Step-up management of pancreatic necrosis

Gastro-foundation fellows weekend 2023

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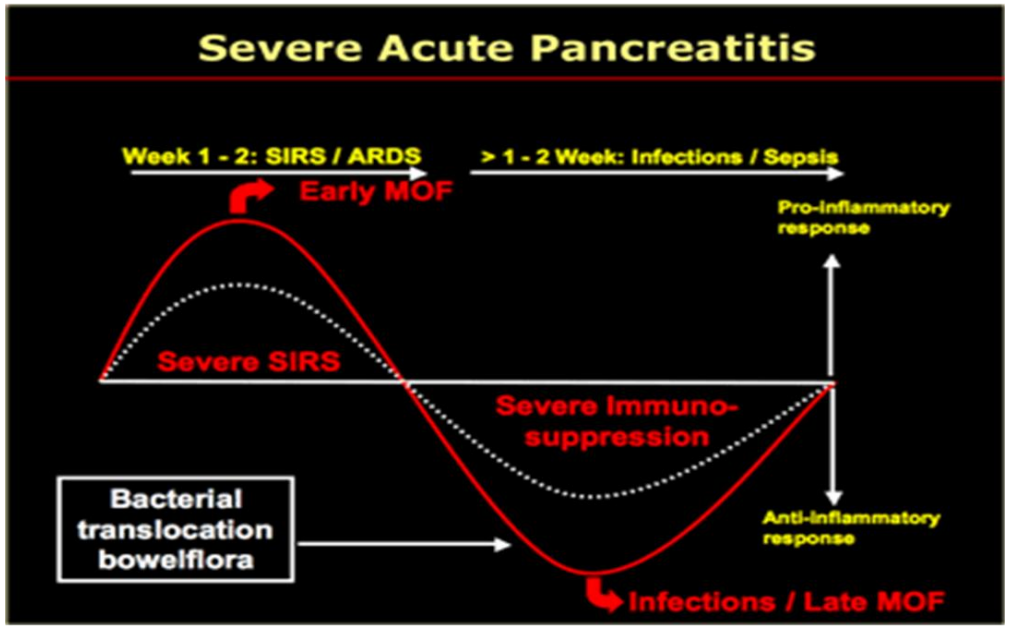
UCT PAH

Digestive Diseases Centre

Relevant concepts in pathophysiology – severe acute pancreatitis

- **Early phase-** first two weeks
  - Multiple organ dysfunction
  - Sepsis/peri-pancreatic complications rare
  - Early surgical intervention no advantage to best supportive care

- **Late phase** – two weeks onwards
  - Septic complications particularly infected pancreatic necrosis predominate



Zerem WJG 2014;
Forsmark NEJM 201

ORIGINAL ARTICLE

Classification of acute pancreatitis—2012: revision of the Atlanta classification and definitions by international consensus

Peter A Banks,[1] Thomas L Bollen,[2] Christos Dervenis,[3] Hein G Gooszen,[4]
Colin D Johnson,[5] Michael G Sarr,[6] Gregory G Tsiotos,[7] Santhi Swaroop Vege,[8]
Acute Pancreatitis Classification Working Group

- **Local complications** – collections, necrosis

  - **Acute peri-pancreatic fluid collection**
    - Peripancreatic fluid associated with oedematous pancreatitis without necrosis, < 4/52 from onset
  - **Pancreatic pseudocyst**
    - Collection of fluid encapsulated by a well defined inflammatory wall, minimal/no necrosis, > 4/52 from onset

  - **Acute necrotic collection – sterile / infected**
    - Collection containing fluid and necrotic tissue from pancreas / peripancretic tissue
  - **Walled off necrosis – sterile / infected**
    - Collection of fluid / necrosis encapsulated by a well defined inflammatory wall, > 4/52 from onset

Banks Gut 2013

12/52

↓ mortality

With time – increased organization

Decreased solid/fluid ratio

- **True pancreatic necrosis**
  - Minimal separation of devitalised tissue
  - High solid/fluid ratio
- **Transitional pancreatic necrosis**
- **Organised pancreatic necrosis**
  - Good separation of devitalised tissue in a fluid filled cavity
  - Well formed wall of granulation tissue

Interventional modality influenced by:

- **Anatomical considerations**
- **Solid / fluid ratio**
- **Institutional expertise**

Open drainage, necrosectomy

Minimally invasive surgery

Percutaneous drainage

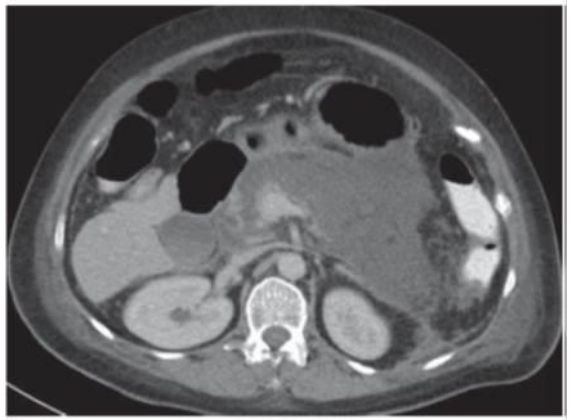
Endoscopic drainage

Carter HPB 2007

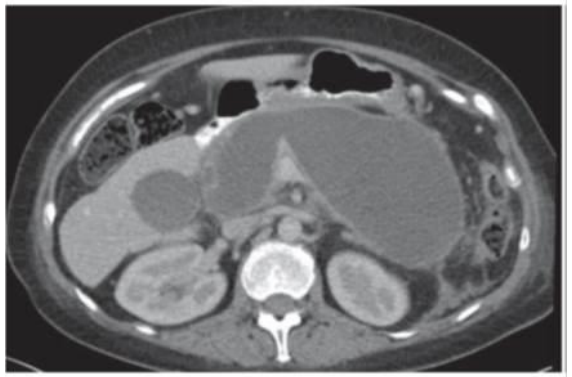
It’s all in the timing...

- 1st 7-10 days: pancreatic necrosis forms a solid / semi-solid inflammatory mass
- After 4 weeks: liquefaction with development of a fibrous wall and organization of the necrosis facilitates invasive drainage
- Delaying surgical intervention until clearly indicated increases the likelihood of successful drainage / debridement and reduces morbidity, mortality

a Day 4



b Day 12



c Day 35

Tenner Am J Gastro 2013
Freeman Panc 2012
Besselink M Arch Surg 2007
Hartwig W J GI Surg 2002

Interventional modalities

- **Minimally invasive techniques**
  - **Percutaneous** catheter drainage
  - **Endoscopic** drainage / debridement
    - *Transmural*
    - *Transpapillary*
  - Minimally invasive **surgical** necrosectomy
    - *Laparoscopic* surgical approach
      - Anterior
      - Retroperitoneal
    - Video assisted retroperitoneal debridement / minor incision retroperitoneal pancreatic necrosectomy (*VARD / MIRP*), *sinus tract endoscopy*
  - **Combined** approaches

Tenner Am J Gastro 2013

- **Open necrosectomy**

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Step-up Approach or Open Necrosectomy for Necrotizing Pancreatitis

PANTER TRIAL

- Randomised study comparing step-up approach of ***percutaneous drainage / endoscopic drainage +/- MIRP*** vs ***open necrosectomy***
  - End point reached: 31/45 open; 17/43 step up
  - Step up: ***less new organ failure***
- Step up approach had reduced ***composite end point of major complication/death***, subsequent pancreatic insufficiency, hernias and possibly cost

2010 NEJM Van Santvoort

A Conservative and Minimally Invasive Approach to Necrotizing Pancreatitis Improves Outcome

HJALMAR C. VAN SANTVOORT,* OLAF J. BAKKER,* THOMAS L. BOLLEN,‡ MARC G. BESSELINK,* USAMA AHMED ALI,* A. MARJOLEIN SCHRIJVER,* MARJA A. BOERMEESTER,§ HARRY VAN GOOR,‖ CORNELIS H. DEJONG,¶ CASPER H. VAN EIJCK,** BERT VAN RAMSHORST,# ALEXANDER F. SCHAAPHERDER,‡‡ ERWIN VAN DER HARST,§§ SIJBRAND HOFKER,‖‖ VINCENT B. NIEUWENHUIJS,‖‖ MENNO A. BRINK,¶¶ PHILIP M. KRUYT,## ERIC R. MANUSAMA,*** GEORGE P. VAN DER SCHELLING,‡‡‡ TOM KARSTEN,§§§ ERIC J. HESSELINK,‖‖‖ CORNELIS J. VAN LAARHOVEN,¶¶¶ CAMIEL ROSMAN,### KOOP BOSSCHA,**** RALPH J. DE WIT,‡‡‡‡ ALEXANDER P. HOUDIJK,§§§§ MIGUEL A. CUESTA,‖‖‖‖ PETER J. WAHAB,¶¶¶¶ and HEIN G. GOOSZEN* for the Dutch Pancreatitis Study Group

- Multi-centre trial: 639 consecutive patients with necrotising pancreatitis
- Treatment
  - Conservative – 62%
    - Mortality – 7%
  - Surgery – 38%
    - Mortality – 27%
    - Early lap 5%; mortality 78%
- Delay in intervention
  - 0-14/7: mortality 56%
  - 14-29/7: mortality 26%
  - >30/7: mortality 15%
- Primary catheter drainage (63%) had fewer complications than primary necrosectomy (42% vs 64%)

Van Santvoort Gastro 2011

ORIGINAL ARTICLE

Minimally invasive and endoscopic versus open necrosectomy for necrotising pancreatitis: a pooled analysis of individual data for 1980 patients

Sandra van Brunschot,[1] Robbert A Hollemans,[2,3] Olaf J Bakker,[4] Marc G Besselink,[2] Todd H Baron,[5] Hans G Beger,[6] Marja A Boermeester,[2] Thomas L Bollen,[7] Marco J Bruno,[8] Ross Carter,[9] Jeremy J French,[10] Djalma Coelho,[11] Björn Dahl,[12] Marcel G Dijkgraaf,[13] Nilesh Doctor,[14] Peter J Fagenholz,[15] Gyula Farkas,[16] Carlos Fernandez del Castillo,[15] Paul Fockens,[1] Martin L Freeman,[17] Timothy B Gardner,[18] Harry van Goor,[19] Hein G Gooszen,[20] Gerjon Hannink,[21] Rajiv Lochan,[10] Colin J McKay,[9] John P Neoptolemos,[22] Atilla Oláh,[23] Rowan W Parks,[24] Miroslav P Peev,[15] Michael Raraty,[22] Bettina Rau,[25] Thomas Rösch,[26] Maroeska Rovers,[20] Hans Seifert,[12] Ajith K Siriwardena,[27] Karen D Horvath,[28] Hjalmar C van Santvoort[4,29]

- 1167 open necrosectomy; 467 minimally invasive surgical and 346 endoscopic necrosectomy (813)
- Risk of death lower for minimally invasive surgical (OR 0.53) and endoscopic (OR 0.20) necrosectomy
- Post propensity score matching with risk stratification, risk of death:
  - Minimally invasive surgical necrosectomy, very high risk patients – risk ratio 0.70; p=0.02
  - Endoscopic necrosectomy, high risk (risk ratio 0.27, p=0.03), very high risk (risk ratio 0.43; p=0.005)

Gut 2017

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

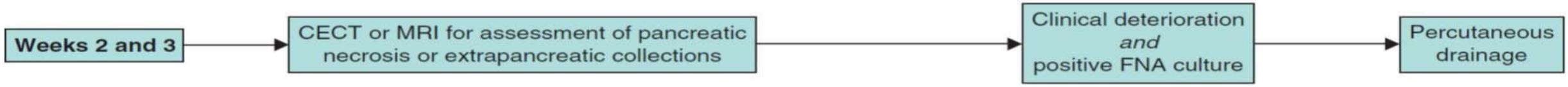
- Mean of 86 months (+/- 11 months) of follow-up
- Primary endpoint of death / major complication
  - 44% step-up group; 73% open necrosectomy (p=0.005)
- Also
  - Step-up group: less incisional hernias (23%vs 53%, p=0.004), exocrine insufficiency (29% vs 56%, p=0.03), endocrine insufficiency (40% vs 64%, p=0.05)
- No difference: additional drainage procedures, pancreatic surgery, recurrent / chronic pancreatitis, pain, cost. QOL increased over time, similarly between groups

Hollemans Gastroenterology 2019

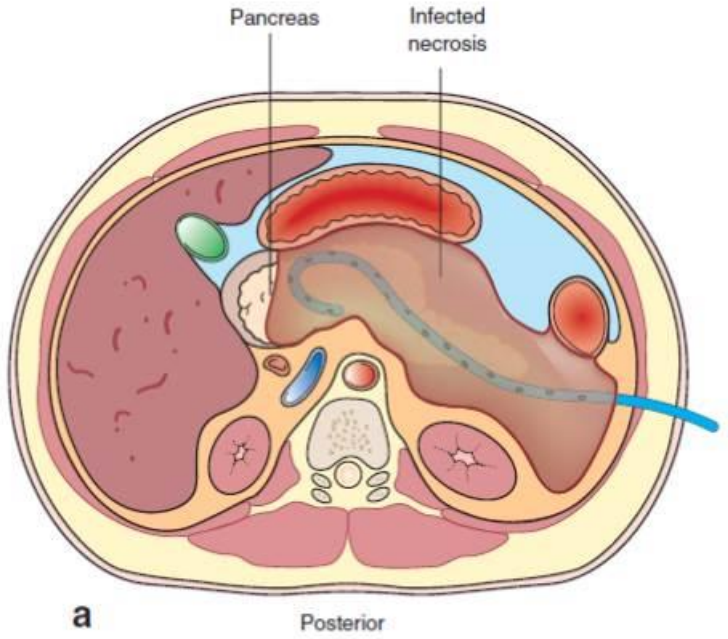
Review

Staged multidisciplinary step-up management for necrotizing pancreatitis

D. W. da Costa[1], D. Boerma[2], H. C. van Santvoort[2], K. D. Horvath[6], J. Werner[7], C. R. Carter[8], T. L. Bollen[3], H. G. Gooszen[1], M. G. Besselink[4] and O. J. Bakker[5]



- Infection of necrosis
  - Features of sepsis / deteriorating organ function
  - Start quinolone / carbapenum
  - X-sectional imaging
  - Selective FNA – diagnostic uncertainty, guiding AB's
  - Percutaneous drainage if limited response to antibiotics
  - 35-55% treated with PCD alone

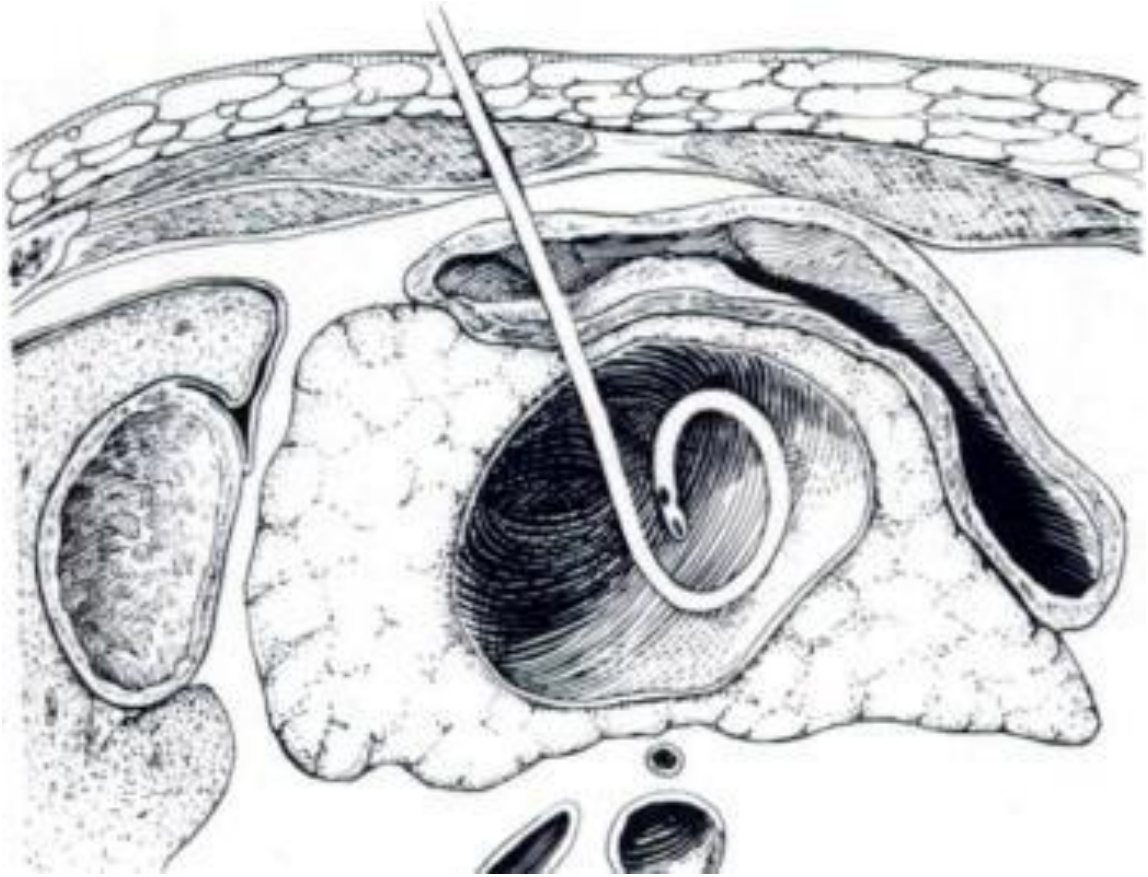


Drainage approaches:

- ***Retroperitoneal***
- Transperitoneal
- Transgastric

Da Costa BJS 2013

Transgastric drainage



Nunez AJR 1985

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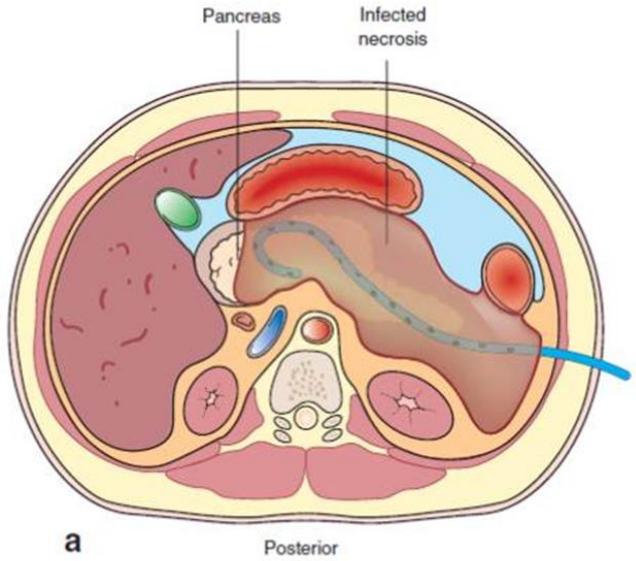
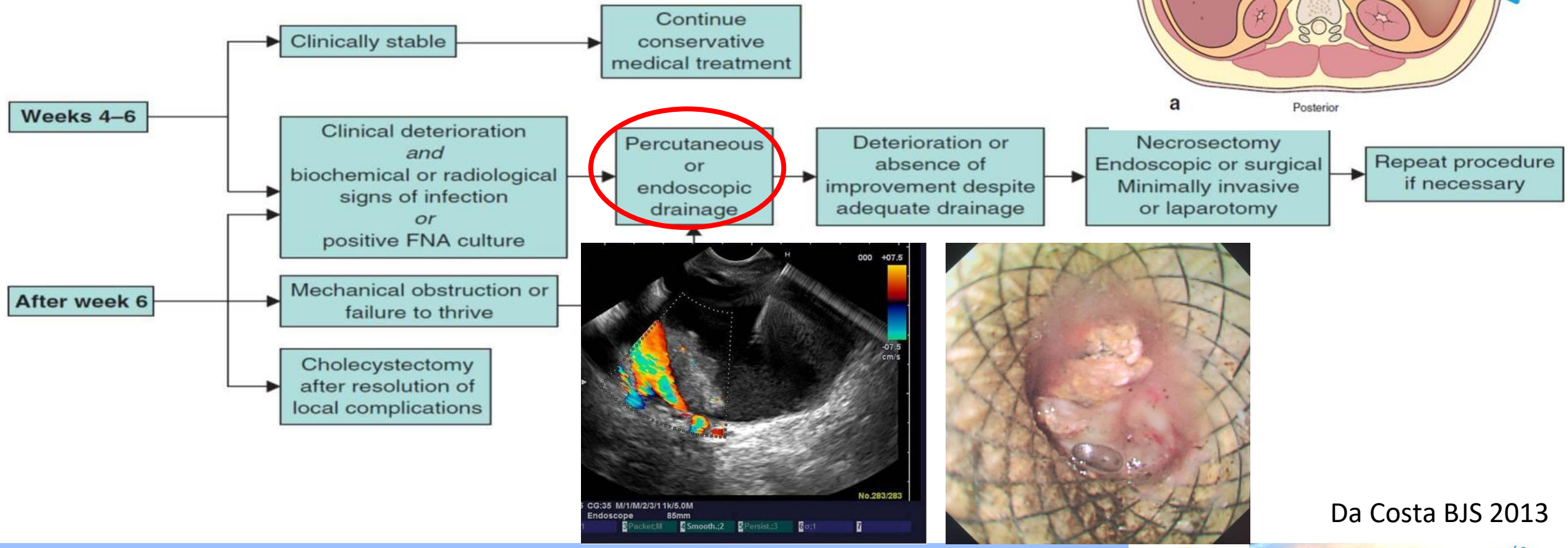
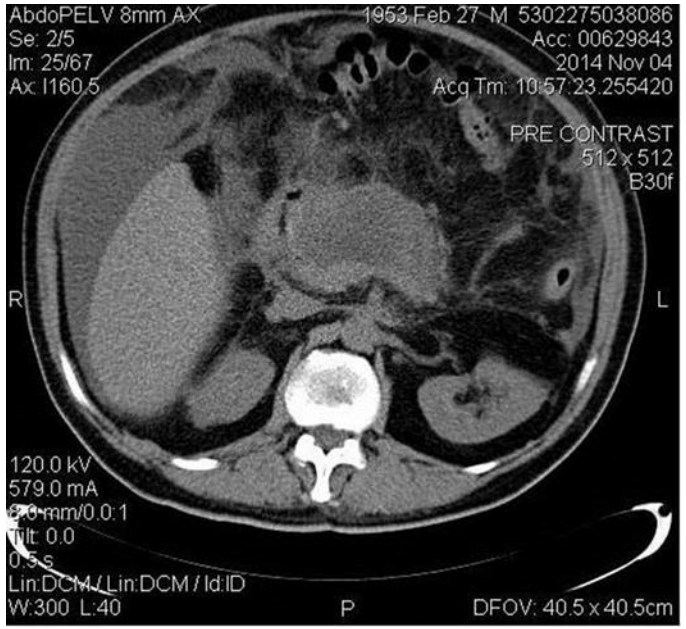
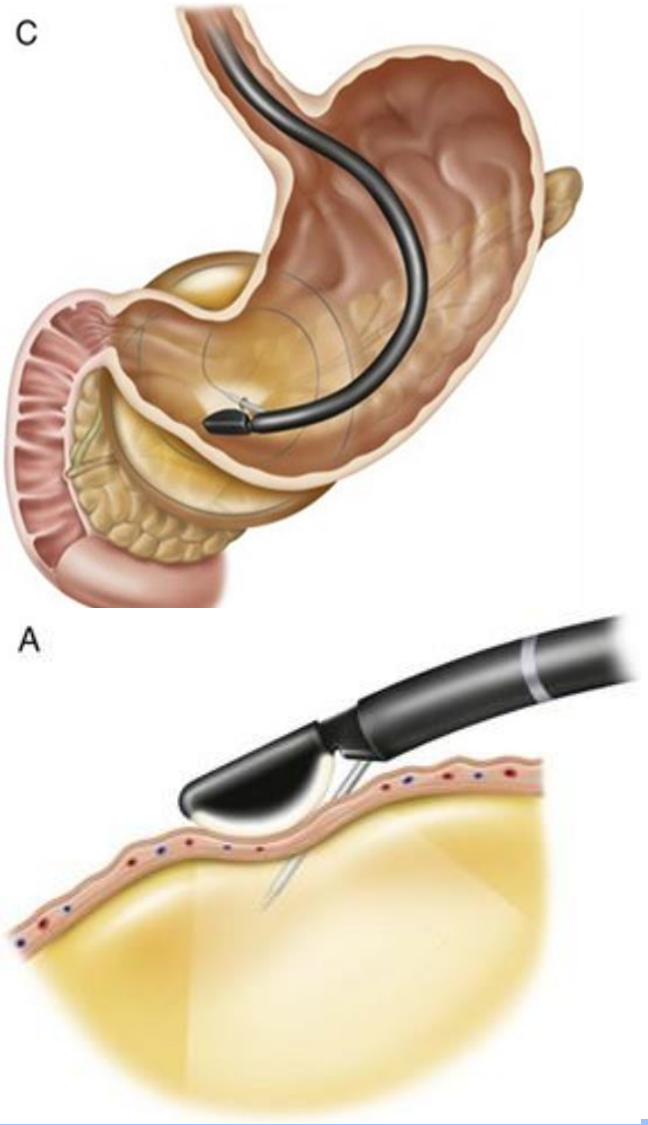




Da Costa BJS 2013

Endoscopic ultrasound guided transmural drainage

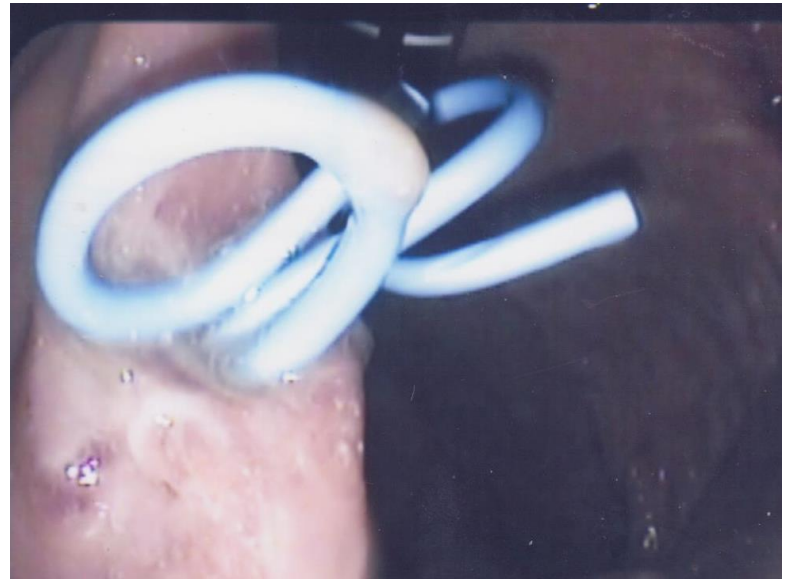




- Introduction of delivery system into cyst
  - Under vision

Endoscopic transmural drainage

- Passage of endoscopic guidewire into cyst, under US vision
- Under endoscopic & fluoroscopic control, cystotome passed into cyst using diathermy



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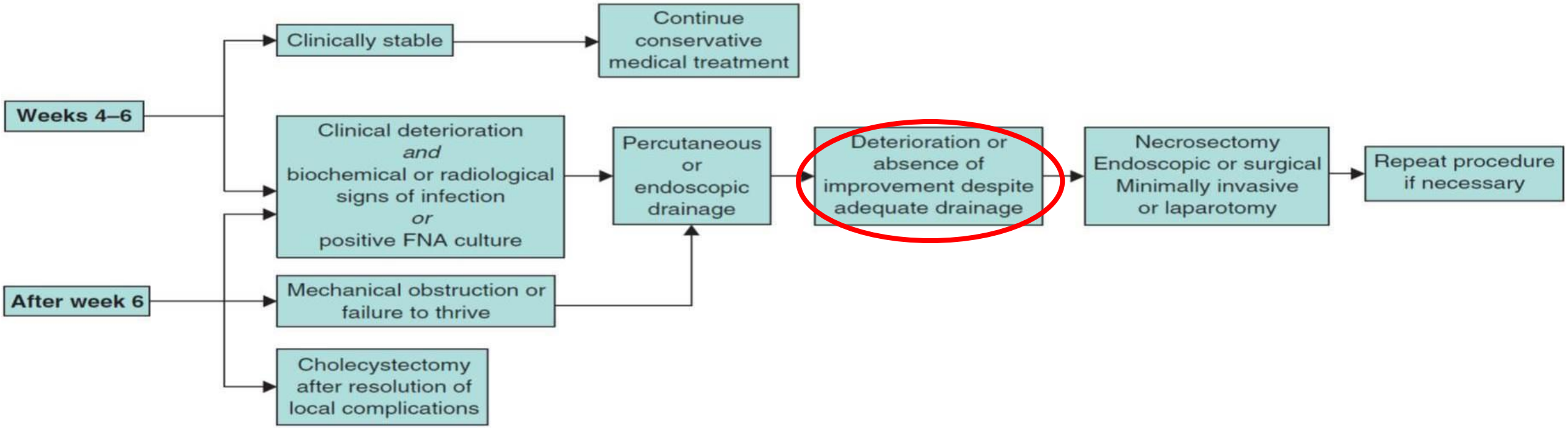

Da Costa BJS 2013

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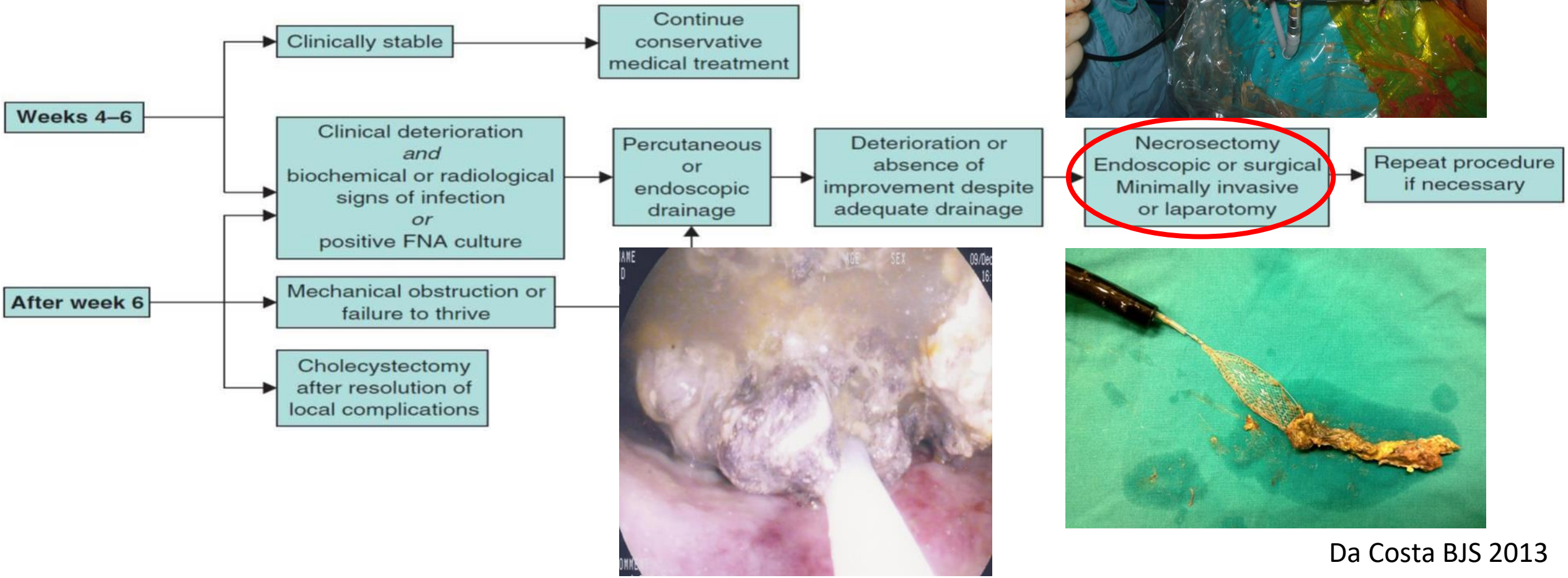


Da Costa BJS 2013

ORIGINAL ARTICLE: Clinical Endoscopy

Multiple transluminal gateway technique for EUS-guided drainage of symptomatic walled-off pancreatic necrosis

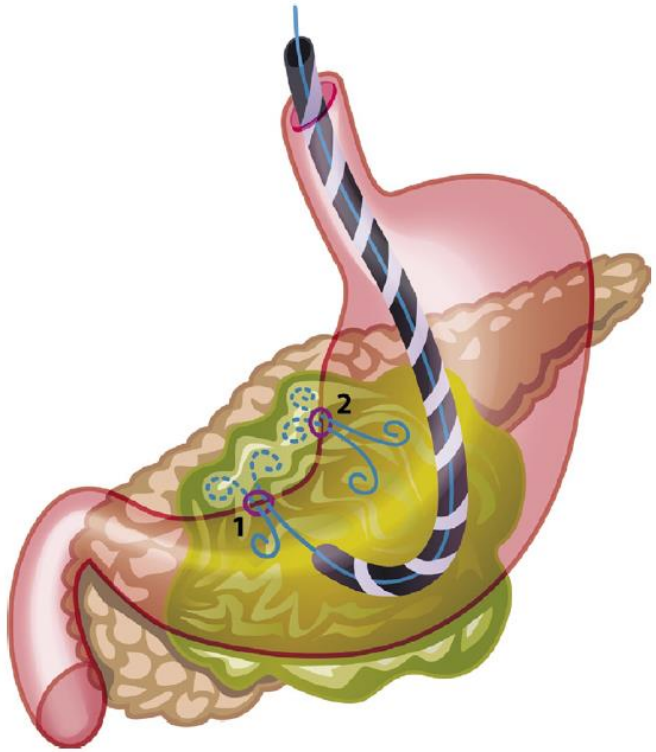
Shyam Varadarajulu, MD, Milind A. Phadnis, PhD, John D. Christein, MD, C. Mel Wilcox, MD

Birmingham, Alabama, USA

TABLE 3. Clinical outcomes of patients with walled-off pancreatic necrosis

Predictor	Conventional drainage N = 48	MTGT N = 12	*P* value
Treatment success, no. (%)	25 (52.1)	11 (91.7)	.018*
Complications, no. (%)	5 (10.4)	0 (0)	.573*
Reintervention, no. (%)	12 (25)	6 (50)	.156*
Hospital stay, median (IQR), d	4.5 (2-16.5)	16.5 (4-45)	.079
Follow-up time, median (IQR), d	169 (60-228)	159.5 (112-228)	.539

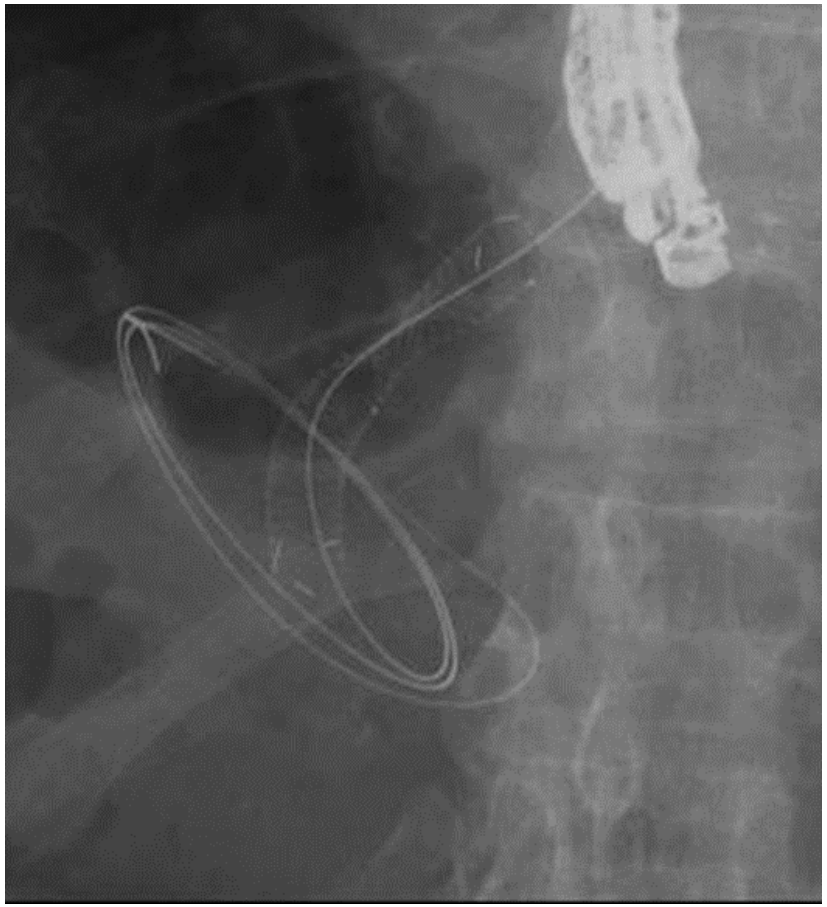
MTGT, Multiple transluminal gateway technique; *IQR,* interquartile range.
*Fisher's exact test was used.

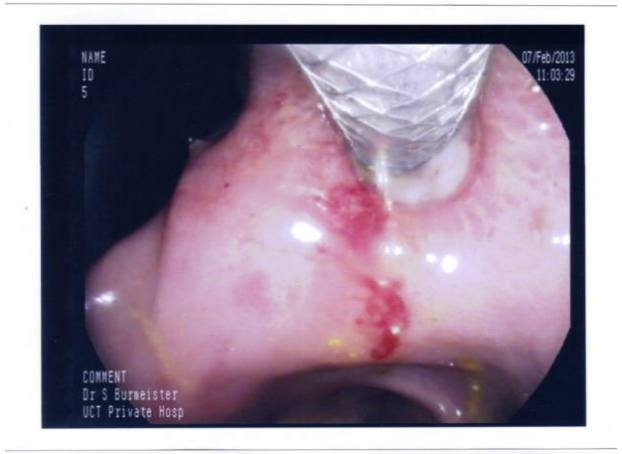


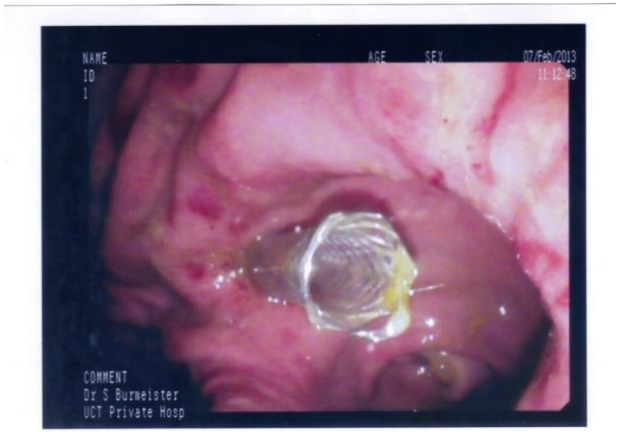
Varadarajulu GI Endo 2011

Self-expanding metal stents - SEMS

- Subsequently postulated that SEMS might **improve drainage** through their **wider diameters**
- Further
  - Allow **nasocystic catheters**
  - Facilitate **necrosectomy**







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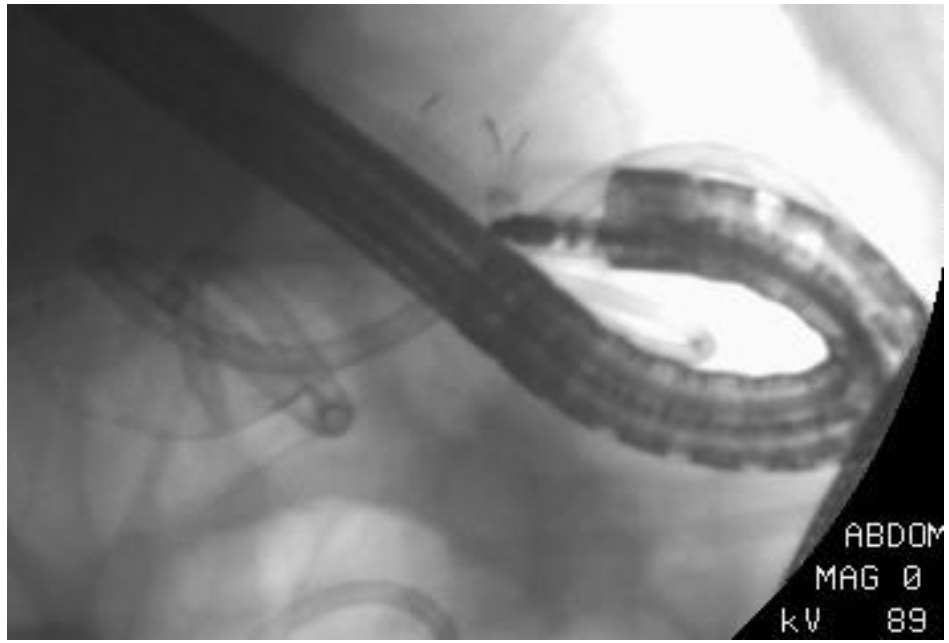
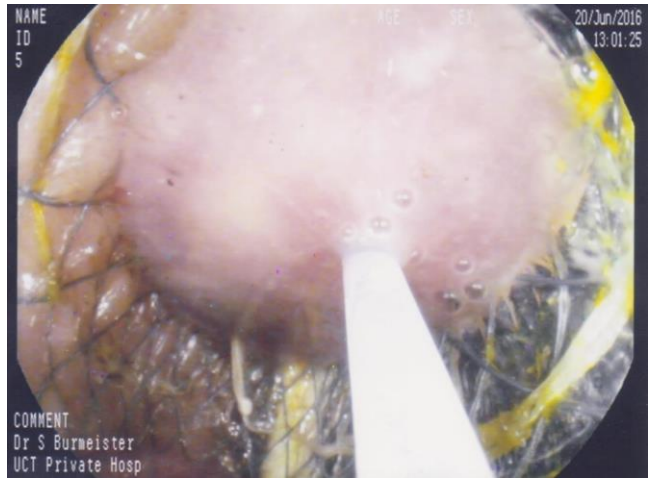
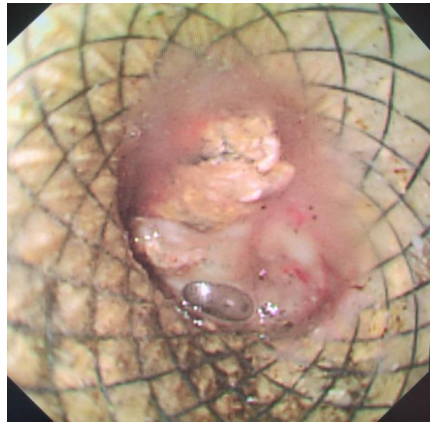


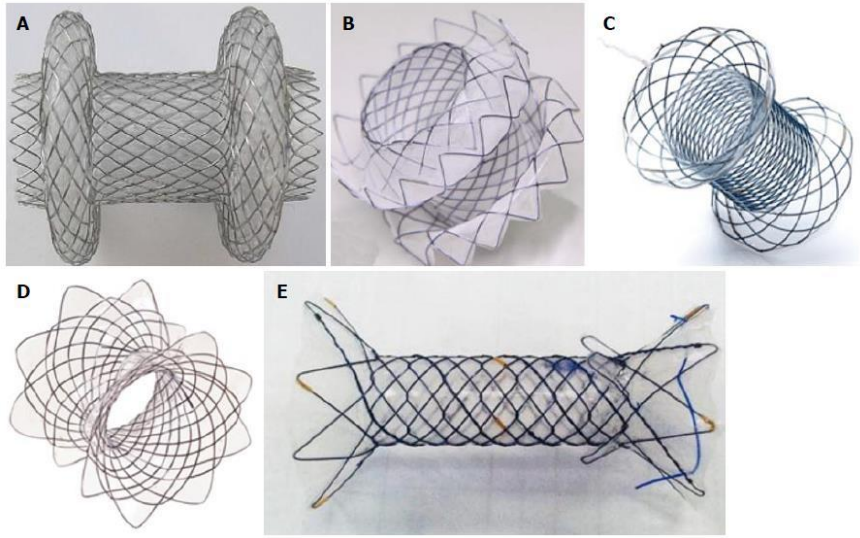




Lumen apposing covered SEMS

Table 3 Covered self-expandable metal stents for endoscopic ultrasonography guided pancreatic cyst drainage

Stent	Company	Length (mm)	Internal diameter (mm)	Maximal flange diameter (mm)	Delivery device length (mm)	Delivery device diameter (Fr)
Axios™	Xlumena	10	10 or 15	21 or 24	1460	10.8
Aix™	Leufen	30	10 or 15	25	2300	10
Nagi™	Taewoong	10 or 20 or 30	10 or 12 or 14 or 16	22 or 24 or 26 or 28	1800	10.5
BCF™ Hanaro	M.I. Tech	30 or 40	10 or 12	25	1800	10.2



Braden WJG 2014
Mangiavillano WJG 2016

Lumen apposing covered SEMS

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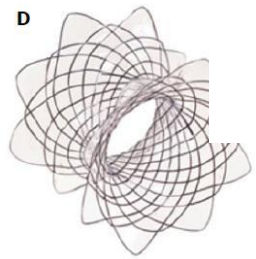
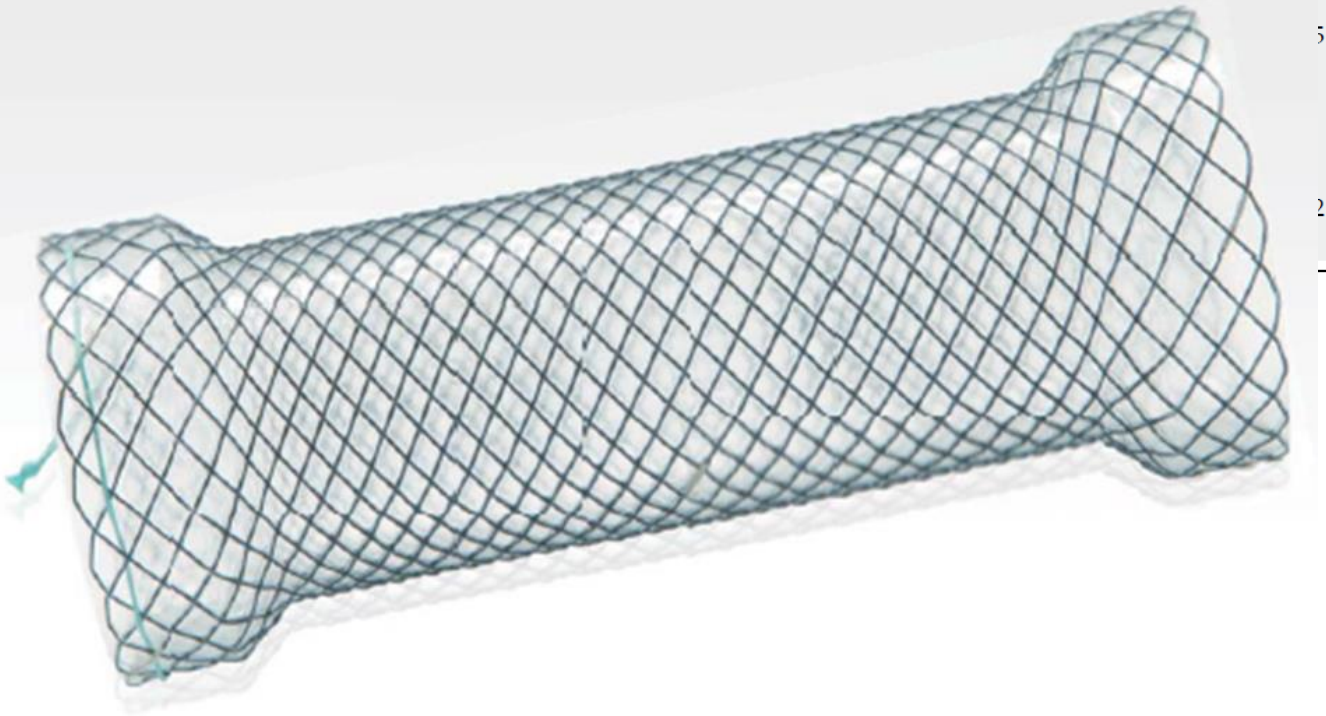
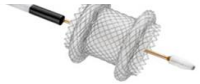
Stent	Company	Length (mm)	Internal diameter (mm)	Maximal flange diameter (mm)	Delivery device length (mm)	Delivery device diameter (Fr)
Axios™	Xlume					3
Aix™	Leufe					
Nagi™	Taewoo					5
BCF™	M.I. Te					2
Hanaro						







Braden WJG 2014
Mangiavillano WJG 2016

SEMS vs plastic stents

ORIGINAL ARTICLE

Non-superiority of lumen-apposing metal stents over plastic stents for drainage of walled-off necrosis in a randomised trial

Ji Young Bang, Udayakumar Navaneethan, Muhammad K Hasan, Bryce Sutton, Robert Hawes, Shyam Varadarajulu

- 60 patients; LAMS 31, plastic stent (PS) 29
- ***No*** significant ***difference*** in number of ***procedures***, ***treatment success, clinical adverse events***, readmissions, LOS, overall treatment cost
- ***LAMS:***
  - ***shorter*** procedures (15 vs 40min,p<0.001),
  - ***↑stent-related adverse events*** (32.3% vs 6.9%, p=0.01)
  - ↑procedure ***costs*** (US$ 12 155 vs $6 609, p<0.01)
- ***Significant stent-related adverse events occurred ≥ 3/52 post LAMS placement***
  - interim ***protocol amendment*** with CT at 3/52 & LAMS removal if resolution of WON

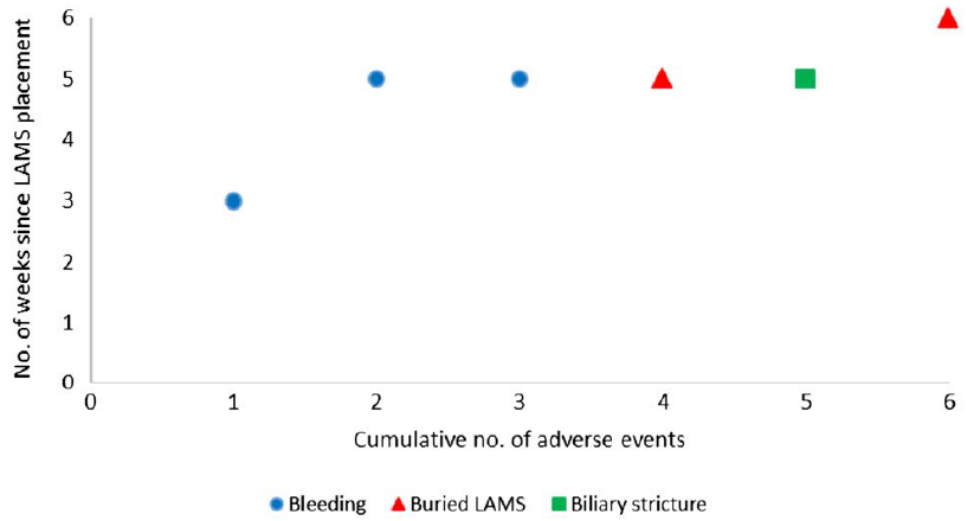
Adverse events	LAMS	PS	P value
Overall	13 (41.9)	6 (20.7)	0.077
Stent-related	10 (32.3)	2 (6.9)	0.014
Prior protocol change	8 (25.8)	0	0.005
After protocol change	2 (6.5)	2 (6.9)	0.999
Clinical	3 (9.7)	4 (13.8)	0.702

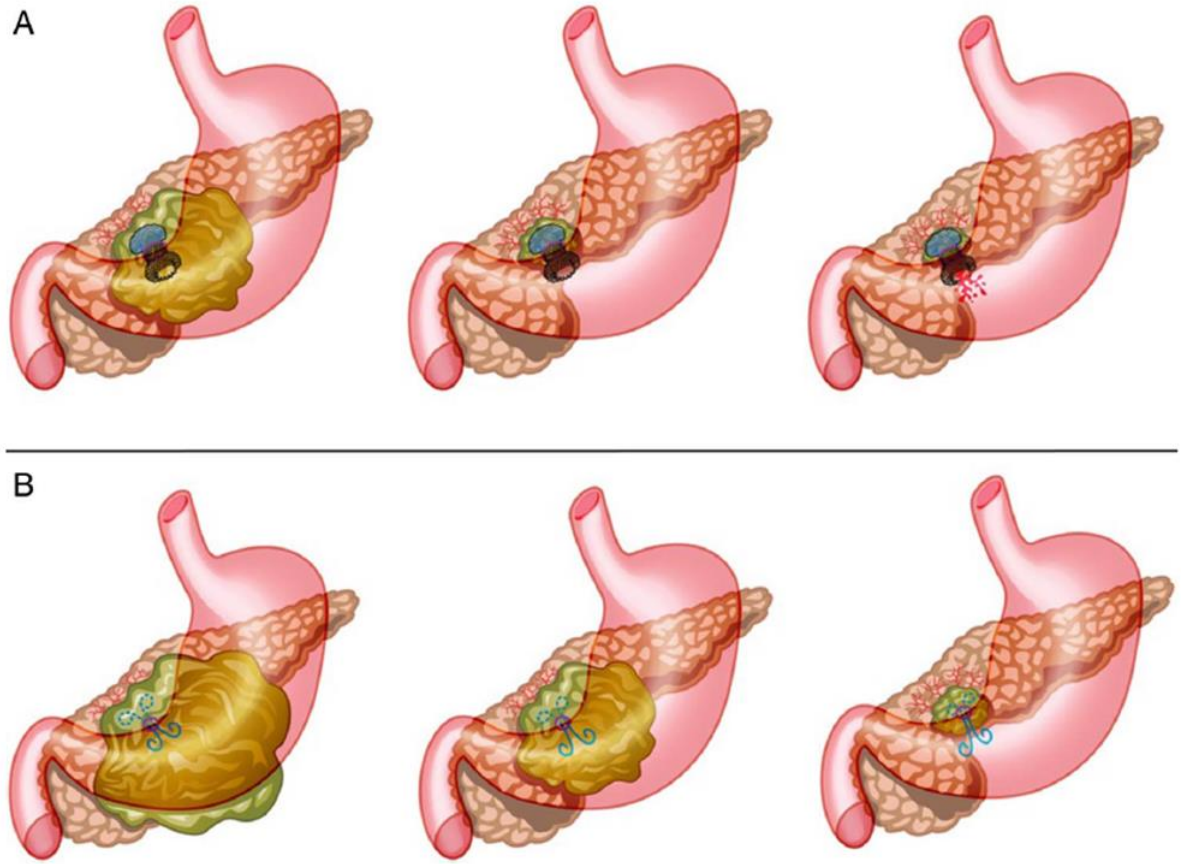
2018 Gut Bang

Lumen-apposing metal stents (LAMS) for pancreatic fluid collection (PFC) drainage: may not be business as usual

Ji Young Bang, Muhammad Hasan, Udayakumar Navaneethan, Robert Hawes, Shyam Varadarajulu

- Interim results from a randomised trial comparing LAMS with plastic stents





2016 Gut Bang

SEMS vs plastic stents

SYSTEMATIC REVIEW AND META-ANALYSIS

Metal stents versus plastic stents for the management of pancreatic walled-off necrosis: a systematic review and meta-analysis

Fateh Bazerbachi, MD,[1] Tarek Sawas, MD,[1] Eric J. Vargas, MD,[1] Larry J. Prokop,[2] Suresh T. Chari, MD,[1] Ferga C. Gleeson, MB, BCh,[1] Michael J. Levy, MD,[1] John Martin, MD,[1] Bret T. Petersen, MD,[1] Randall K. Pearson, MD,[1] Mark D. Topazian, MD,[1] Santhi S. Vege, MD,[1] Barham K. Abu Dayyeh, MD, MPH[1]

Digestive Diseases and Sciences (2018) 63:289–301
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REVIEW

Efficacy and Safety of Lumen-Apposing Metal Stents in Management of Pancreatic Fluid Collections: Are They Better Than Plastic Stents? A Systematic Review and Meta-Analysis

Tariq Hammad[1,2] · Muhammad Ali Khan[3] · Yaseen Alastal[1] · Wade Lee[4] · Ali Nawras[1] · Mohammad Kashif Ismail[3] · Michel Kahaleh[5]

Lumen apposing metal stents in drainage of pancreatic walled-off necrosis, are they any better than plastic stents? A systematic review and meta-analysis of studies published since the revised Atlanta classification of pancreatic fluid collections

Babu P. Mohan, Mahendran Jayaraj[1], Ravishankar Asokkumar[2], Mohammed Shakhatreh[3], Parul Pahal, Suresh Ponnada[4], Udayakumar Navaneethan[5], Douglas G. Adler[6]

UNITED EUROPEAN GASTROENTEROLOGY ueg journal

Original Article

United European Gastroenterology Journal
2018, Vol. 6(5) 729–738

DOI: 10.1177/2050640618761702
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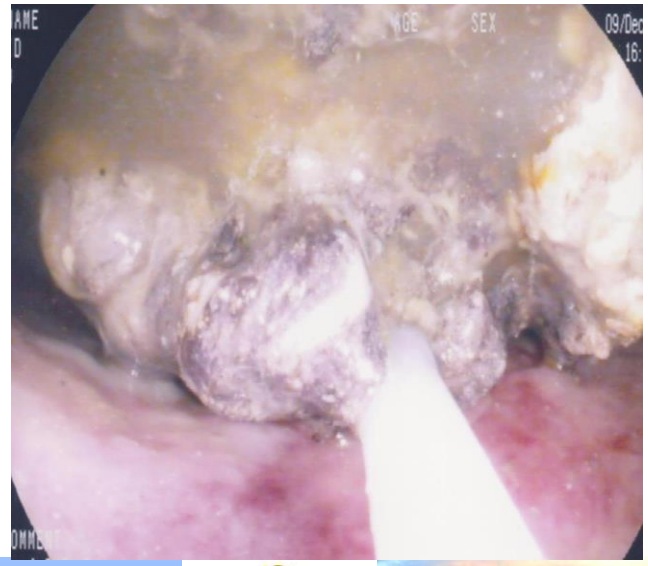
SAGE

Metal versus plastic stents for drainage of pancreatic fluid collection: A meta-analysis

Seung Bae Yoon, In Seok Lee and Myung-Gyu Choi

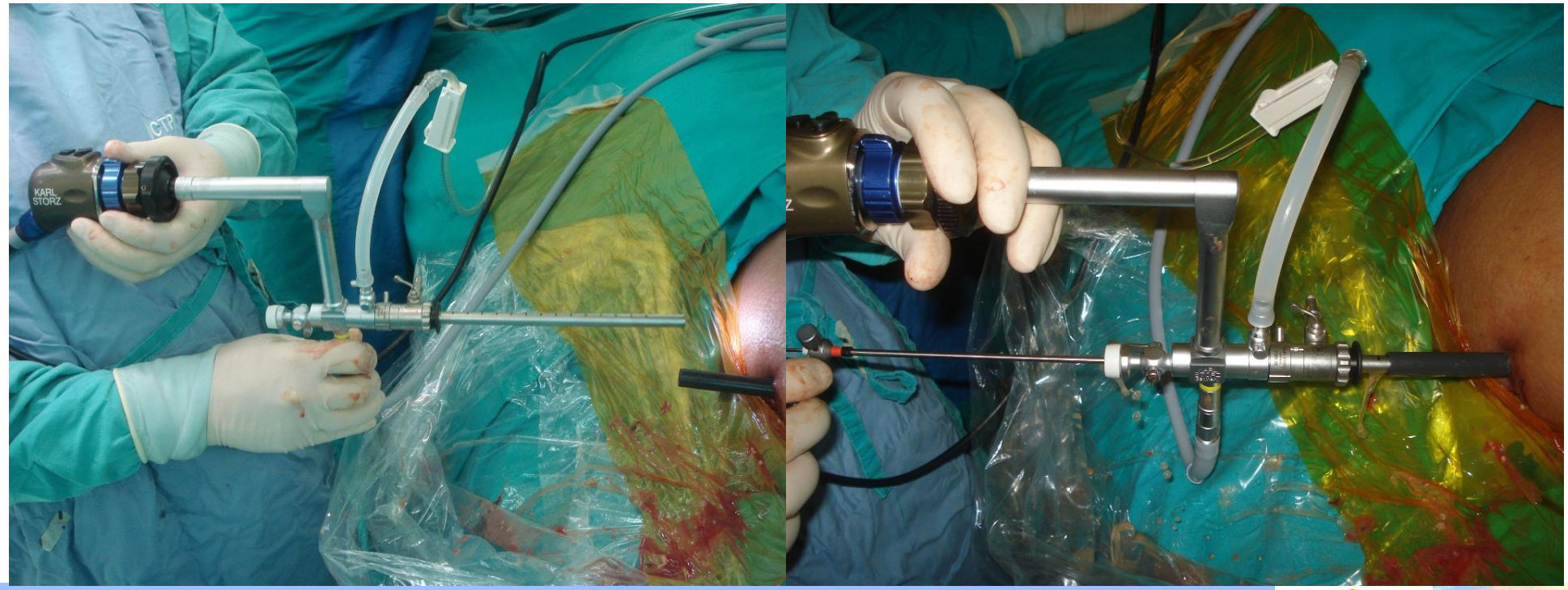
Endoscopic necrosectomy

- Transmural necrosectomy
  - Requires dilated and mature tract into necrotic cavity / SEMS in place
  - Allows lavage and debridement (baskets, forceps, nets, irrigation)
  - Multiple sessions typically required



Minimally invasive surgery

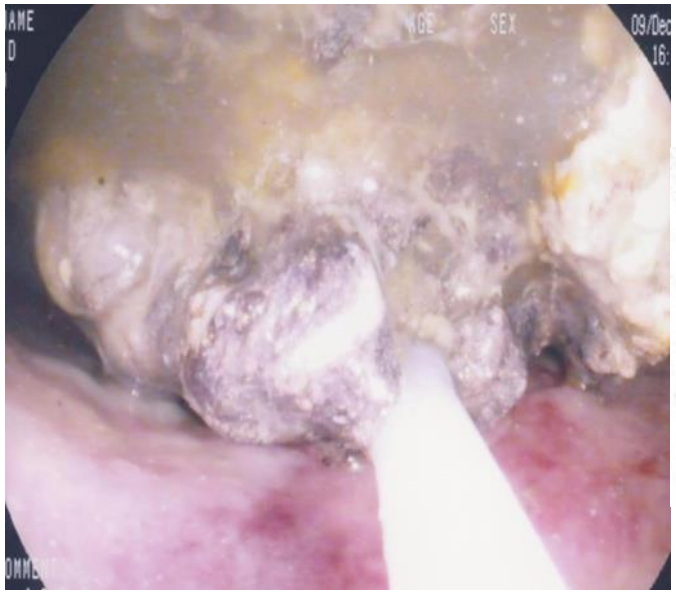
- Video assisted retro-peritoneal debridement (VARD) / minor incision retroperitoneal pancreatic necrosectomy (MIRP), sinus tract endoscopy



Necrosectomy

- **Endoscopic tools** for debridement borrowed from alternative procedures

- **H2O2**
  - Safe, effective



Contents lists available at ScienceDirect

Pancreatology

journal homepage: www.elsevier.com/locate/pan

Hydrogen peroxide assisted endoscopic necrosectomy for walled-off pancreatic necrosis: A systematic review and meta-analysis

Rajat Garg [a], Shradha Gupta [b], Amandeep Singh [c], Marian T. Simonson [d], Tarun Rustagi [e], Prabhleen Chahal [c, *]

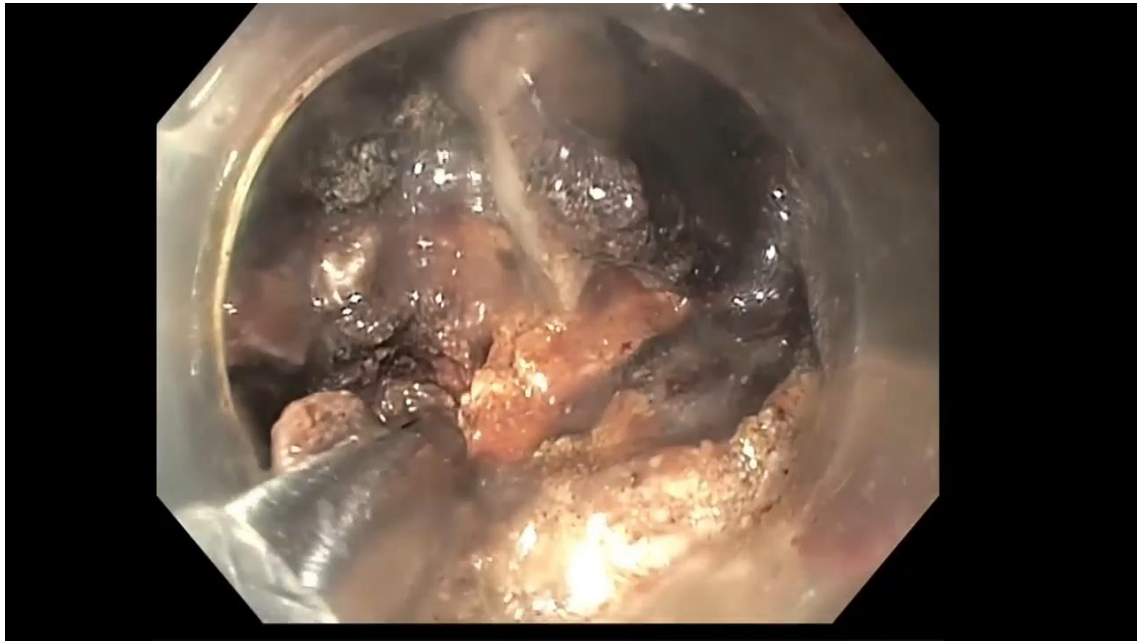
2021 Pancreatology Garg

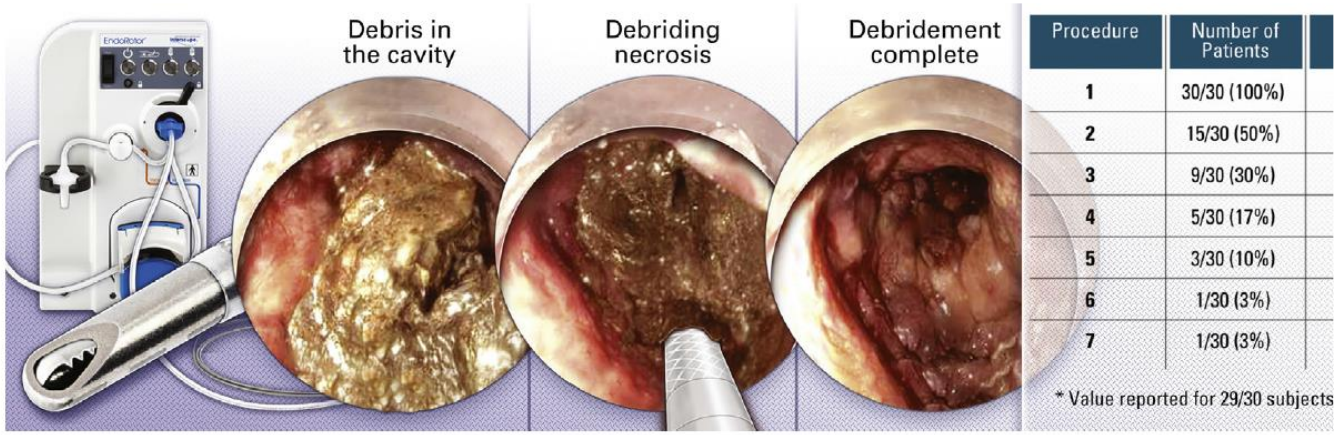
ORIGINAL ARTICLE: Clinical Endoscopy

Safety and efficacy of a novel resection system for direct endoscopic necrosectomy of walled-off pancreas necrosis: a prospective, international, multicenter trial CME

- **Endorotor** – powered endoscopic debridement (PED)
- Safe, effective (n=30)

2022 GIE Stassen



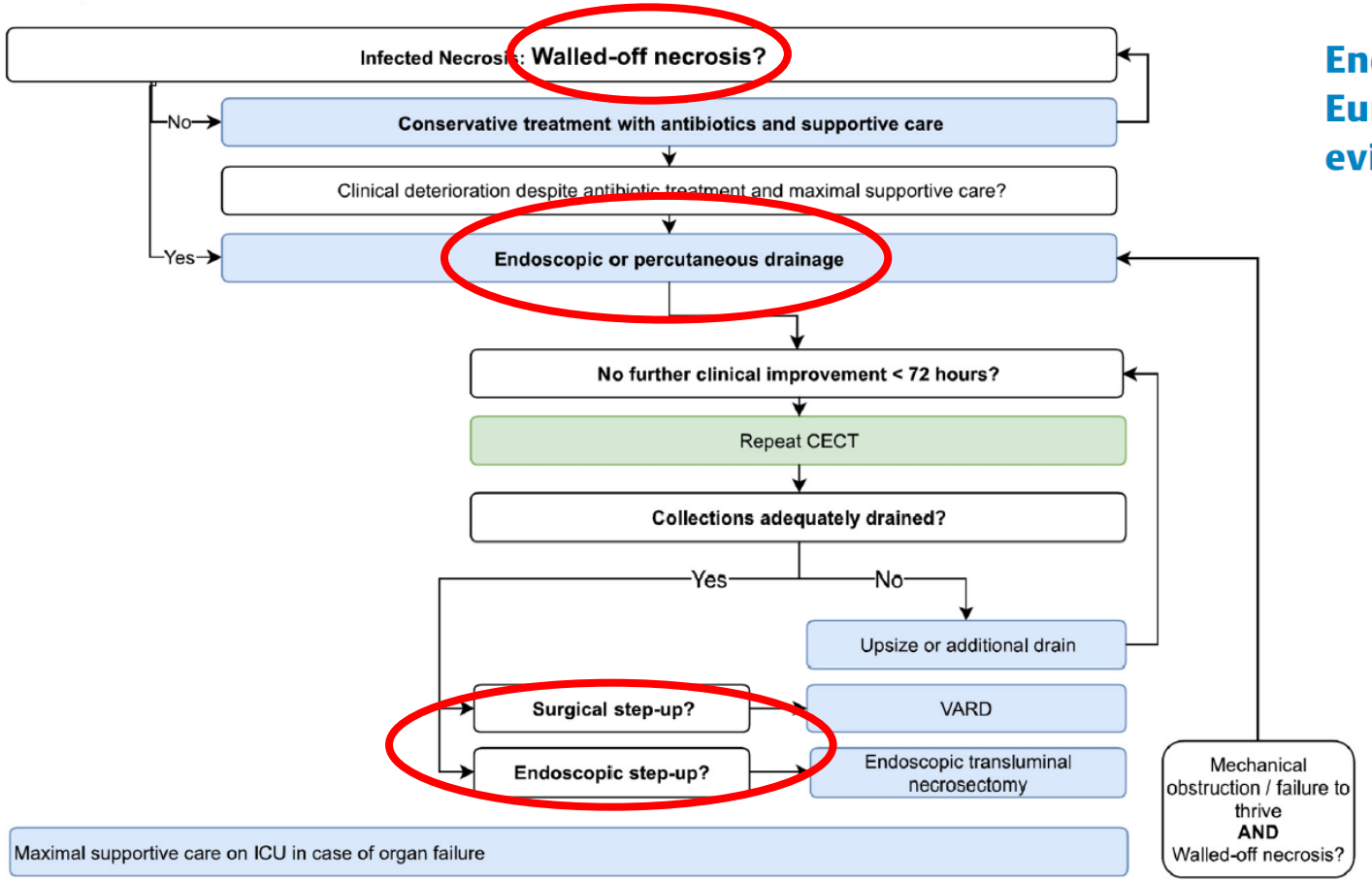


Procedure	Number of Patients
1	30/30 (100%)
2	15/30 (50%)
3	9/30 (30%)
4	5/30 (17%)
5	3/30 (10%)
6	1/30 (3%)
7	1/30 (3%)

* Value reported for 29/30 subjects

Acute pancreatitis: recent advances through randomised trials

Sven M van Dijk,[1] Nora D L Hallensleben,[2] Hjalmar C van Santvoort,[3] Paul Fockens,[4] Harry van Goor,[5] Marco J Bruno,[2] Marc G Besselink,[1] for the Dutch Pancreatitis Study Group



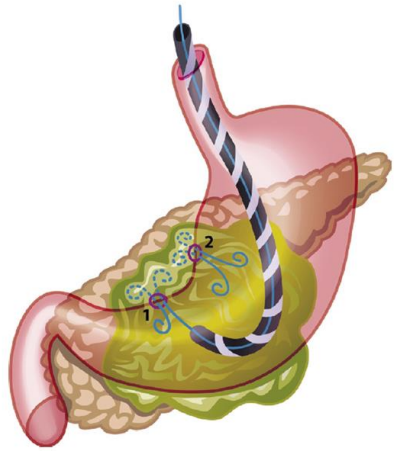
Endoscopic management of acute necrotizing pancreatitis: European Society of Gastrointestinal Endoscopy (ESGE) evidence-based multidisciplinary guidelines

7 ESGE suggests that, in the absence of improvement following endoscopic transmural drainage of walled-off necrosis, endoscopic necrosectomy or minimally invasive surgery (if percutaneous drainage has already been performed) is to be preferred over open surgery as the next therapeutic step, taking into account the location of the walled-off necrosis and local expertise.
Weak recommendation, low quality evidence.

Gut 2017
Endo 2018

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**



TENSION TRIAL

- 98 patients randomised
- ***Non-superiority outcome***: no difference in primary endpoint of major complication / death – 43% endoscopic, 45% surgical (p=0.88)
- Endoscopy: shorter hospital stay (53 vs 69 days; p=0.014), less indirect costs, ***less pancreatic fistulae*** (5 vs 32% p=0.0011)
- NB: ***double pigtail stents*** utilised for endoscopic drainage; ***pancreatic fistula not included within major complications***

2018 Lancet Van Brunschot

Free Paper Session 6 - Pancreas

FP06.01

EXTENSION: LONG-TERM FOLLOW-UP STUDY OF AN ENDOSCOPIC VERSUS SURGICAL STEP-UP APPROACH FOR INFECTED NECROTIZING PANCREATITIS

A. Onnekink[1], L. Boxhoorn[1], S. T. Bac[2], H. C. Timmerhuis[3], M. G. Besselink[4], M. J. Bruno[5], S. van Brunschot[3], H. C. van Santvoort[3], R. Verdonk[2], P. Fockens[1], R. P. Voermans[1] and Dutch Pancreatitis Study Group

[1]Amsterdam UMC, University of Amsterdam, [2]St. Antonius Hospital, Gastroenterology and Hepatology, [3]St. Antonius Hospital, [4]Amsterdam UMC, University of Amsterdam, Surgery, and [5]Erasmuc MC University, Gastroenterology and Hepatology, the Netherlands

- 56 patients
- Mean FU period of 7 years
- No diff in mortality
- Endo
  - Fewer panc fistula
  - Fewer additional drainages
  - Higher physical health scores at 3/12
- “Endoscopic approach preferred”

HPB 2021

An Endoscopic Transluminal Approach, Compared With Minimally Invasive Surgery, Reduces Complications and Costs for Patients With Necrotizing Pancreatitis

Ji Young Bang,[1] Juan Pablo Arnoletti,[2] Bronte A. Holt,[1] Bryce Sutton,[1] Muhammad K. Hasan,[1] Udayakumar Navaneethan,[1] Nicholas Feranec,[3] C. Mel Wilcox,[4] Benjamin Tharian,[1] Robert H. Hawes,[1] and Shyam Varadarajulu[1]

MISER TRIAL

- 66 patients randomised
- Primary endpoint of ***major complication (including pancreatic fistula)*** / ***death***: endoscopic ***11.8% vs 40.6%*** minimally invasive surgery (p=0.007)
  - ***Enteral / pancreatic fistulae: endo 0% vs 28.1%*** (p=0.001)
- Mean no. of ***major complications:***
  - endo 0.15 +/- 0.44; surgery 0.69 +/- 1.03 (p=0.007)
- No difference in mortality (endo 8.8% vs surgery 6.3%; p=0.999)
- Endoscopy: ***higher QOL, lower total cost***

2019 Gastroenterology Bang

Digestive Endoscopy 2020; **32**: 298–308 doi: 10.1111/den.13470

Review

Superiority of endoscopic interventions over minimally invasive surgery for infected necrotizing pancreatitis: meta-analysis of randomized trials

Ji Young Bang,[1] Charles Melbern Wilcox,[3] Juan Pablo Arnoletti[2] and Shyam Varadarajulu[1]

- 184 patients
- ***Enterocutaneous fistula / perforation***
  - Endo 3.6% vs MIS 17.9%, p=0.034
- ***Pancreatic fistula***
  - Endo 4.2% vs MIS 38.2%, p<0.001
- ***New onset multiple organ failure***
  - Endo 5.2% vs MIS 19.7%, p=0.045
- No difference in mortality, intra-abdominal bleeding, pancreatic insufficiency
- ***Shorter hospital stay*** for endoscopically managed patients

2020 Dig Endo Bang

Early (<4 Weeks) Versus Standard (≥ 4 Weeks) Endoscopically Centered Step-Up Interventions for Necrotizing Pancreatitis

Guru Trikudanathan, MD[1], Pierre Tawfik, MD[2], Stuart K. Amateau, MD, PhD[1], Satish Munigala, MBBS, MPH[3], Mustafa Arain, MD[1], Rajeev Attam, MD[1], Gregory Beilman, MD[4], Siobhan Flanagan, MD[5], Martin L. Freeman, MD[1] and Shawn Mallery, MD[1]

- 193 patients
  - 76 early intervention, 117 standard intervention
  - 75% included endoscopic drainage +/- necrosectomy
- Early intervention more often indicated for sepsis and more associated with acute kidney injury, respiratory failure, shock
- Organ failure improved after intervention in both groups
- ***Early group*** greater:
  - ***Mortality*** 13% early vs 4% std, p=0.02
  - Need for ***open necrosectomy*** 7% early vs 1% std, p=p=0.03
  - Median ***hospital*** (37vs 26 days;p=0.01), ***ICU stay*** (2.5 vs 0 days; p=0.001)
- ***No difference in complications*** – bleeding (11% vs 10%), stent occlusion (40% vs 33%), fistulae (33% vs 21%). Perforation, n=7 only occurred in std group

2018 Am J Gastro Trikudanathan

Gastroenterology 2020;158:67–75

AGA CLINICAL PRACTICE UPDATE: EXPERT REVIEW

American Gastroenterological Association Clinical Practice Update: Management of Pancreatic Necrosis

Todd H. Baron,[1] Christopher J. DiMaio,[2] Andrew Y. Wang,[3] and Katherine A. Morgan[4]

[1]Division of Gastroenterology and Hepatology, University of North Carolina, Chapel Hill, North Carolina; [2]Division of Gastroenterology, Icahn School of Medicine at Mount Sinai, New York, New York; [3]Division of Gastroenterology and Hepatology, University of Virginia, Charlottesville, Virginia; and [4]Division of Gastrointestinal and Laparoscopic Surgery, Medical University of South Carolina, Charleston, South Carolina

BEST PRACTICE ADVICE 7: Percutaneous drainage and transmural endoscopic drainage are both appropriate first-line, nonsurgical approaches in managing patients with walled-off pancreatic necrosis (WON). Endoscopic therapy through transmural drainage of WON may be preferred, as it avoids the risk of forming a pancreatocutaneous fistula. **BEST PRACTICE**

Gastroenterology 2020;158:67–75

AGA CLINICAL PRACTICE UPDATE: EXPERT REVIEW

American Gastroenterological Association Clinical Practice Update: Management of Pancreatic Necrosis

Todd H. Baron,[1] Christopher J. DiMaio,[2] Andrew Y. Wang,[3] and Katherine A. Morgan[4]

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ADVICE 8: Percutaneous drainage of pancreatic necrosis should be considered in patients with infected or symptomatic necrotic collections in the early, acute period (<2 weeks), and in those with WON who are too ill to undergo endoscopic or surgical intervention. Percutaneous drainage should be strongly considered as an adjunct to endoscopic drainage for WON with deep extension into the paracolic gutters and pelvis or for salvage therapy after endoscopic or surgical debridement with residual necrosis burden. **BEST PRACTICE ADVICE 9:**

- In the 2-4 week window, if intervention is indicated, Endo drainage can be considered

Gastroenterology 2020;158:67–75

AGA CLINICAL PRACTICE UPDATE: EXPERT REVIEW

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with residual necrosis burden. **BEST PRACTICE ADVICE 9:** Self-expanding metal stents in the form of lumen-apposing metal stents appear to be superior to plastic stents for endoscopic transmural drainage of necrosis. **BEST PRACTICE**

Dual-modality drainage of infected and symptomatic walled-off pancreatic necrosis: long-term clinical outcomes

Andrew S. Ross, MD, Shayan Irani, MD, S. Ian Gan, MD, Flavio Rocha, MD, Justin Siegal, MD, Mehran Fotoohi, MD, Ellen Hauptmann, MD, David Robinson, MD, Robert Crane, MD, Richard Kozarek, MD, Michael Gluck, MD

Seattle, Washington, USA

- 117 underwent primary dual modality drainage – pigtail stents
- Median follow-up of 749.5 days
- No procedural mortality; 3.4% disease related mortality
- ***No patients required surgical necrosectomy*** or ***surgical treatment for adverse events***; 3 patients required delayed surgery for pain (n=2), GOO (n=1)
- Adverse events: early – bleeding (n=4), pneumoperitoneum (n=1), sepsis post drain removal (n=1); late – stent migration, pain, GOO
- No pancreatico-cutaneous fistulae

2014 GIE Ross

Conclusion

- Conservative step-up therapy is the gold standard in the management of necrotising pancreatitis
- Endoscopic therapy has evolved as the modality of choice in the interventional treatment of pancreatitis related collections and infected necrosis
- Fully covered metal stents are preferable to plastic stents in endoscopic transmural drainage
- Percutaneous drainage remains a valuable modality and should be viewed as complementary rather than competitive
- Need for improved tools to aid necrosectomy
- Decision making should be individualized and is best done in a referral, multi-disciplinary setting