Virginia Mason™

WOPN
Debridement, Lavage, Both, Neither
The Virginia Mason Approach

Richard Kozarek—Seattle

Debridement

Historically necrosectomy was done early/open surgery

—prohibitive morbidity
—mortality rates approximating 15–30%

Arvanitakis et al. Endoscopy 2018;50:524-46

Early Series of Endoscopic/Percutaneous Drainage WOPN

Kozarek et al. Gastroenterology 1991;100:1362

Freeny et al. Am J Roentgenol. 1995;170:969

Baron et al. Gastroenterology 1996;111:755

Baron et al. Gastrointest Endosc. 2002;56:7

Outcomes After Attempted Endoscopic Drainage of Patient Fluid Collections

	AP	CP	PN	AP vs. CP	AP vs. PN	CP vs. PN
Successful resolution	23/31 (74%)	59/64 (92%)	31/43 (72%)	p = 0.02	NS	p = 0.006
Complications	6/31 (19%)	11/64 (17%)	16/43 (37%)	NS	NS	p = 0.02
Recurrence	2/23 (9%)	7/59 (12%)	9/31 (29%)	NS	NS	p = 0.047
Hospital days	9	3	20	p = 0.0003	NS	p = 0.0001

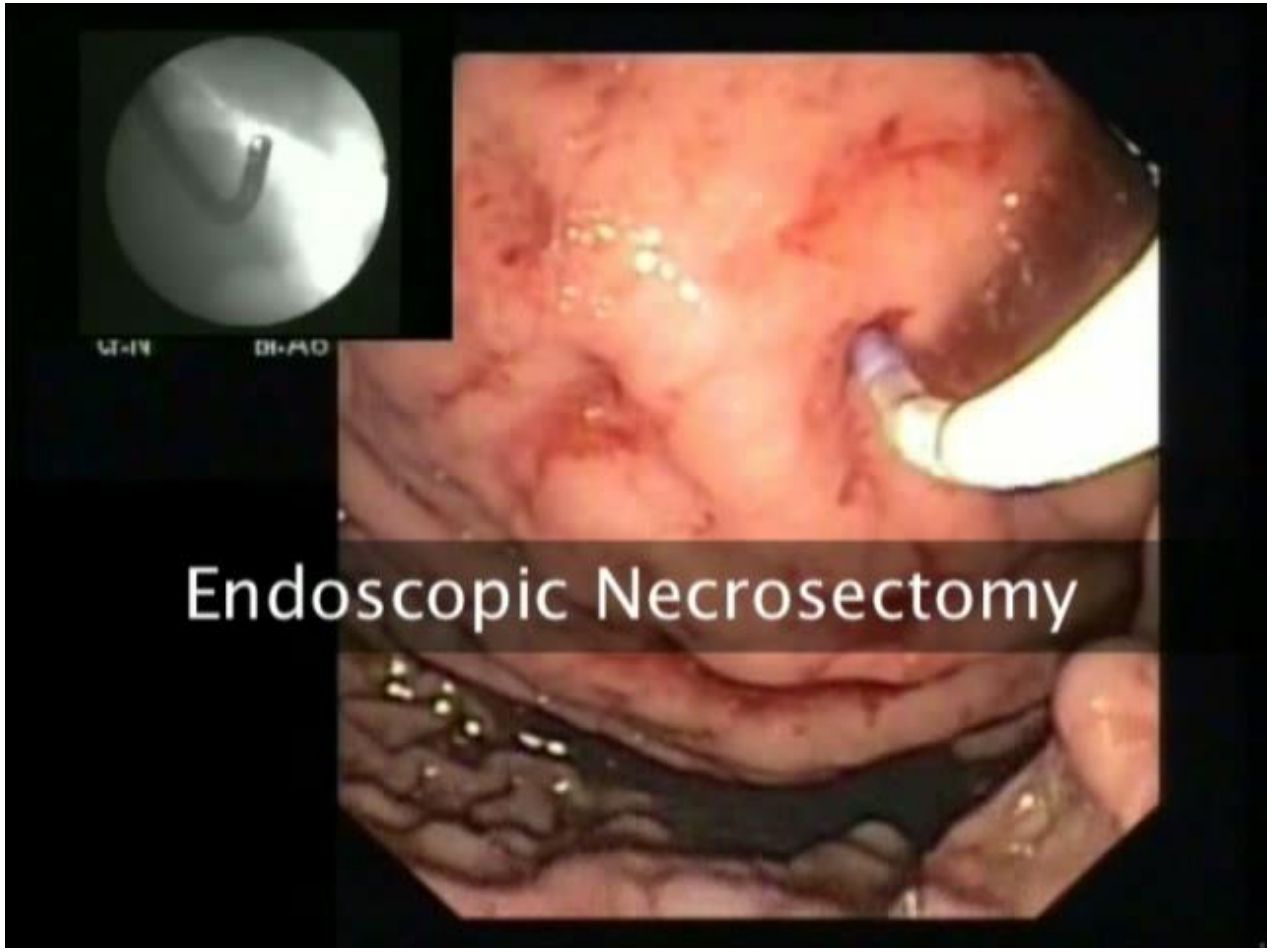
AP, Acute pseudocyst; CP, chronic pseudocyst; PN, pancreatic necrosis.
Adapted from: Baron et al. Gastrointest Endosc 2002;56:7-17.

Transgastric/Transduodenal Debridement

Initial publication:

Seewald S et al. Aggressive endoscopic therapy for pancreatic necrosis and pancreatic abscess: a new safe and effective treatment algorithm (videos). Gastrointest Endosc. 2005;62:92-100.

Endoscopic Necrosectomy



Endoscopic Necrosectomy

Seifert et al, Lancet, 2009; 356(9230):653

- 96 patients with infected pancreatic necrosis
- Initial clinical success in 80% of patients
  - Sustained clinical improvements in 84% after mean follow-up of 43 months
- Median number of endoscopic procedures per patient: 6
- 26% procedure-related morbidity
- Mortality: 7.5%
  - 2 procedure-related deaths

Multicenter US Series DEN

Gardner et al, GIE 2011; 73:718

- Retrospective review 104 pts, 6 centers
- X Rx 60 days after onset of pancreatitis
- Successful resolution 91% at mean 4.1 months
- Median # procedures: 3
- Complix 14% (5 perforations, 1 massive bleed)
- 5 deaths, 1 peri-procedural
- 6% recurrent collex/3% recurrent pancreatitis

Pancreatitis
Werkgroep Nederland

PANTER Trial - NEJM 2010

PENGUIN Trial - JAMA 2012

TENSION Trial – Lancet 2018

Summary RCT

PANTER Trial

- Minimally invasive step-up approach of percutaneous drainage followed by VARD, if necessary; superior (reduced rate major complications or death) to open necrosectomy.

PENGUIN Trial

- Endoscopic transgastric necrosectomy caused a reduced pro-inflammatory response and reduced composite endpoint of major clinical adverse events/death compared to surgical necrosectomy.

TENSION Trial

- Endoscopic step-up approach was not superior to the surgical step-up approach in reduction of major complications or death in patients with infected necrosis.

TENSION

RCT, multicenter, 98 pts

- Endoscopic step-up vs Surgical step-up
  - Endo step-up = EUS-TM, followed by DEN
  - Surg step-up = Perc drain, followed by VARD

Primary endpoint: composite of major AE or death during 6 month f/u

Primary endpoint reached

	Endo Step-Up (n = 51)	Surgical Step-Up (n = 47)	p value
Primary endpoint reached	43%	45%	NS
New onset MOF	4%	13%	NS
Death	**18%**	**13%**	NS
Pancreatic fistula	5%	32%	.0011
Days in hospital	53	69	.014

van Brunschot S, et al. *Lancet* 2018;391(10115):51-58

Virginia Mason™

The Short and Long-Term Results of Dual Modality Drainage for Pancreatic Necrosis

Is it Real?/Are Results Reproducible?

Richard Kozarek

Perspective

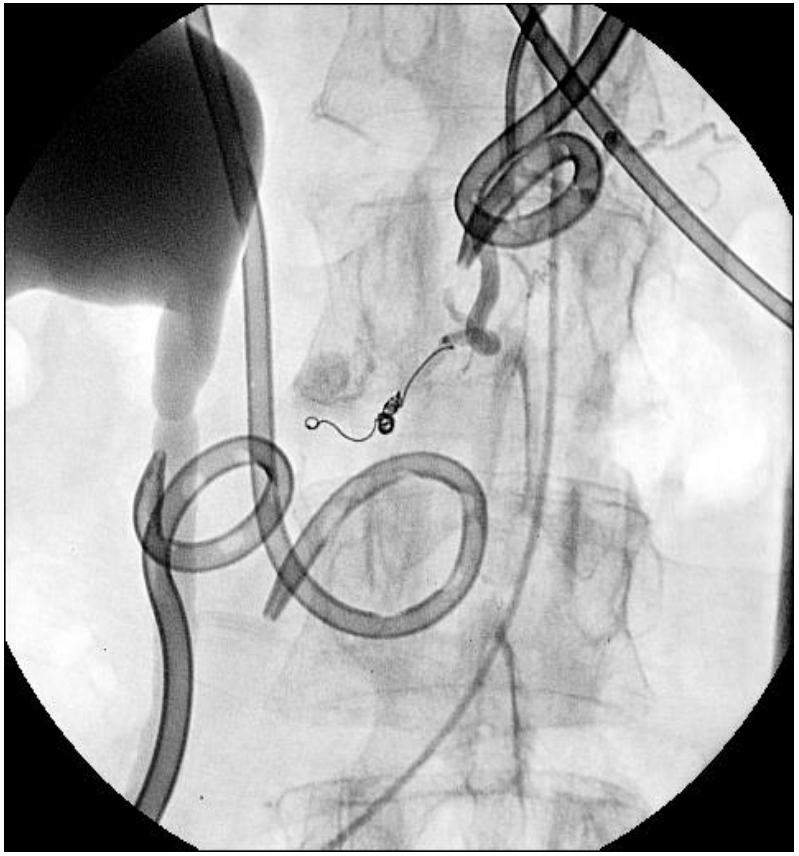
Our Medical Center has treated SAP/necrotizing pancreatitis with percutaneous catheter placement for > 20 yrs.

Freeny et al. AJR. 1995;170:969-75

Traverso and Kozarek. Surg Clin North Am. 1999;79:745-57

Percutaneous Drainage for Pancreatic Necrosis

- Large-bore drains placed under CT-guidance into infected necrosis
- Progressive up-sizing (30Fr) drainage and lavage until resolution
- VMMC: less than 10% rate of surgical necrosectomy; mortality <10%
  - 46% rate of pancreaticocutaneous fistulae with disconnected duct syndrome*



*Fotoohi, et al. 1998

Combined Endoscopic & Percutaneous Drainage

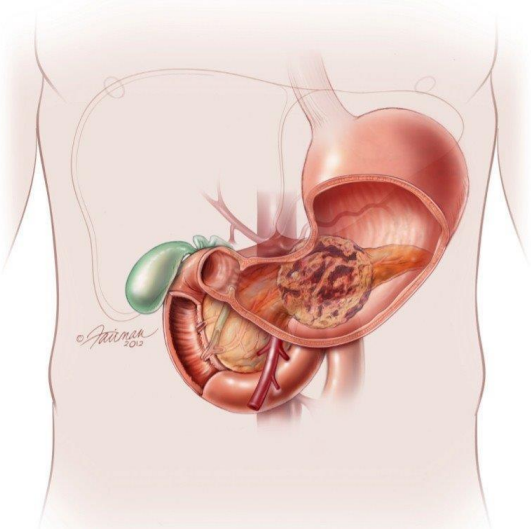
- To define a combined endoscopic and percutaneous approach to drainage of ON with the goal of precluding the development of chronic pancreatico-cutaneous fistulae

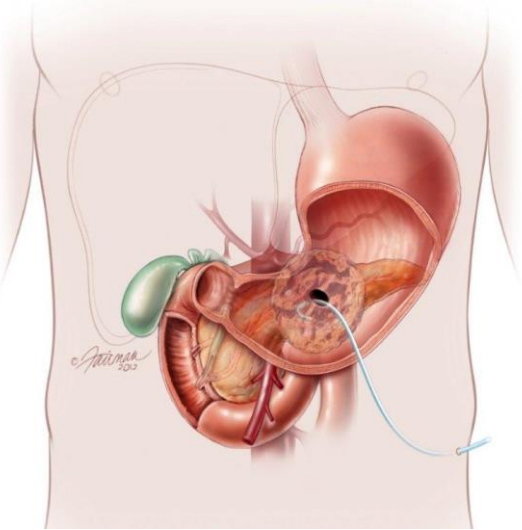
Ross & Gluck, *GIE* 2009

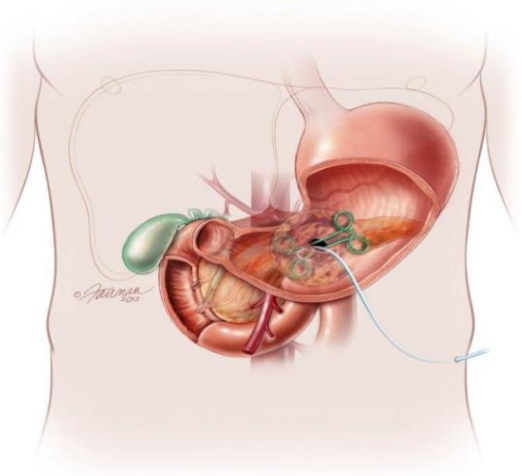
Technique

- CT-guided percutaneous drain placement by Interventional Radiologist
  - 5–10cc's of fluid removed
- Immediately followed by endoscopic "necrogastrostomy"/"necroduodenostomy"
  - EUS-guided if no "bulge" was seen on endoscopy or extensive varices noted on CT
- Pancreatogram performed where feasible
  - Ductal anatomy imperative to determining duration of trans-enteric stent placement

Ross & Gluck, *GIE* 2009





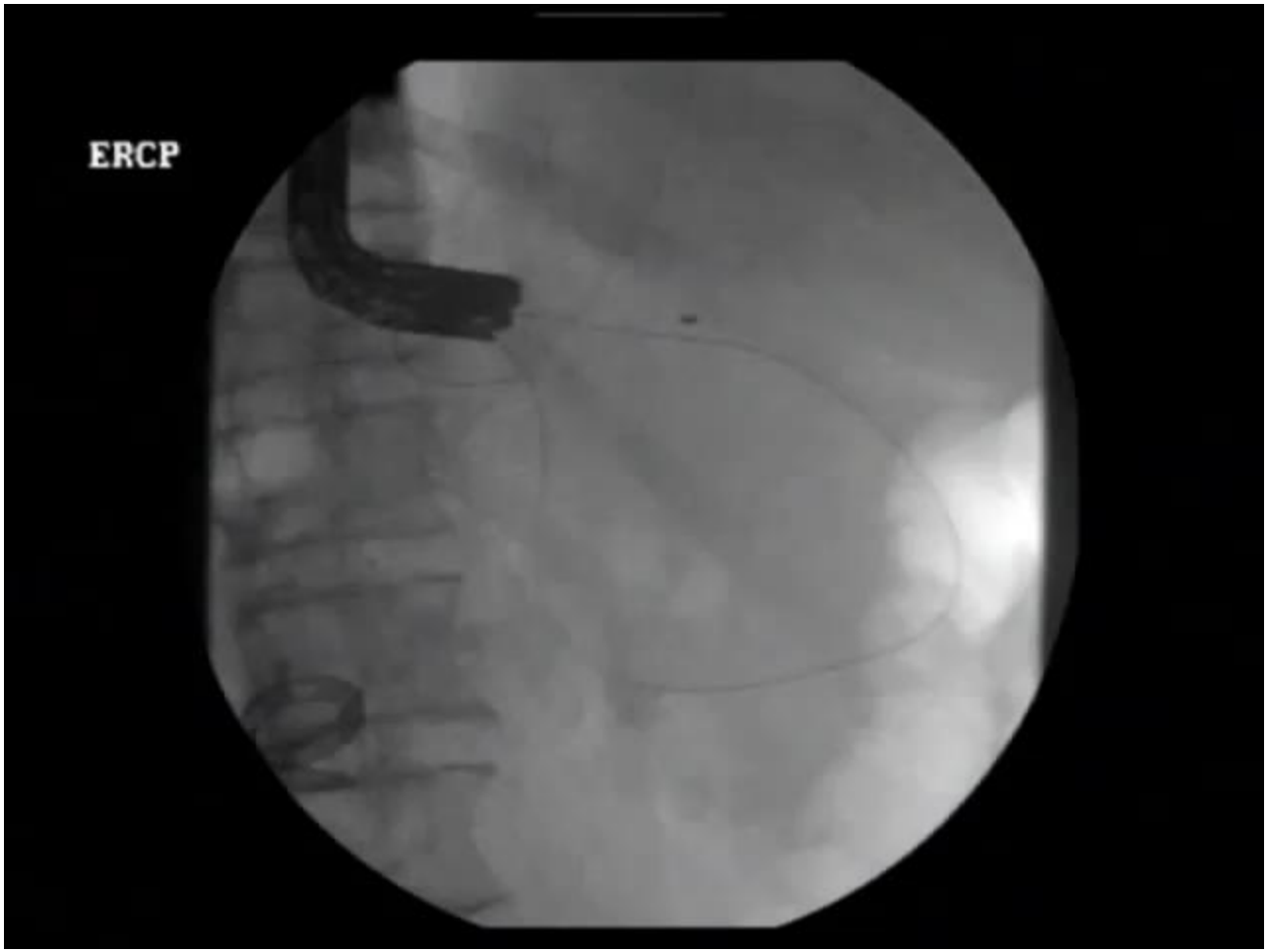


Post-op Care

- Culture-directed antibiotics
- Interval CT scans & upsizing of drains if needed
- Percutaneous drains left in place until complete resolution of cavity based on CT scan and then capped
  - Drain removed if subsequent CT scan did not show re-accumulation of fluid and patient was clinically well
- In the case of disconnected duct syndrome, transgastric stents left in place indefinitely

Ross & Gluck, *GIE* 2009

Direct Endoscopic Gastrostomy



Dual Drainage for WOPN

Ross et al, *GIE* 2010;71:79

Gluck et al, *Clin Gastroenterol Hepatol* 2010;8:1283

Gluck et al, *J Gastrointest Surg* 2012; 16;248

- Prospective study 50 pts with WOPN Rx w/ DMD vs 43 historical controls Rx percutaneous drainage alone.
- Significant ↓ need for CTs/tube studies/LOH, need for surgery, time to drain removal, residual fistula

Dual Modality Drainage of Infected and Symptomatic WOPN: Long-Term Clinical Outcomes

Ross A. et al. Gastrointest Endosc 2014;79:929

Retrospective review, 117 patients with WOPN Rx with DMD

- Median f/u 750 days
- No surgical necrosectomy required
- 2 late surgeries
- No external fistulas post drain removal
- 3.4% disease related mortality

TABLE 1. Demographic data for the cohort

Men, no. (%)	117 (74)
Age, mean, y	55.2
Mean CTSI	7.80
Intensive care unit	N = 70
No. patients with disconnected duct syndrome, no. (%)	75 (64.1)
Median duration of follow-up, d (patients completing treatment)	749.5

TABLE 2. Additional procedure-related data for patients treated with DMD for infected and symptomatic WOPN

Duration of percutaneous drainage, median, d	63
No. percutaneous drains, mean (SD)	1.3 (0.7)
No. CT scans, mean (SD)	7 (3.3)
No. tube checks, mean (SD)	6.1 (3.0)
No. ERCPs, mean (SD)	1.4 (1.0)
% of patients with pancreatic duct stents placed at some point in treatment	45.2
Immediate procedure-related adverse events	
Self-limited bleeding	N = 4
Asymptomatic pneumoperitoneum	N = 1
Infection	N = 1

DMD, Dual-modality drainage; *WOPN,* walled-off pancreatic necrosis; *SD,* standard deviation.

TABLE 3. Clinical outcomes for patients treated with DMD for infected and symptomatic WOPN

Disease-related mortality	3.4%
Persistent hemorrhage	N = 2
Mucous plug	N = 1
Multiple-system organ failure	N = 1
Procedure-related mortality	0%
Chronic pancreaticocutaneous fistula	N = 0
Absence of external drains (living patients only)	100%
Need for early surgery	N = 0
Necrosectomy	N = 0
Procedure-related adverse events	
Need for late surgery	N = 2
Pain	N = 1
Gastric outlet obstruction	

DMD, Dual-modality drainage; *WOPN,* walled-off pancreatic necrosis.

Hyun et al. Gut and Liver 2019;13:215
211 patients, 2.4% mortality

Comparison of clinical outcomes between infected and sterile WON

	Infected WON (n = 98)	Sterile WON (n = 113)	*P* value
Mortality with drain in place	4 (4.1)	1 (0.9)	0.19
Length of stay, days	29.83 ± 25.58	17.25 ± 16.51	<0.01
ICU stay required	37 (37.8)	17 (15.0)	<0.01
Fistula	26 (26.5)	11 (9.7)	<0.01
> 1 percutaneous drain	31 (31.6)	16 (14.2)	<0.01
Interval between drain and removal, days	101.18 ± 102.58	72.42 ± 47.74	0.02
Number of total tube checks	6.60 ± 3.86	5.21 ± 2.95	0.01
Disconnected duct syndrome	68 (69.4)	71 (62.8)	0.30
Number of total CT scans	8.90 ± 5.16	6.73 ± 3.42	<0.01

Values are n (%) or mean ± SD. ICU, intensive care unit; WON, walled-off necrosis

Updates

Hyun et al. Gut Liver. 2019;13:215-22.
Outcomes of Infected versus Symptomatic Sterile Walled-Off Pancreatic Necrosis Treated with a Minimally Invasive Therapy.

Sahar et al. J Gastroenterol Hepatol. 2018;33:1548-52.
Comparable outcomes short and long-term antibiotics.

Sahar et al. Endosc Int Open. 2017 Nov;5:E1052-9.
Comparable outcomes in DMD pigtail stents vs LAMS.

Sahar et al. Eur J Clin Microbiol Infect Dis. 2018 Jul;37(7):1353-9. Defines changing flora WON in era of minimally invasive Rx.

*Our group has not done open, laparoscopic or VARD in a decade

PFC – How Do We Treat?

- Multidisciplinary
- Rx dependent upon institutional skill set, acute vs. chronic leak, persistence of leak/disconnected PD/degree of debris within collection
- **Treat the leak**
- **Treat the consequences of the leak**

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3. Gluck M, Ross A, Irani S, Lin O, Hauptmann E, Siegal J, Fotoohi M, Crane R. Robinson D, Kozarek RA. Endoscopic and percutaneous drainage of symptomatic walled-off pancreatic necrosis reduces hospital stay and radiographic resources. Clin Gastroenterol Hepatol 2010; 8:1083-1088.
4. Gluck M, Ross A, Irani S, Lin O, Gan SI, Fotoohi M, Hauptmann E, Crane R, Siegal J, Robinson DH, Traverso LW, Kozarek RA. Dual modality drainage for symptomatic walled-off pancreatic necrosis reduces length of hospitalization, radiological procedures, and number of endoscopies compared to standard percutaneous drainage. J Gastrointest Surg 2012;16:248-56; discussion 256-7.
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7. Nadav Sahar, Richard Kozarek, Zaheer S. Kanji, Andrew S. Ross, Michael Gluck, S. Ian Gan, Michael Larsen, Shayan Irani. Do Lumen-Apposing Metal Stents (LAMS) Improve Treatment Outcomes of Walled-off Pancreatic Necrosis over Plastic Stents Using Dual Modality Drainage? Endosc Int Open 2017; 5:E1052-E1059.
8. Sahar N, Kozarek RA, Kanji ZS, Chihara S, Gan SI, Gluck M, Larsen M, Ross AS, Irani S. Duration of antibiotic treatment after endoscopic ultrasound-guided drainage of walled-off pancreatic necrosis not affecting outcomes. J Gastroenterol Hepatol. 2018;33:1548-52.
9. Sahar N, Kozarek RA, Kanji ZS, Chihara S, Gan SI, Irani S, Larsen M, Ross AS, Gluck M. The microbiology of infected pancreatic necrosis in the era of minimally invasive therapy. Eur J Clin Microbiol Infect Dis. 2018;37:1353-9.
10. Hyun JJ, Sahar N, Singla A, Ross AS, Irani SS, Gan SI, Larsen MC, Kozarek RA. Outcomes of Infected versus Symptomatic Sterile Walled-Off Pancreatic Necrosis Treated with a Minimally Invasive Therapy. Gut Liver. 2019;13:215-22.