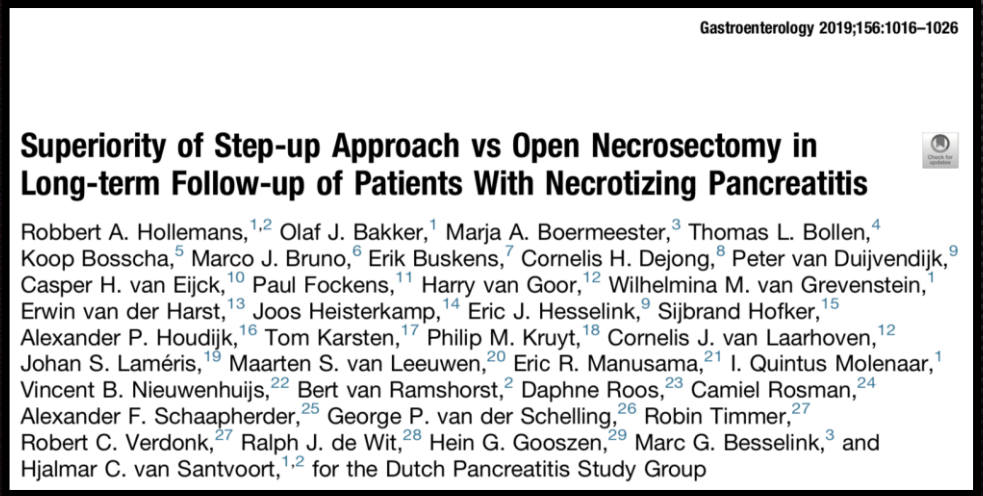
Sandra van Brunschot, Janneke van Grinsven, Hjalmar C van Santvoort, Olaf J Bakker, Marc G Besselink, Marja A Boermeester, Thomas L Bollen, Koop Bosscha, Stefan A Bouwense, Marco J Bruno, Vincent C Cappendijk, Esther C Consten, Cornelis H Dejong, Casper H van Eijck, Willemien G Erkelens, Harry van Goor, Wilhelmina M U van Grevenstein, Jan-Willem Haveman, Sijbrand H Hofker, Jeroen M Jansen, Johan S Laméris, Krijn P van Lienden, Maarten A Meijssen, Chris J Mulder, Vincent B Nieuwenhuijs, Jan-Werner Poley, Rutger Quispel, Rogier J de Ridder, Tessa E Römkens, Joris J Scheepers, Nicolien J Schepers, Matthijs P Schwartz, Tom Seerden, B W Marcel Spanier, Jan Willem A Straathof, Marin Strijker, Robin Timmer, Niels G Venneman, Frank P Vleggaar, Rogier P Voermans, Ben J Witteman, Hein G Gooszen, Marcel G Dijkgraaf, Paul Fockens, for the Dutch Pancreatitis Study Group*

The value of surgical step-up approach 2010, NEJM

The value of endoscopic step-up approach 2018, Lancet

The PANTER study

- Long-term FU w/ 86 ± 11 months FU time
- Step-up approach was associated w/
  - ***Less*** death + major complications (44% vs. 73%, p= 0.005)
  - ***Less*** incisional hernias (23% vs. 53%, p = 0.004)
  - ***Less*** PEI (29% vs. 56%, p = 0.03)
  - ***Less*** endocrine insufficiency (40% vs. 64%, p = 0.05)



Gastroenterology 2019;156:1016–1026

Superiority of Step-up Approach vs Open Necrosectomy in Long-term Follow-up of Patients With Necrotizing Pancreatitis

Robbert A. Hollemans,[1,2] Olaf J. Bakker,[1] Marja A. Boermeester,[3] Thomas L. Bollen,[4] Koop Bosscha,[5] Marco J. Bruno,[6] Erik Buskens,[7] Cornelis H. Dejong,[8] Peter van Duijvendijk,[9] Casper H. van Eijck,[10] Paul Fockens,[11] Harry van Goor,[12] Wilhelmina M. van Grevenstein,[1] Erwin van der Harst,[13] Joos Heisterkamp,[14] Eric J. Hesselink,[9] Sijbrand Hofker,[15] Alexander P. Houdijk,[16] Tom Karsten,[17] Philip M. Kruyt,[18] Cornelis J. van Laarhoven,[12] Johan S. Laméris,[19] Maarten S. van Leeuwen,[20] Eric R. Manusama,[21] I. Quintus Molenaar,[1] Vincent B. Nieuwenhuijs,[22] Bert van Ramshorst,[2] Daphne Roos,[23] Camiel Rosman,[24] Alexander F. Schaapherder,[25] George P. van der Schelling,[26] Robin Timmer,[27] Robert C. Verdonk,[27] Ralph J. de Wit,[28] Hein G. Gooszen,[29] Marc G. Besselink,[3] and Hjalmar C. van Santvoort,[1,2] for the Dutch Pancreatitis Study Group

Hollemans RA, et al. Gastroenterology 2019

IPD Meta Analysis

- 1980 Px w/ necrotizing pancreatitis from 51 hospitals in 8 countries (1991-2011)
- 1167 open, 467 MIS surgical & 346 MIS endoscopic necrosectomy
  - ↓ Death for surgical MIS (OR=0.53, p=0.006), and ↓ Death for endoscopic MIS (OR=0.20, p=0.006)
- After PSM with risk stratification
  - In very high risk group: ↓ Death for surgical MIS (RR=0.70, p=0.02), and ↓ Death for endoscopic MIS (RR=0.43, p=0.005)
  - In high risk group: ↓ Death for endoscopic MIS (RR=0.27, p=0.03)

van Brunschot S, et al. Gut 2018

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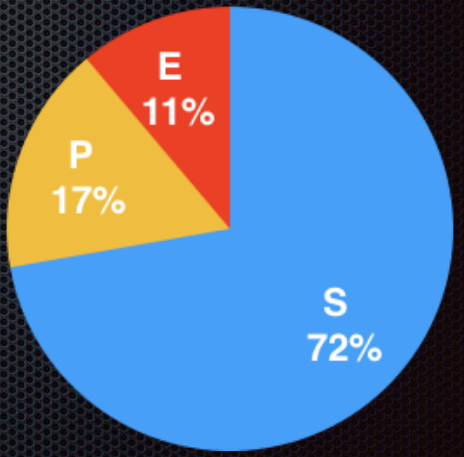
Surgery for SAP in China

The Nanjing Pancreas Center

- A multi-disciplinary center designated for pancreatic diseases (24/7 MDT)
- A real high-volume center
  - 644 pancreatic resections, 371 Whipples, and 455 APs, 32 SAPs, 98 NAPs in 2018
- Treatment modalities in our center (All-in-One)
  - CT guided PCD
  - MARPN
  - Endoscopic drainage & debridement
  - ***Small-incision retroperitoneal necrosectomy***
  - ***Trans-abdominal open necrosectomy ± small-incision***



Doctors in the Center

Surgery for SAP in China

What we’ ve learnt as surgeons for the SAP treatment during the past 10 years

- Delayed intervention
- Minimal-invasion
- To avoid trans-abdominal approach
- Techniques in necrosectomy
- High-volume makes profession and perfection

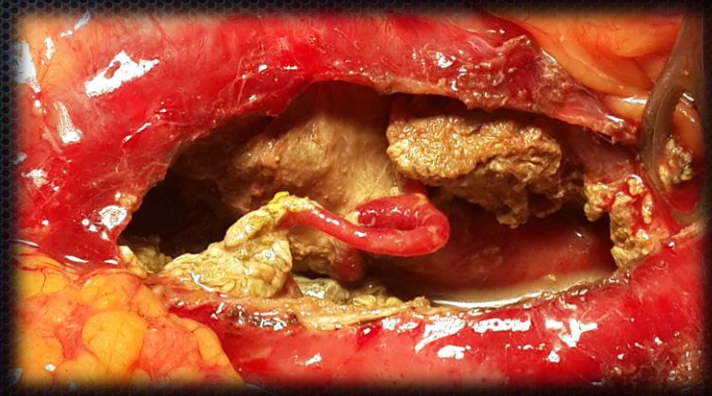
"Tomb Raider" techniques in necrosectomy

Tomb Raiders	Surgeons
	
■ Historical material + shovel	■ Medical history + Imaging
■ Right timing (Midnight)	■ Right timing (after 4w)
■ Find safe pathways	■ Find right approaches
■ Enter vaults along passage	■ Enter cavities along abscess
■ Dig out treasures	■ Take out debris and pus
■ Running away	■ Drainage & -ostomies

Surgery for SAP in China

Our surgical techniques for surgical necrosectomy in SAP

- Precise allocation of necrotic cavity: imaging study, route of PCD
- Combined approach: flank retroperitoneal small incision ± trans-abdominal incision, depends on the location and form of necrotic cavity
- Trans-abdominal: Approach via the greater curvature
- Debridement: Iron-heart with soft-hand
- Cautions: Signs of GI fistula, bare vessels
- Large-bore drainage with irrigation



Surgical algorithm I

Choosing approach according to necrosis location

- Central type: trans-abdominal
- Lateral / bilateral type: flank retroperitoneal small incision
- Mixed type: combined approach

Surgical algorithm II

Early surgical intervention (<4 weeks)

- Massive hemorrhage, fistulas, sepsis due to large IPN, etc.

- ✓ 43 year-old, Male
- ✓ Uncontrolled IPN
- ✓ Referred from another hospital 300km+ away
- ✓ Repeated CPR on his transferring way
- ✓ PCD was utilized
- ✓ Massive venous hemorrhage
- ✓ Emergent open surgery

Video clip

Colonic fistula

Video clip

MARPN

Video clip

Endoscopic Necrosectomy

Video clip

Small-incision Retroperitoneal Necrosectomy

Video clip

Surgical Necrosectomy

Video clip

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Reflections on the Current Treatment Model

Reflections on current surgical treatment in SAP

- **ALL** patients undergoing same treatment modality, ignoring the characteristics of the necrosis
- **ALL** patients undergoing step-up approach, ignoring the personal features of the disease
- **ALL** patients undergoing intervention after 4 weeks

Trans-mucosal vs. Trans-serosal Surgery

Surgical Step-up

Approach depends on familiar technique, not on the patient

Doctors tend to not trust techniques from other disciplines

Deeply integrated MDT team is the solution

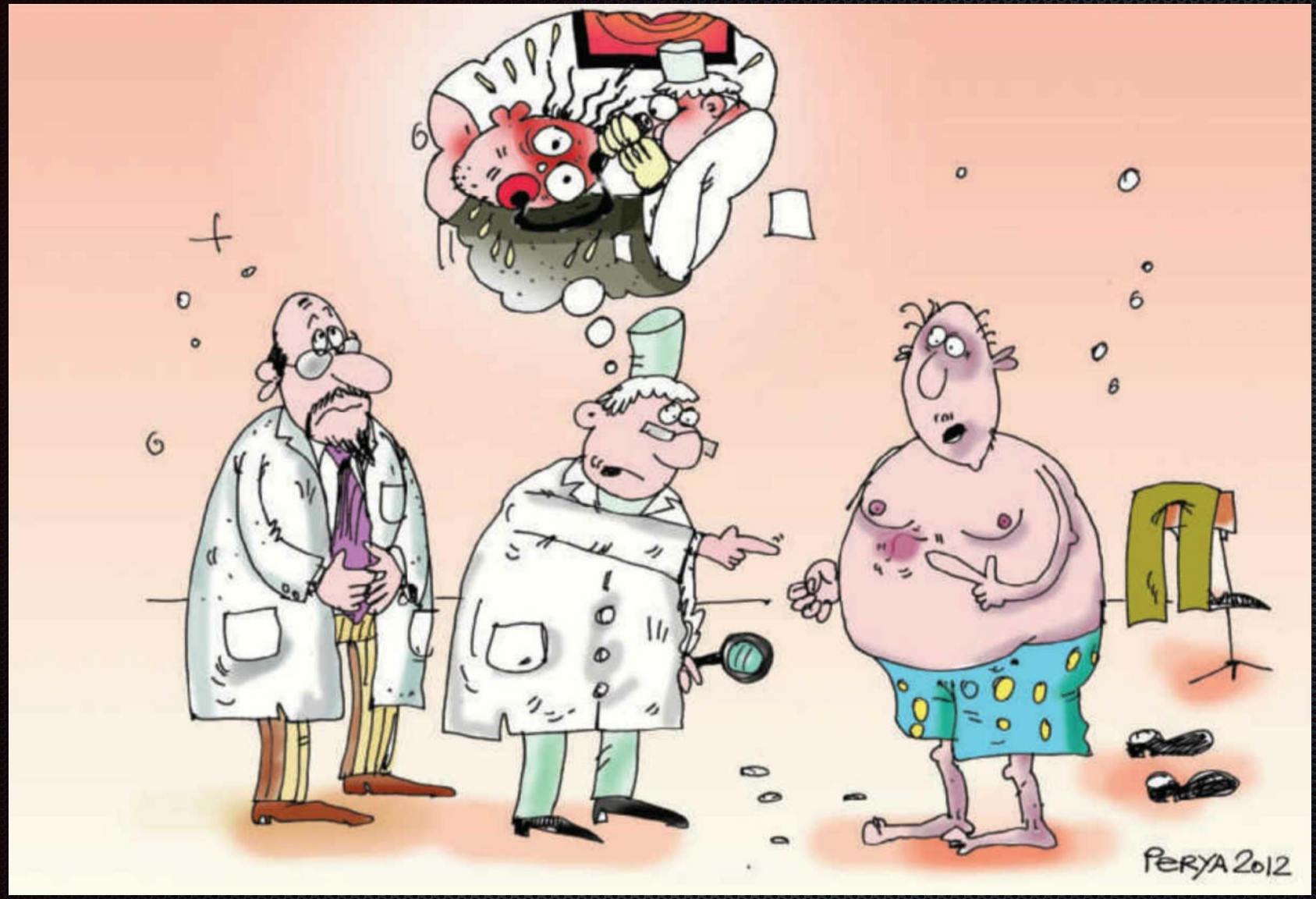
serosal surface

Endoscopic Step-up

Intervention

mucosal surface

SURGERY **vs.** **NOTES**

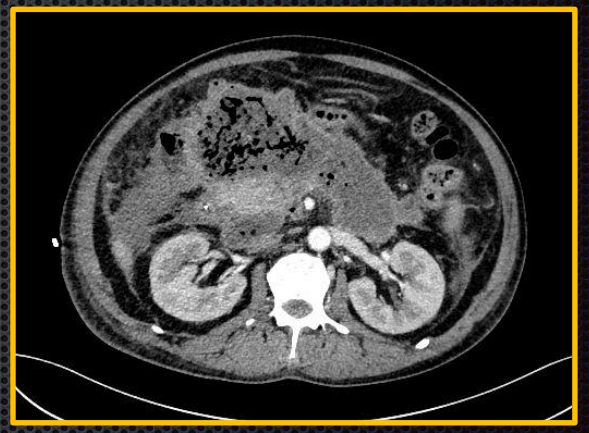


From: **The little book of surgical cartoons,**
Evgeniy E. Perelygin

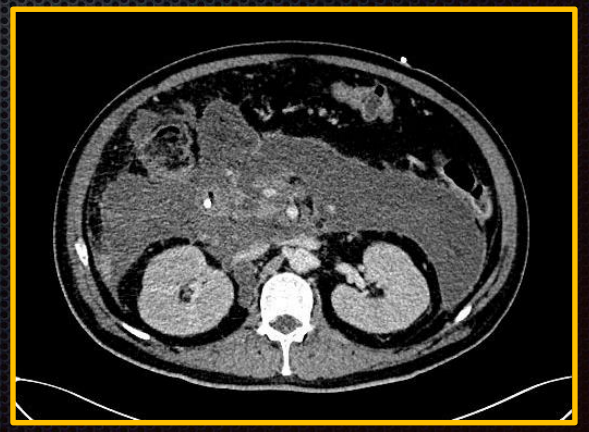
Assistant: “Should we remove the lipoma with NOTES?
Surgeon: “NOTES is NUTS”

“Dry” necrosis VS. “Wet” necrosis

- **“Dry” necrosis**
  - Mainly solid/semi-solid necrosis
  - Debridement is the mainstay of treatment
  - More likely need small-incision/open necrosectomy

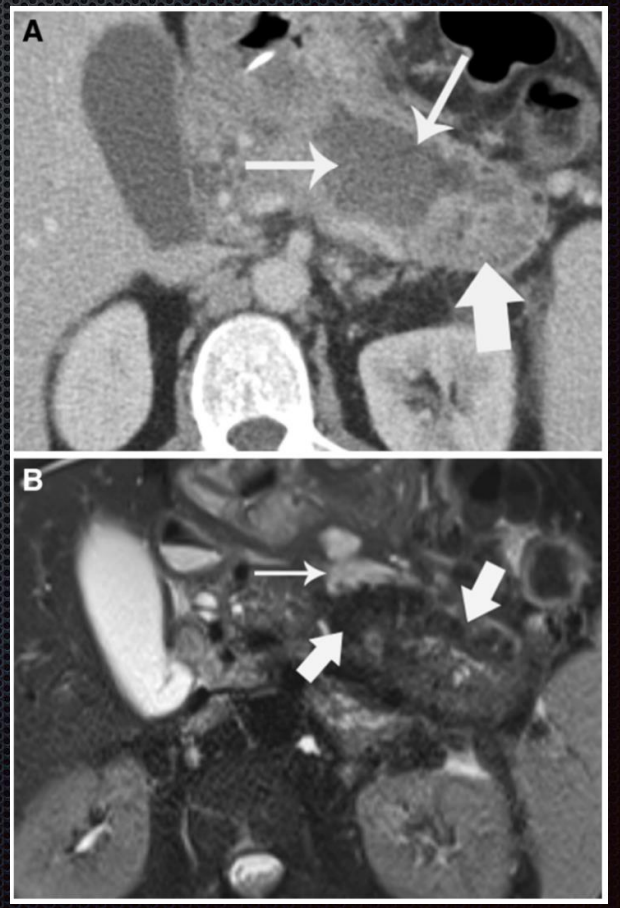


- **“Wet” necrosis**
  - Mainly liquified necrosis and pus
  - Drainage is the mainstay of treatment
  - More likely to be cured by MIS approach



Solid debris evaluation

- Accuracy of CT in evaluation of percentage fluid volume was 65% using T2WI MRI used as standard
- Higher interreader agreement for percentage fluid volume on MRI (κ = 0.55) vs. CT (κ = 0.196)
- MRI demonstrates higher reproducibility for fluid to debris component estimation



Kamal A, et al. Abdom Imaging 2015

Solid debris evaluation

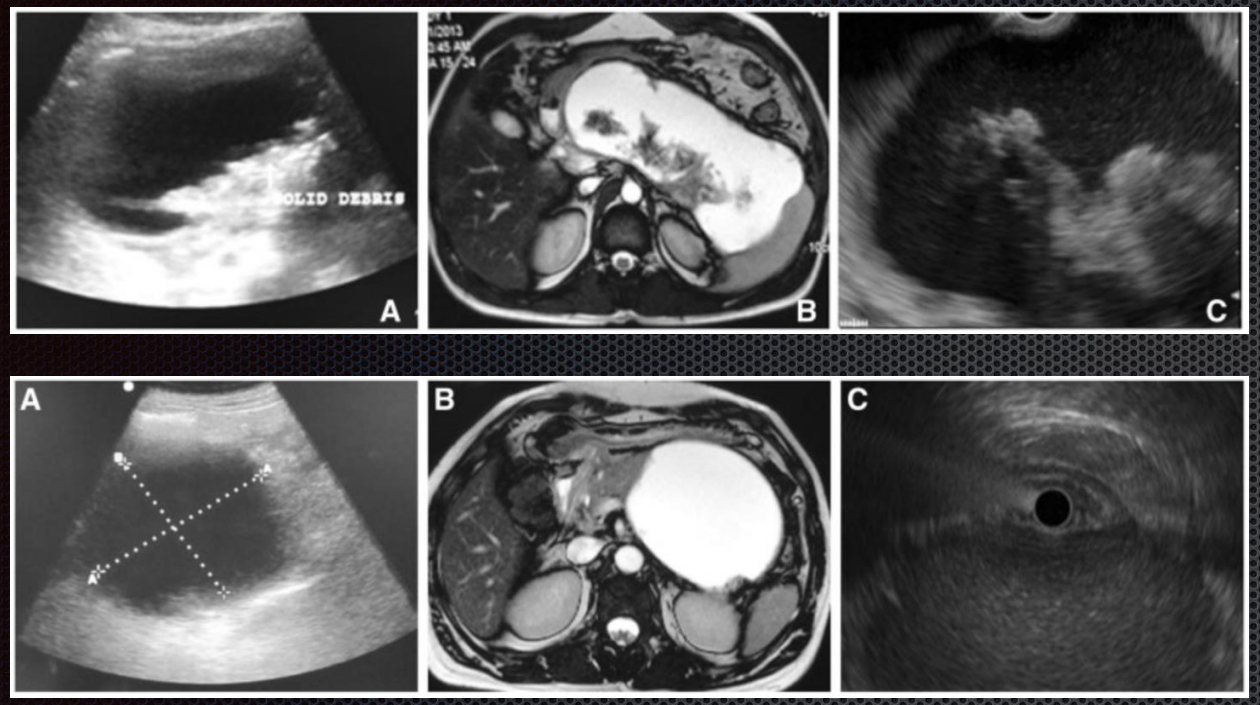


Table 1. Solid content in walled-off pancreatic necrosis on different imaging modalities ($n = 52$)

Imaging modalities	Solid content in WOPN, *n* (%)		
	<10%	10–40%	>40%
Endoscopic ultrasound[a]	10 (19.6%)	33 (64.7%)	8 (15.7%)
Magnetic resonance imaging	14 (26.9%)	30 (57.7%)	8 (15.4%)
Abdominal ultrasound[b]	10 (20.8%)	33 (68.8%)	5 (10.4%)

[a]One case could not be well assessed on EUS because of the presence of air in the collection

[b]WOPN could not be visualized in four patients, among whom three had a high content of solid debris on EUS and one had air foci within the collection.

EUS = endoscopic ultrasound; WOPN = walled-off pancreatic necrosis

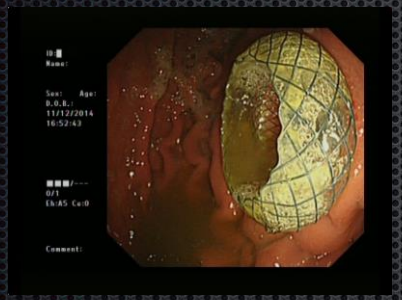
- More than 40% debris was better characterized on EUS and MRI
- EUS detected collaterals around WOPN that were not detected on USG or MRI

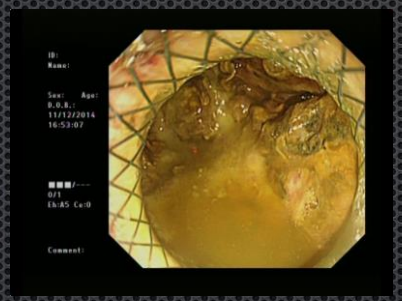
Rana SS, et al. Gastroenterol Rep (Oxf) 2016

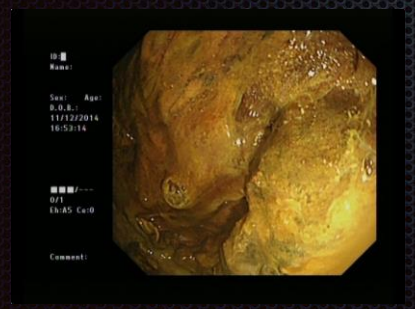
When not step-up?

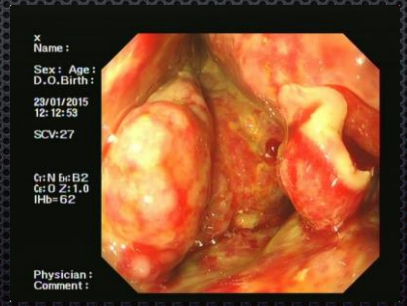
Case 1: repeated endoscopic necrosectomy

- Endoscopic necrosectomy for 17 times + endoscopic gastrostomy + ERC w/ biliary stenting
- Hospitalization 4 months+, Px developed mental sickness



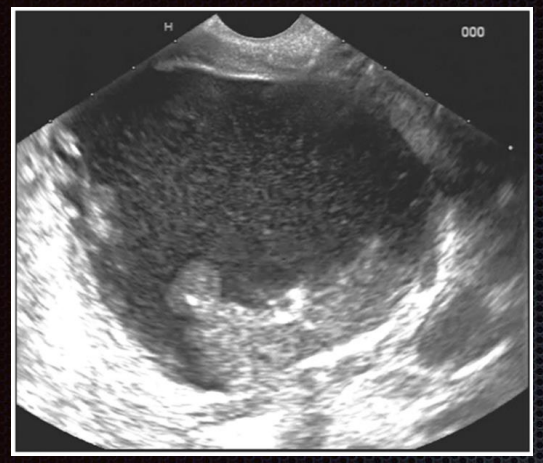






Video clip

Solid debris & clinical outcomes



<40% solid debris

>40% solid debris

Table 2. Correlation of disease parameters with the number of endoscopic procedures

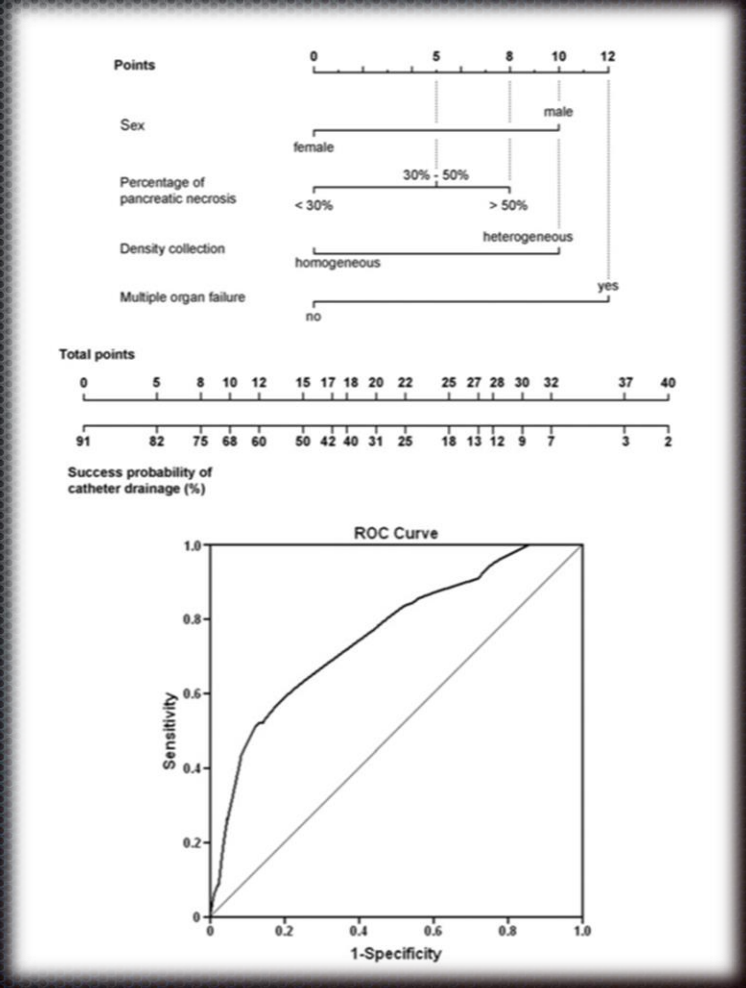
Characteristics of the WOPN and duration of illness	Correlation coefficient	*P* value
Duration of the disease	−0.068	0.682
Size of the collection	0.320	0.047
Extent of necrosis	0.800	<0.001

- <10% necrotic debris needed only single session of endoscopic drainage,
- 10-40% solid debris needed two or more sessions
- >40% solid debris either needed direct endoscopic debridement or surgical necrosectomy

Rana SS, et al. Endosc Ultrasound 2014

Prediction of need for surgery after PCD

- 130 IPN, factors associated with PCD success (survival w/o necrosectomy) were analyzed
- Risk factors for reduced success
  - Male sex (OR=0.27, p<0.01)
  - Multiple organ failure (OR=0.15, p<0.01)
  - Percentage of pancreatic necrosis (<30%/30%–50%/>50%: OR=0.54, p=0.03)
  - Heterogeneous collection (OR=0.21, p<0.01)
- Prediction model: AUC-ROC = 0.76



Hollemans RA, et al. Ann Surg 2016

Prediction of need for surgery after PCD

Other reported Risk factors

- Alcoholic pancreatitis
- Hypocalcaemia at admission; higher APACHE II at admission
- Extrapancreatic necrosis in the left anterior and posterior para-renal spaces
- Mean CT density of necrotic fluid collection
- Number of failed organ; late-onset organ failure on PCD
- Up-rising trend in hsCRP, IL-6, prealbumin during treatment; lower albumin level
- Serum procalcitonin level

Shenvi S, et al. Pancreatology 2016
Ji L, et al. Pancreas 2018

Tailored approach for SAP

- Clinical situations with predicted failure of non-surgical treatment (PCD, MARPN, endoscopic…) **[Indication >5 points]**
  - Amount of necrotic debirs (≥200m / ≥400mL in imaging study) **[3 points/5 points]**
  - Large hematoma after hemorrhage w/ infected necrosis **[2 points]**
  - Early development of clinical deterioration (≥2 persistent organ failure) despite ideal intensive care **[2 points]**
  - Other risk factors: Male gender, etc. **[1 point]**
  - Presence of sepsis **[1 point]**

Take home message

- Step-up approach is the currently preferred treatment modality for necrotizing pancreatitis
- Surgery remains to be indispensable in the minimal-invasion era
- Not all patient will benefit from a fixed treatment norm
- New risk-stratified treatment strategy warrant further validation

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Thank You for Your Attention

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