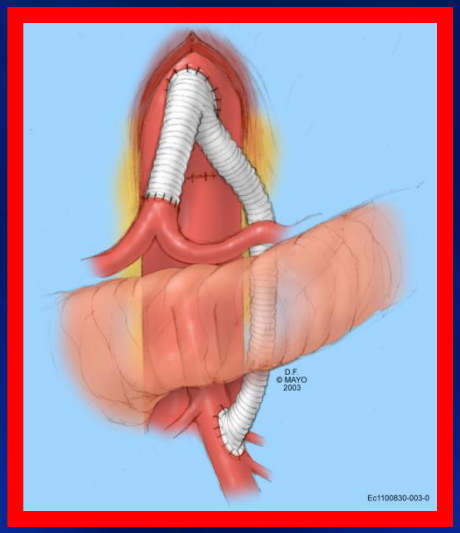
Chronic Visceral Artery Occlusive Diseases

When to Choose Open and When Endovascular Repair?



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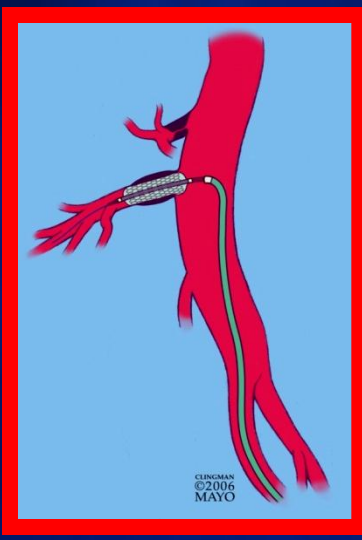

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Conflict of Interest

None

Chronic Mesenteric Ischemia

- Uncommon
- Can progress to acute mesenteric ischemia, bowel infarction and death
- Revascularization provides immediate relief of symptoms

Chronic Mesenteric Ischemia

Etiology

- Atherosclerosis
- Arteritis
  - Takayasu's , PAN, Giant cell, Buerger's
- Middle aortic syndrome
  - Aortic hypoplasia or coarctation
  - Neurofibromatosis
- Dissection
  - Spontaneous (FMD)
  - Traumatic
  - Extension of aortic dissection
- Aneurysm
- Median arcuate ligament compression

Mesenteric Arterial Disease

Clinical Presentation in 229 patients

Presentation	N	%
Abdominal pain	219	96
Weight loss	193	84
"Food fear"	104	45
Diarrhea	91	40
Nausea or vomiting	55	24
Gastric ischemic ulcer	29	10
Prior mesenteric intervention	15	7

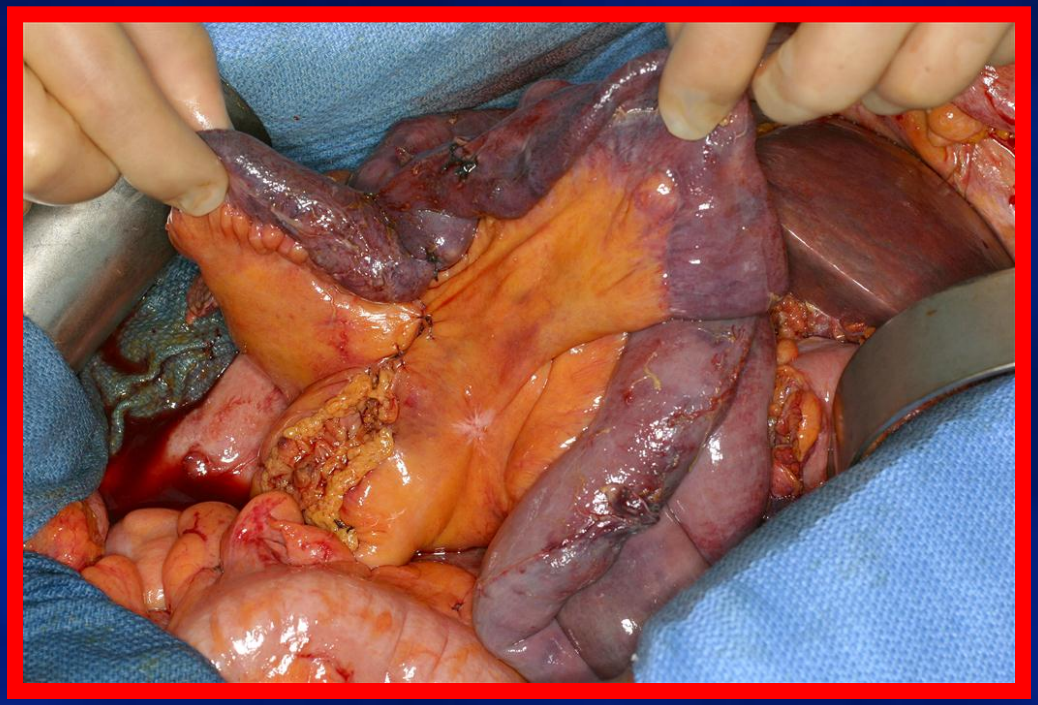
Mean duration of symptoms: 9 months

Oderich GS, Bower TC, Sullivan TM, Bjarnason H, Cha S, Gloviczki P: Open versus endovascular revascularization for chronic mesenteric ischemia: Risk-stratified outcomes. J Vasc Surg 49:1472-1479, 2009

Chronic Mesenteric Ischemia Progresses to Acute Mesenteric Ischemia

65% of patients with acute mesenteric thrombosis had symptoms of CMI

Mortality:40%



Park WM, Gloviczki P, Cherry KJ, Jr et al. Contemporary management of acute mesenteric ischemia: factors associated with survival. J Vasc Surg 2002;35:445-52.

Chronic Mesenteric Ischemia
Indications for Intervention

- **Symptomatic patient**
- Asymptomatic patient
  - rarely, with 3 vessel disease
  - when associated with open repair of a complex aneurysm

Chronic Mesenteric Ischemia

Options for Revascularization

- **Open surgical revascularization**

  Supra-celiac aorta to celiac and/or SMA by-pass
  Infra-renal aorta to SMA (celiac) bypass
  Iliac artery to SMA bypass
  Trans-aortic endarterectomy

- **Hybrid revascularization**

  SMA patch + retrograde SMA stenting

- **Endovascular**

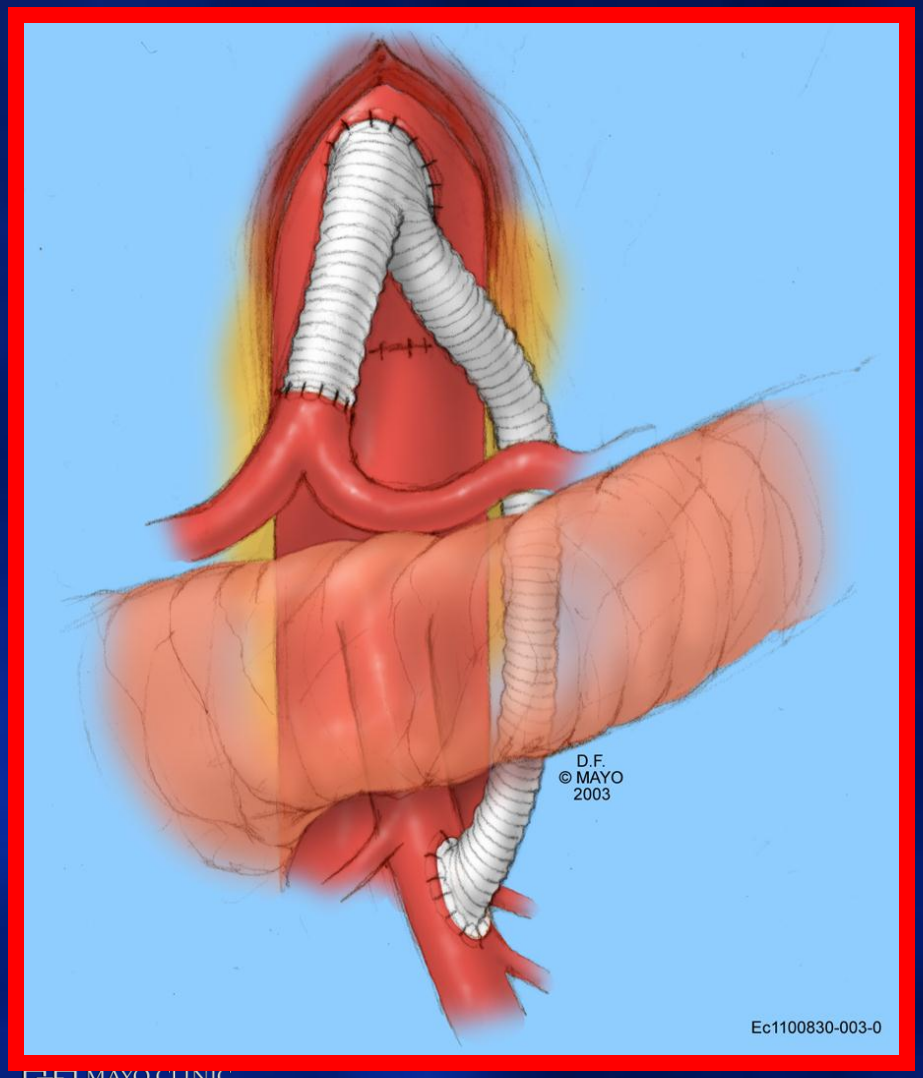
  Angioplasty alone or with stenting

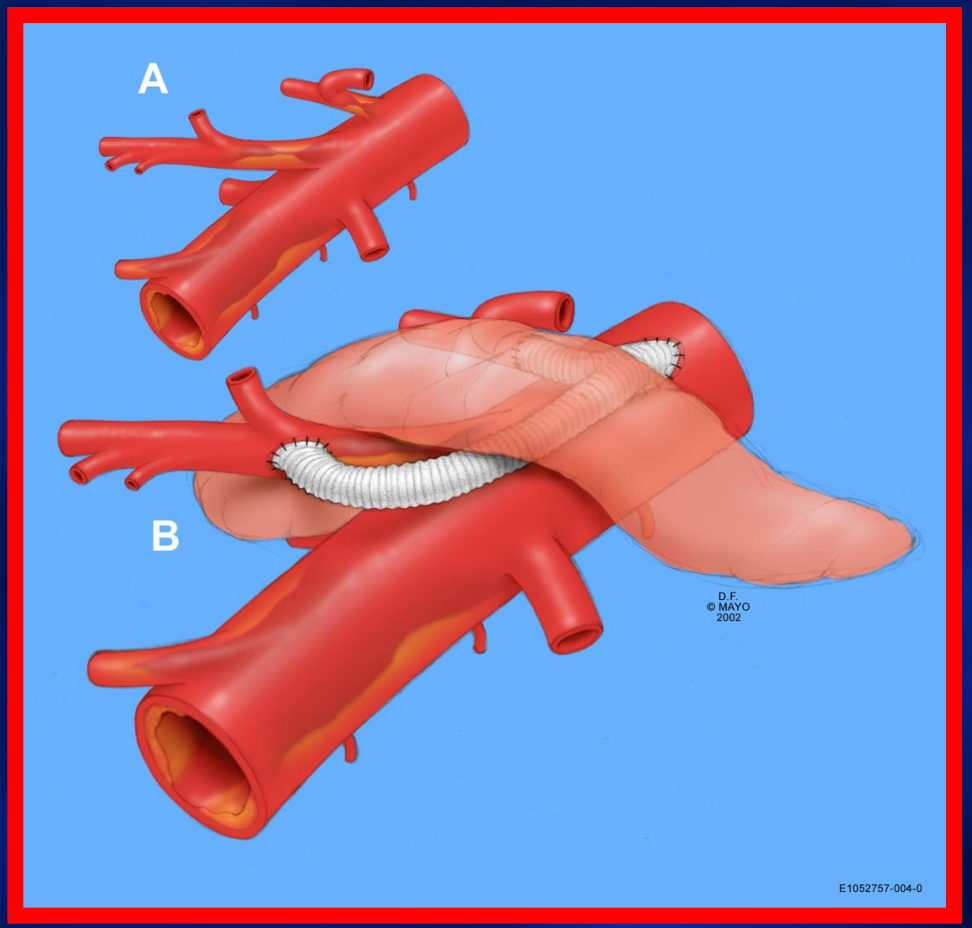
- **Laparoscopic**

  Median arcuate ligament release

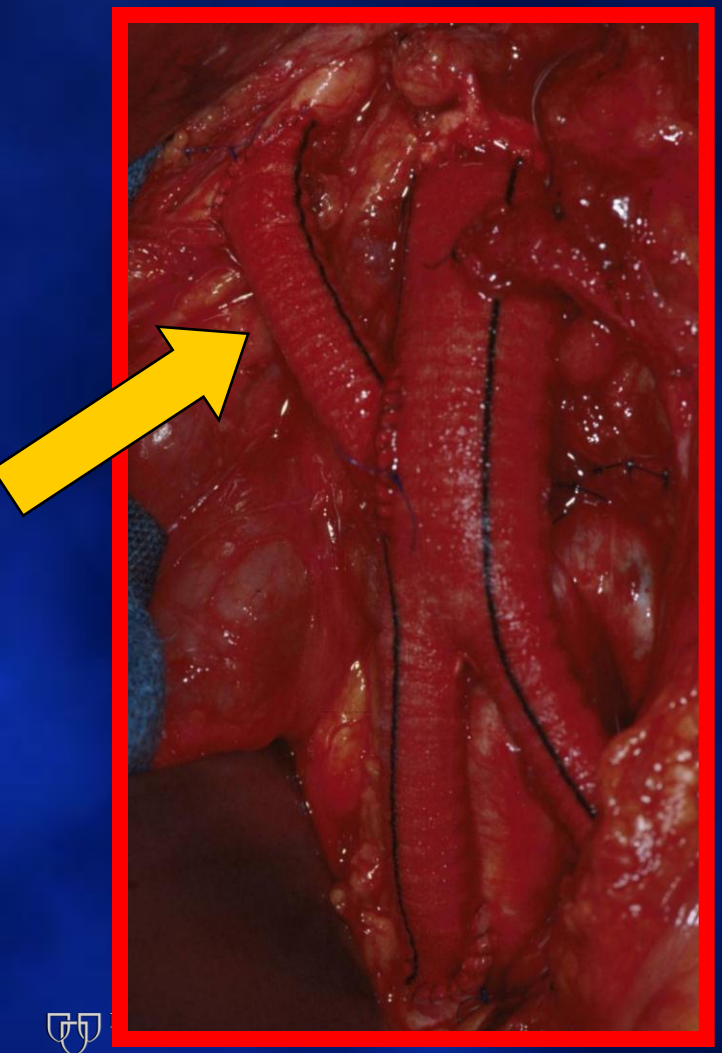
Chronic Mesenteric Ischemia

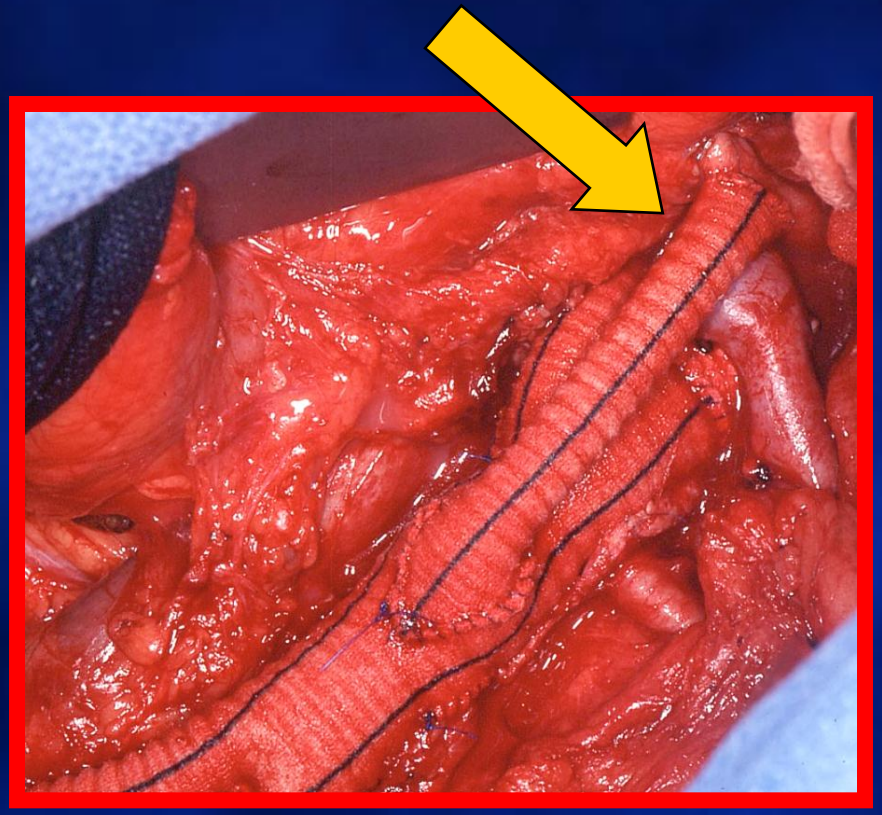
Supraceliac Aorta to Celiac-SMA Bypass





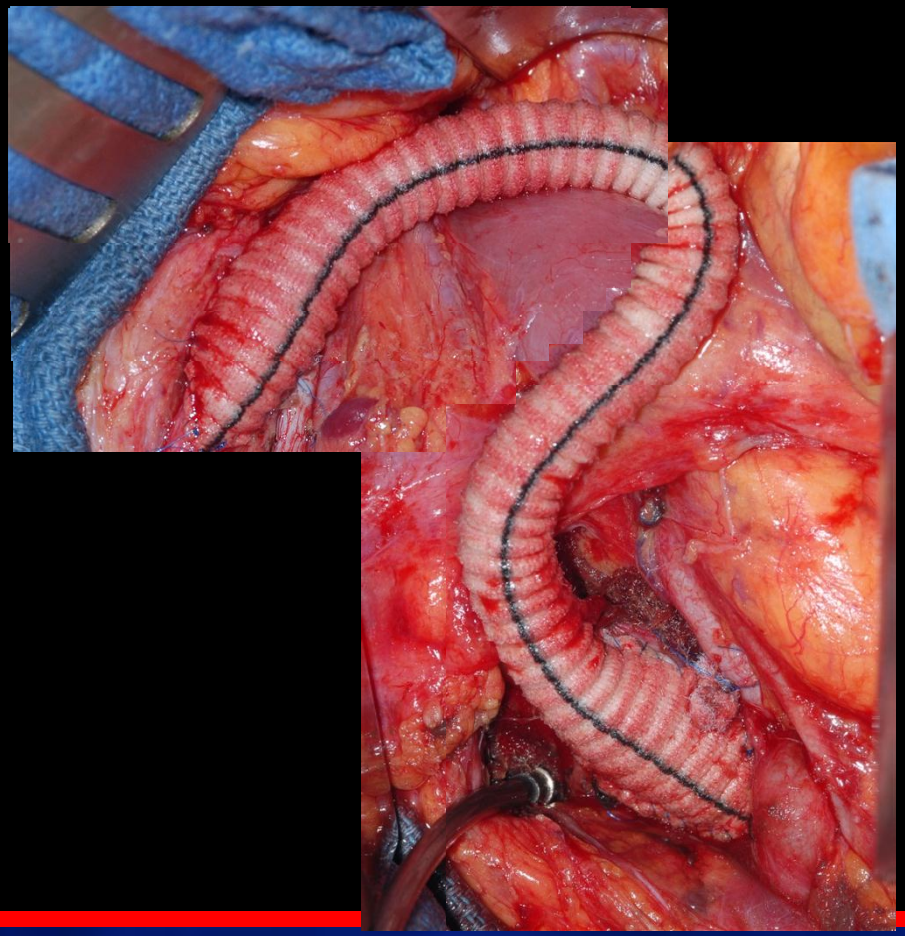
Retrograde Graft





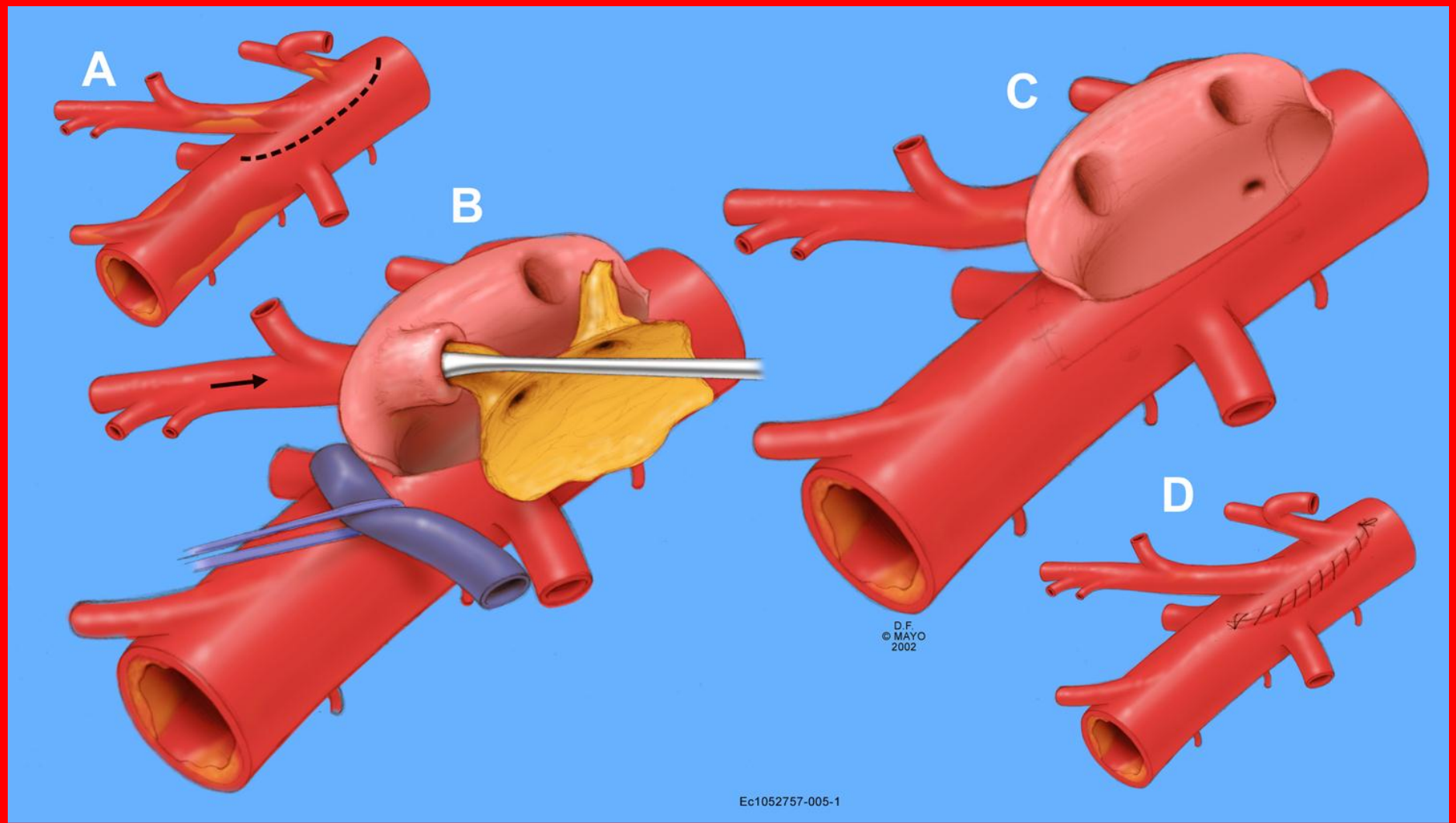
Open Mesenteric Revascularization

Retrograde Iliac artery to SMA Bypass

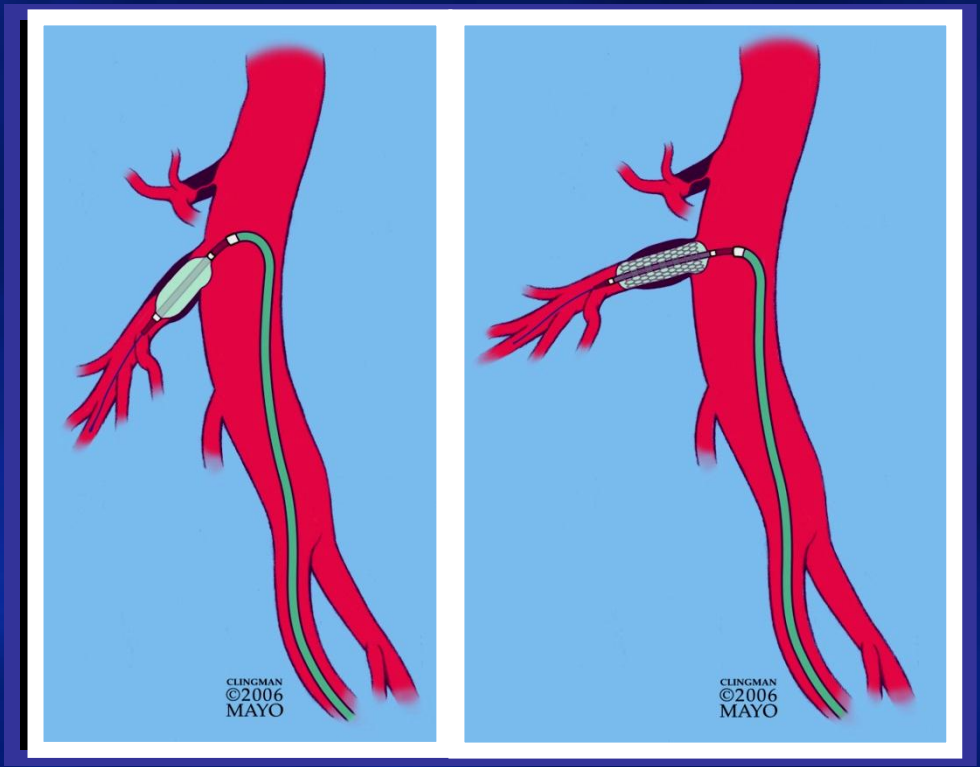


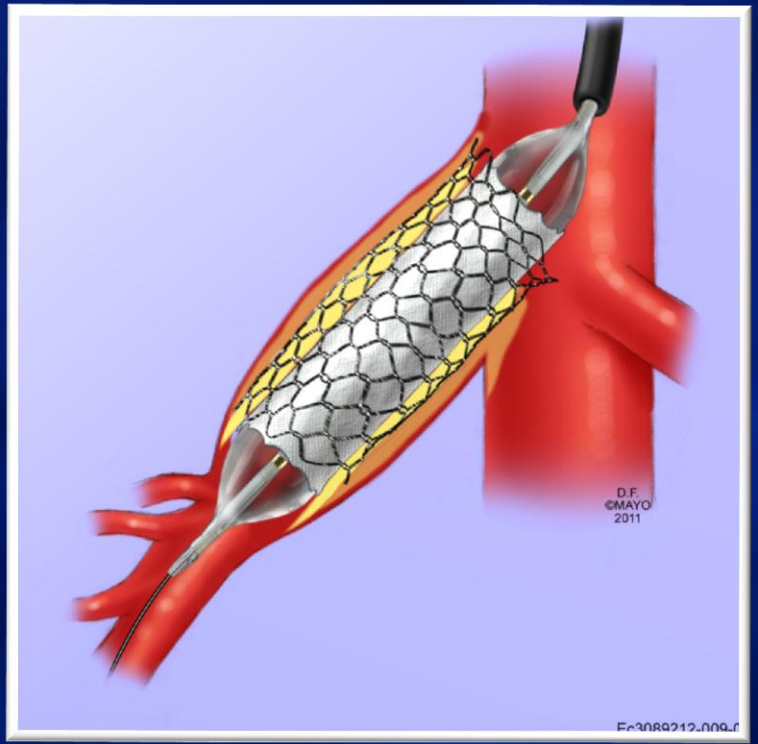
Paravisceral Atherosclerosis

Transaortic thrombo-endarterectomy

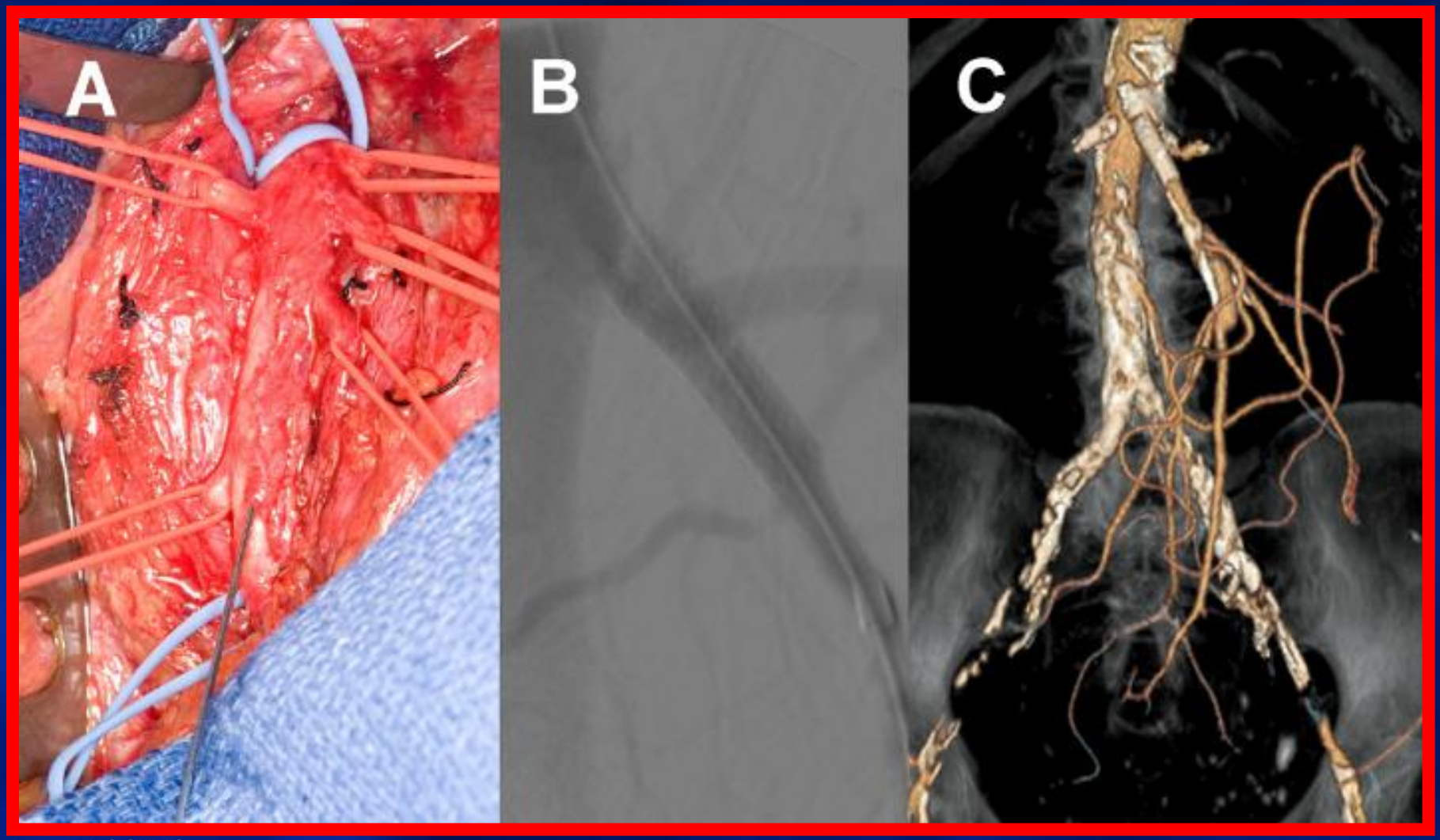


Chronic Mesenteric Ischemia
Endovascular Treatment





Hybrid Revascularization

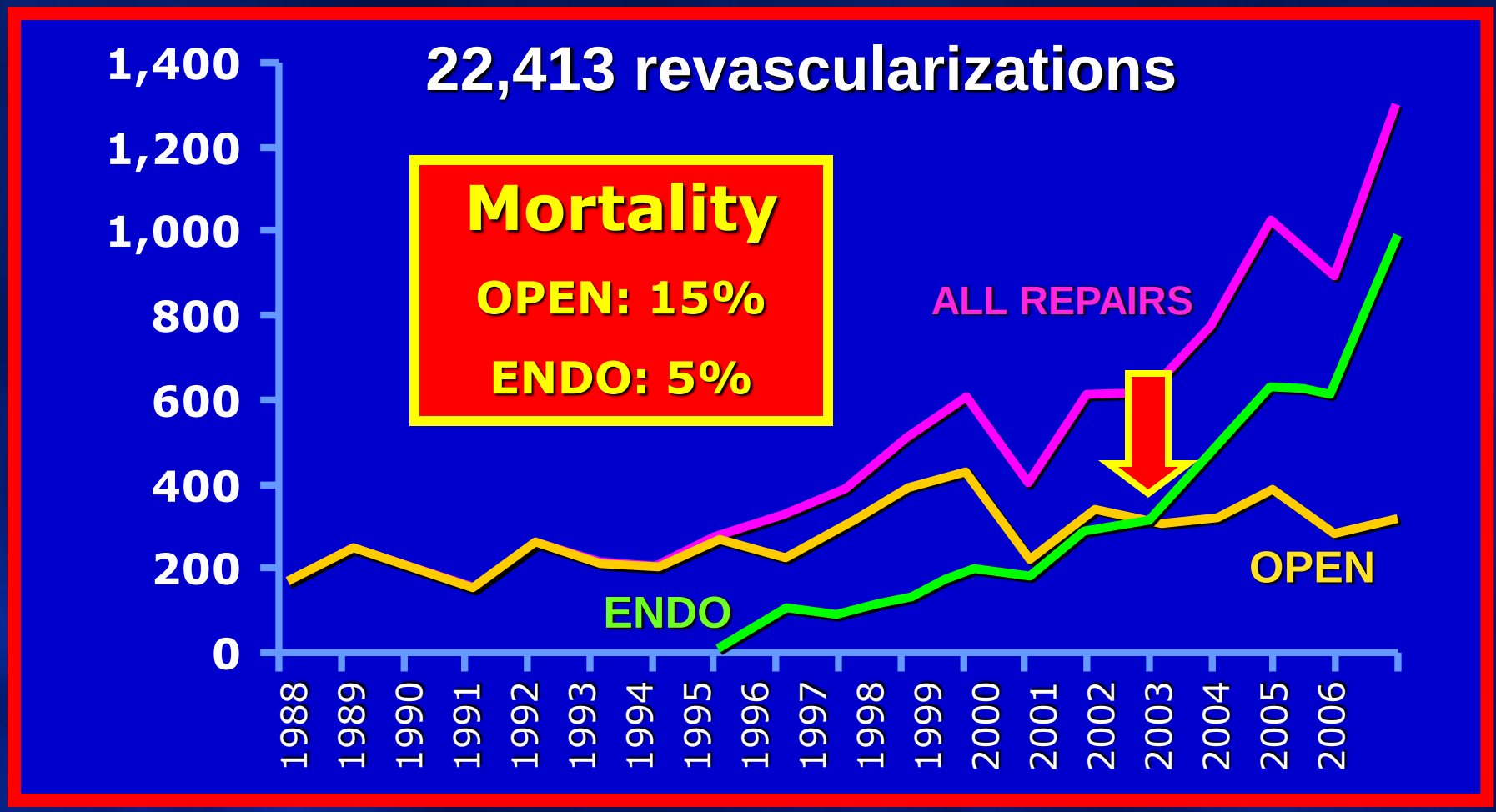


Chronic Mesenteric Ischemia
Controversies of Treatment

- **Open versus Endovascular**
- Single or multiple vessels
- Open reconstruction
  - Antegrade versus retrograde
  - Vein versus prosthetic graft
  - Endarterectomy vs. by-pass
- Endovascular reconstruction
  - Femoral vs. brachial access
  - Embolic protection device
  - Uncovered or covered stent

Open and Endovascular Revascularizations for CMI

United States (1988 – 2006)



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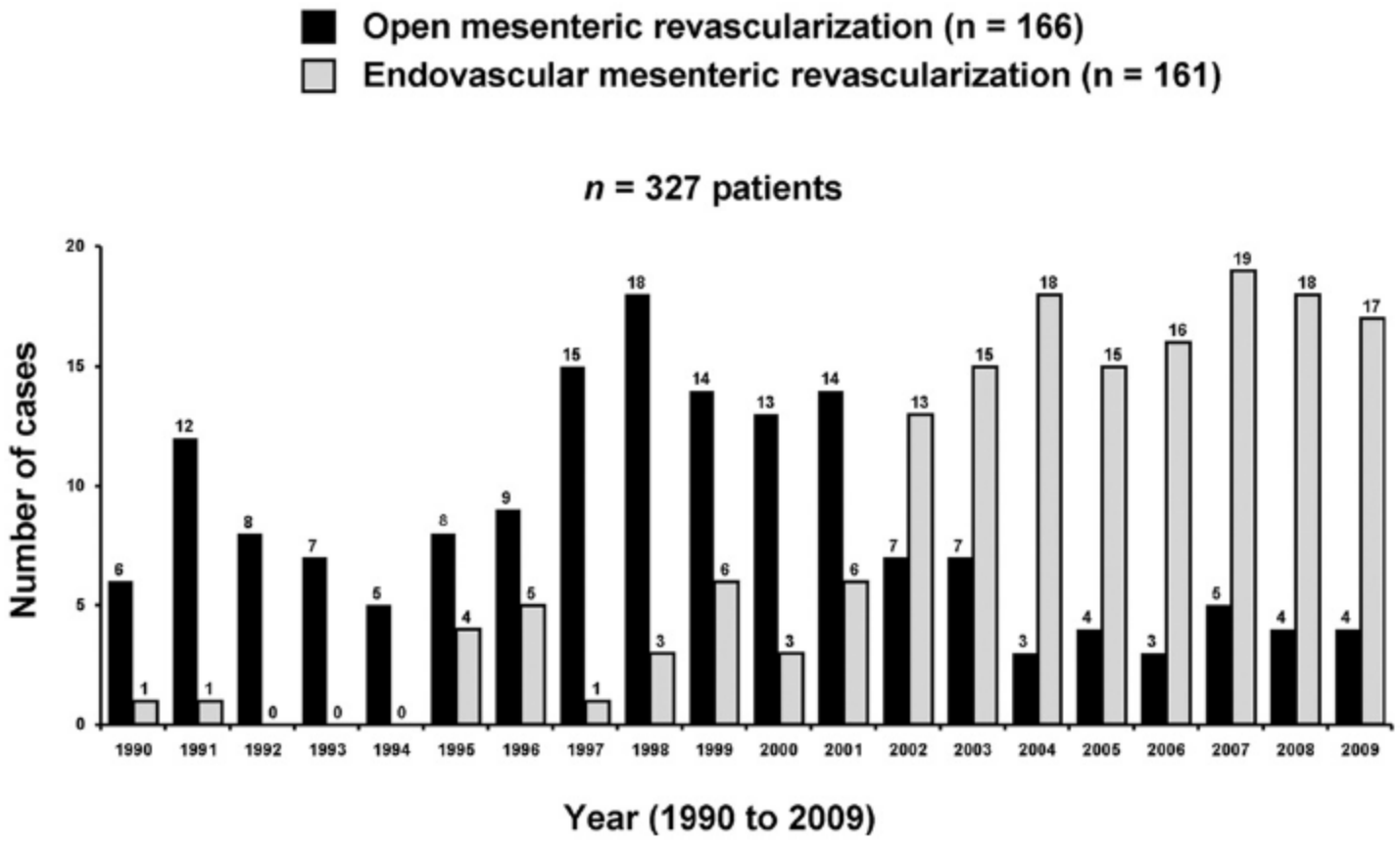
Schemerhorn M et al. J Vasc Surg 2009;50:341-8

Open and Endovascular Mesenteric Revascularizations
Mayo Clinic (1990 – 2009)



Open versus endovascular revascularization for chronic mesenteric ischemia: Risk-stratified outcomes

Gustavo S. Oderich, MD,[a] Thomas C. Bower, MD,[a] Timothy M. Sullivan, MD,[b] Haraldur Bjarnason, MD,[c] Stephen Cha, MS,[d] and Peter Gloviczki, MD,[a] *Rochester and Minneapolis, Minn*

Objective: Outcomes of open (OR) and endovascular revascularization (ER) for chronic mesenteric ischemia (CMI) were analyzed with respect to clinical risk stratification.

Methods: The data of 229 consecutive patients treated for CMI with OR (146 patients/265 vessels) or ER (83 patients/105 ves[illegible] standard scoring systems. End points were mortality and morbidity, recurrence-free survival, and patency rates. A subset analysis compared 111 patients (208 vessels) who had OR with 58 patients (76 vessels) who had stenting.

Results: The ER patients were significantly older (71 ± 15 vs 65 ± 11 years; $P < .05$), had higher risk (58% vs 31%), and fewer vessels [illegible]vascularized (1.3 ± 0.5 vs 1.8 ± 0.4). Four (2.7%) procedurally related deaths occurred in the OR and two (2.4%) in the E[illegible]p (P = NS). Mortality was higher for high-risk patients (OR, 6.7% vs 0.9%; ER, 4.8% vs 0%; $P <$ .05), but differenc[illegible]ot significant among low-risk or high-risk OR vs ER patients. OR patients had more complications (36% vs [illegible]) and longer hospitalization (12 ± 8 vs 3 ± 5 days; $P < .001$). At 5 years, OR had improved ($P < .05$) recur[illegible]l (89% ± 4% vs 51% ± 9%), and primary (88% ± 3% vs 41% ± 9%) and secondary patency rates (97% ± [illegible]ore restenoses (hazard ratio [HR], 5.1; 95% confidence interval [CI], 2.4-10.2), recurrences (HR, 6.7; [illegible]interventions occurred in the ER group (HR, 4.3; 95% CI, 1.9-9.7). At last follow-up, significant [illegible]noted in 137 OR (96%) and 72 ER patients (92%, $P =$ NS). In the subset analysis of patients h[illegible]tenting. OR resulted in improved ($P <$ .05) recurrence-free survival [illegible] and 98% ± 1% vs 52% [illegible]

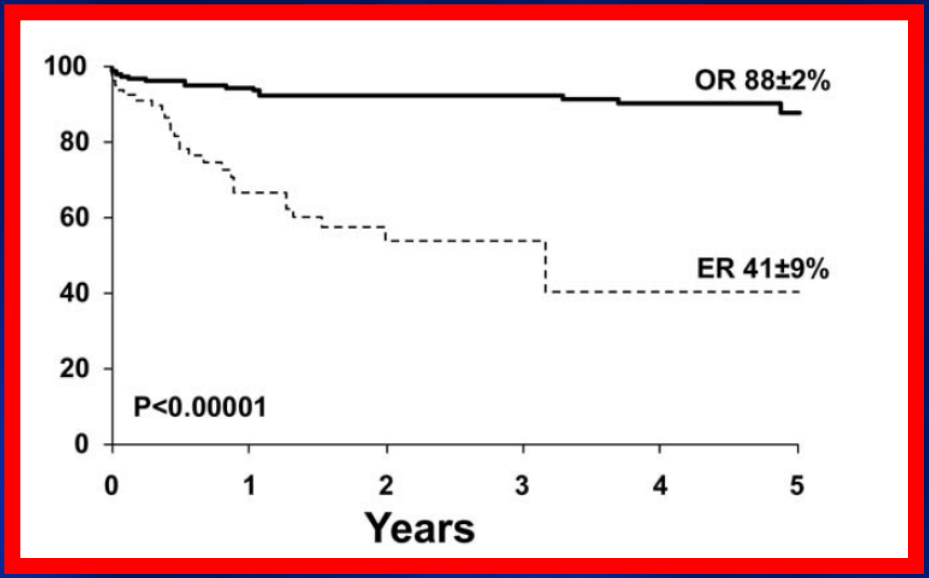
Conclusion: OR has sig[illegible] patients with CMI. Bo[illegible] ventions were more lik[illegible] high-risk CMI patient[illegible]

OPEN: Mortality 2.7%, higher morbidity, longer hospital stays

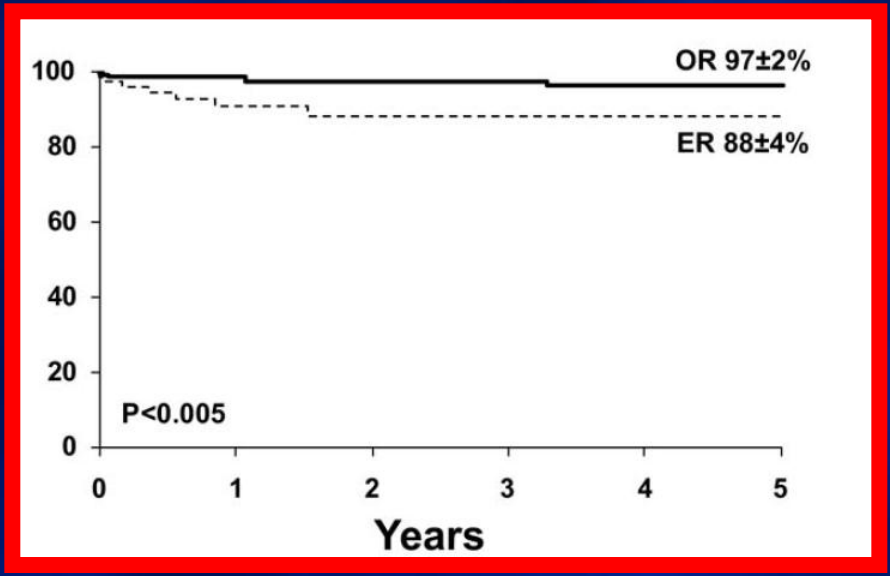
ENDO: Mortality 2.4%, higher restenosis rate, more recurrence and more reinterventions

Open versus Endovascular Mesenteric Revascularization

Primary Patency

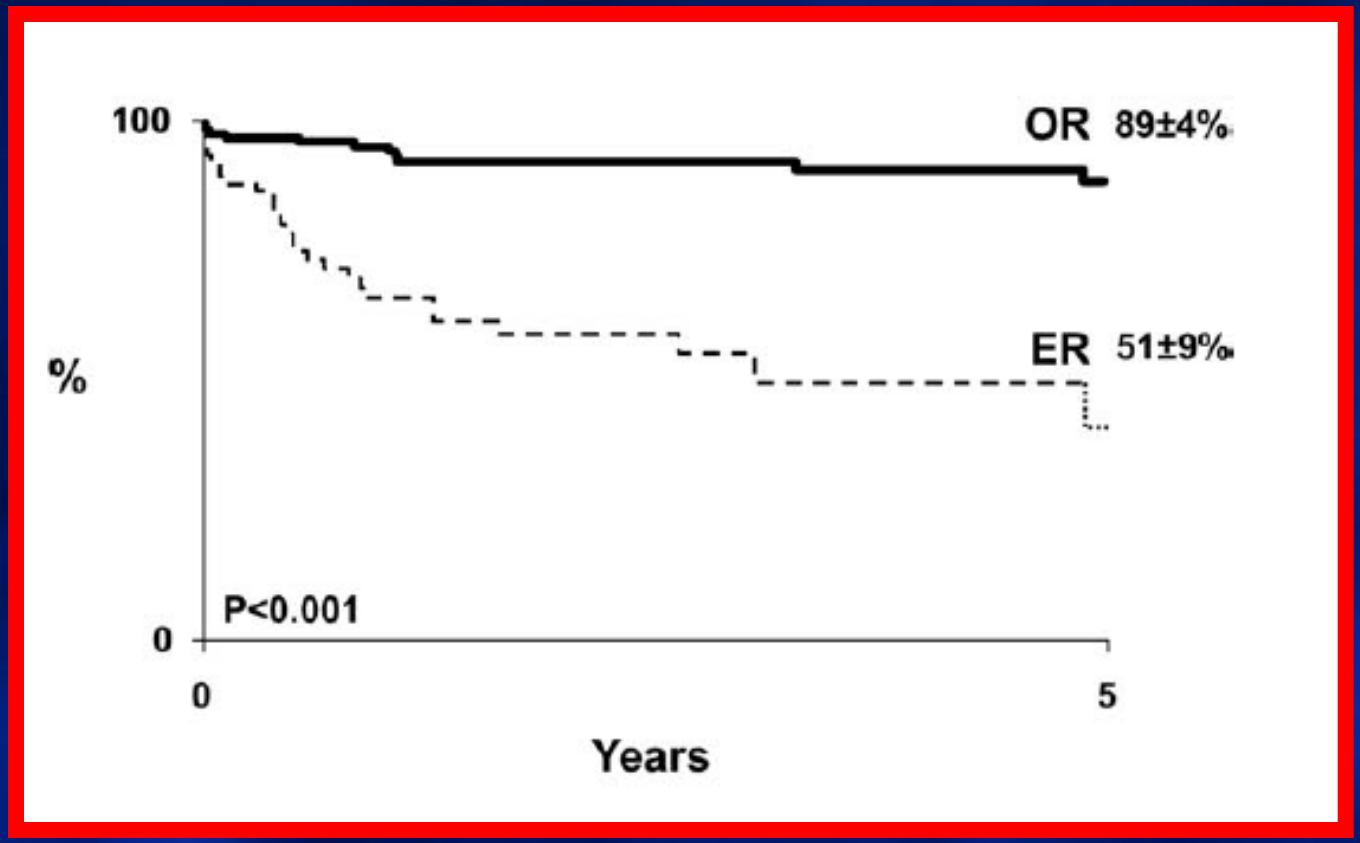


Secondary Patency



Open versus Endovascular Mesenteric Revascularization

Freedom from Recurrent Symptoms



Contemporary Results of Open Revascularization for Chronic Mesenteric Ischemia

First Author (Year)	n/Vessels	Percentage					
		Technical Success	Mortality	Morbidity	Recurrence	Restenosis	Primary Patency
Kihara (1999)[6]	42/52	100	10	35	10	24	65
Mateo (1999)[7]	85/n/r	100	8	33	20	23	71
Foley (2000)[17]	28/28	100	3	n/r	10	10	79
Leke (2002)[24]	17/25	100	6	41	0	0	100
Cho (2002)[23]	25/41	100	0	n/r	21	n/r	57
Park et al (2002)[16]	98/179	100	5	21	8	11	n/r
Illuminati (2004)[25]	11/12	100	0	27	10	10	90
Brown (2005)[9]	33/51	100	9	30	9	0	92
Sivamurthy (2006)[10]	41/68	100	15	41	32	17	83
Kruger (2007)[26]	39/67	100	2.5	12	5	n/r	92
Biebl (2007)[8]	26/48	100	8	29	11	n/r	n/r
Atkins (2007)[27]	49/88	100	3.1	35	9	n/r	90
Mell (2008)[19]	80/134	100	[illegible]	26	14	25	n/r
Oderich (2009)[12]	146/265	100	2.7	37	[illegible]	[illegible]	[illegible]
	Low-risk	100	[illegible]	37	6	9	94
	High-risk	100	6.7	38	[illegible]	[illegible]	[illegible]
Total	735/1058	100	5	32	12	11	87

Differences in anatomy and outcomes in patients treated with open mesenteric revascularization before and after the endovascular era

Evan J. Ryer, MD,[a] Gustavo S. Oderich, MD,[a] Thomas C. Bower, MD,[a] Thanila A. Macedo, MD,[b] Terri J. Vrtiska, MD,[b] Audra A. Duncan, MD,[a] Manju Kalra, MBBS,[a] and Peter Gloviczki, MD,[a] *Rochester, Minn*

Objective: To compare the clinical characteristics, anatomy, and outcomes of patients treated with open mesenteric revascularization (OR) for chronic mesenteric ischemia (CMI) before and after the preferential use of endovascular revascularization (ER).

Methods: We reviewed a prospective database of 257 patients treated for CMI with OR or ER from 1998 to 2009. Treatment trends were analyzed to identify changes in practice paradigm. Prior to 2002, OR was used in 58 of 81 patients (72%). Since 2002, ER surpassed OR as the most common treatment option; OR was indicated in 58 of 176 patients (33%) who either failed ER or had unfavorable lesions for stent placement. We analyzed differences in clinical data, anatomical characteristics, and outcomes in 116 patients treated with OR before (Pre-Endo, n = 58) and after 2002 (Post-Endo, n = 58). Anatomical characteristics were determined by a blinded investigator using conventional angiography, magnetic resonance angiography, and computed tomography angiography with centerline of flow measurements.

Results: Both groups had similar demographics, risk factors, and clinical presentation, with the exception of higher ($P < .05$) rates of hypertension, hyperlipidemia, cardiac interventions, dysrhythmias, and higher comorbidity scores in the Post-Endo group. This group also had more extensive mesenteric artery disease, including higher incidence of three-vessel involvement (76% vs 57%; $P = .048$) and superior mesenteric artery (SMA) occlusion (67% vs 41%; $P = .005$). There were no differences ($P > .05$) in the number of vessels revascularized (1.8 ± 0.4 vs 1.7 ± 0.5) and in graft configuration (antegrade, 91% vs 78%; retrograde, 9% vs 22%; two-vessel, 69% vs 81%) in the Pre- and Post-Endo groups, respectively. There were no differences in operative mortality (1.7% vs 3.4%), morbidity (43% vs 53%), length of stay (12 ± 1 vs 12 ± 1 days), and immediate symptom improvement (88% vs 86%) in the Pre- and Post-Endo groups, respectively. Mean follow-up was 57 ± 6 months for patients treated before 2002 and 29 ± 6 months for those treated after 2002 ($P = .0001$). At 5 years, primary and secondary patency rates and recurrence-free survival were 82%, 86%, and 84% in the Pre-Endo and 81%, 82%, and 76% in the Post-Endo groups ($P > .05$).

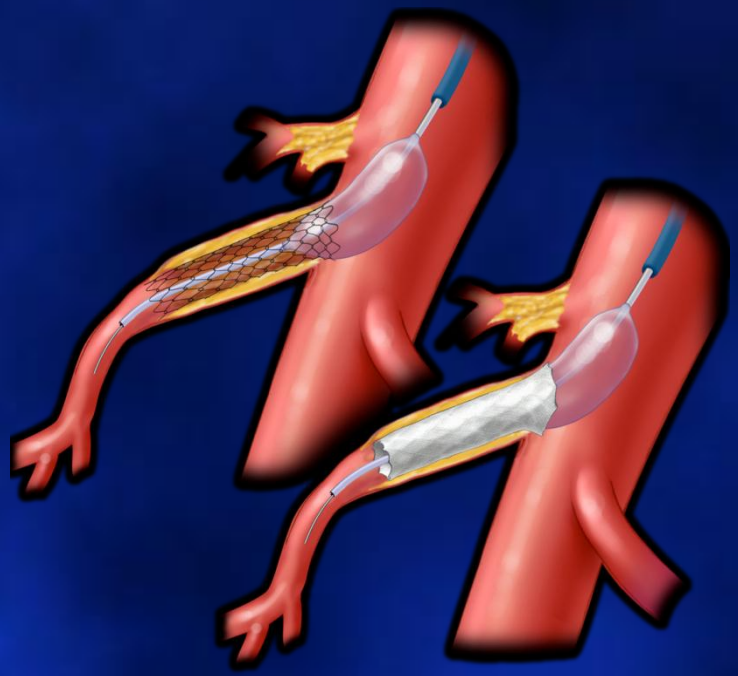
Conclusion: OR has been used in approximately one-third of patients treated for CMI since 2002. Despite more comorbidities and more extensive mesenteric artery disease in patients now treated with OR, outcomes have not changed compared with those operated prior to the preferential use of mesenteric stents before 2002. (J Vasc Surg 2011;53:1611-8.)

Open vs Endovascular Mesenteric Revascularizations

	OPEN *n = 412 patients*	ENDO *n = 227 patients*	*P* value
	%	%	
30-d mortality	6 %	5 %	NS
30-d morbidity	32 %	11	<.0001
Recurrent stenosis	15 %	37 %	<.0001
Reinterventions	9	20	.0004
Primary patency	86%	51%	<.0001
Secondary patency	87%	83%	NS

Van Petersen et al. Open or endovascular revascularization for chronic splanchnic ischemia . J Vasc Surg 2010;51:1309-16.

Comparison of Covered Stents vs. Bare-Metal Stents for Treatment of Chronic Mesenteric Ischemia



Gustavo S. Oderich, Luke S. Erdoes[1], Christopher LeSar[1], Bernardo Mendes, Peter Gloviczki, Audra A. Duncan, Manju Kalra, Sanjay Misra, Stephen Cha and Thomas C. Bower

Mayo Clinic, Rochester, MN and [1]University of Tennessee, Chattanooga, TN

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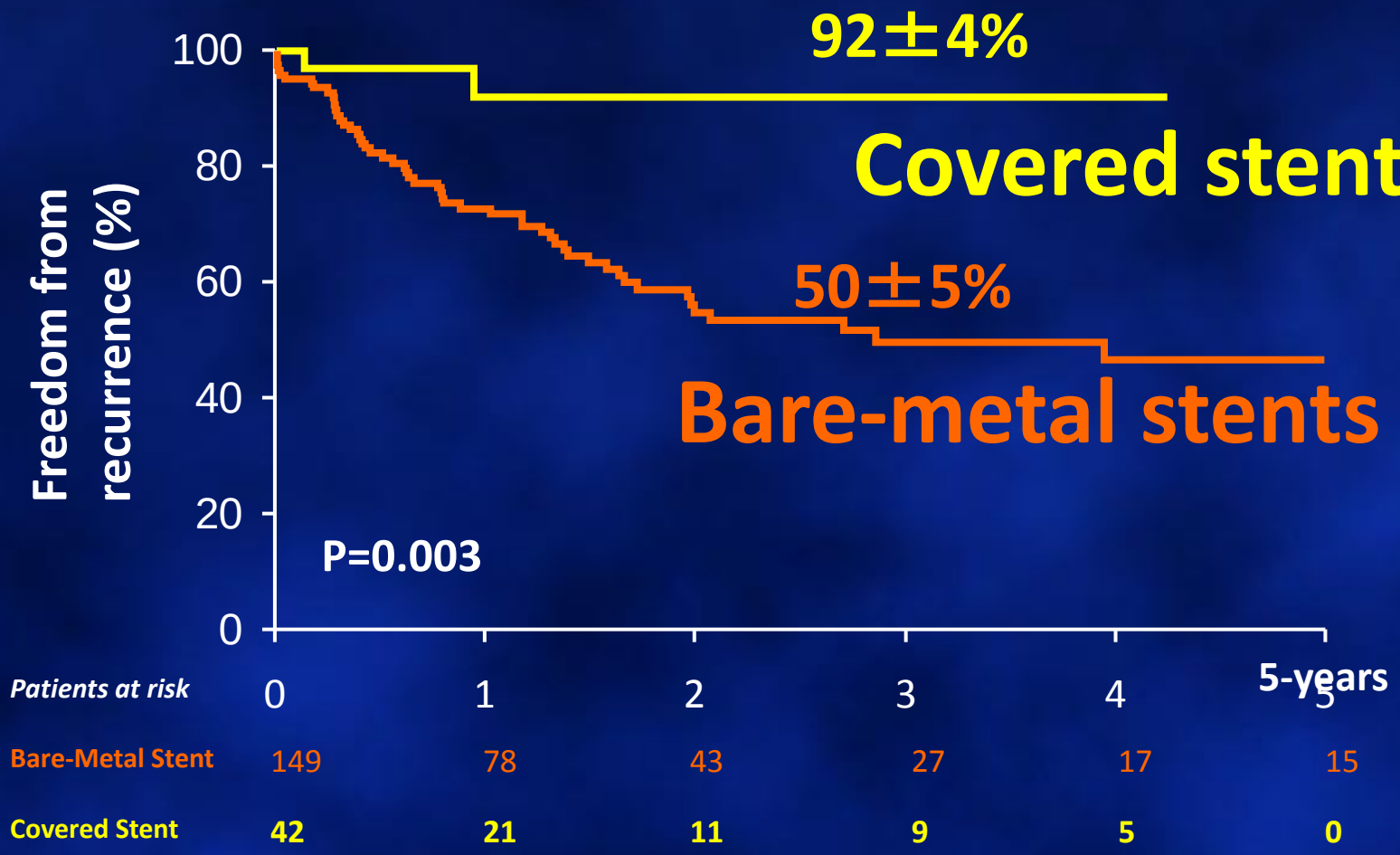
Stents for CMI
(2000-2010)

Stent	Primary Intervention	Re-Intervention	Total
Bare-Metal	149	15	164
Covered	42	21	63
Total	164	63	225

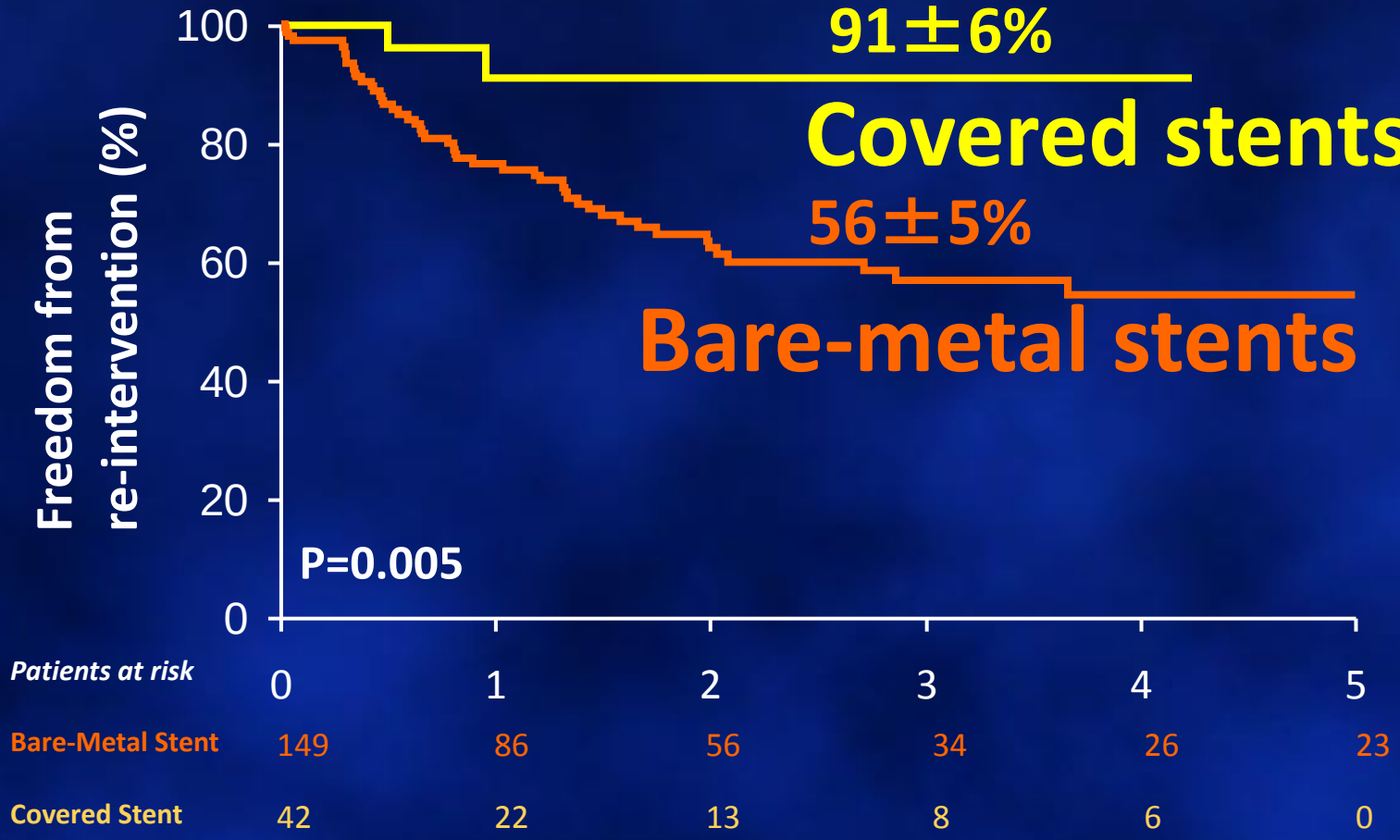
Primary Interventions

Freedom from Recurrence

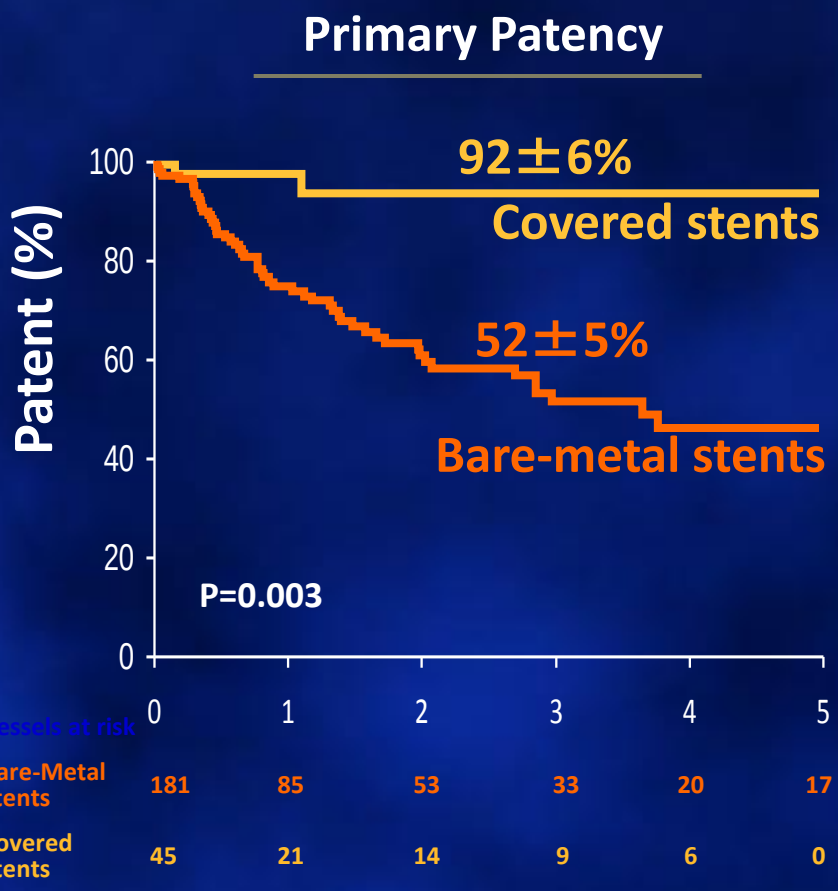


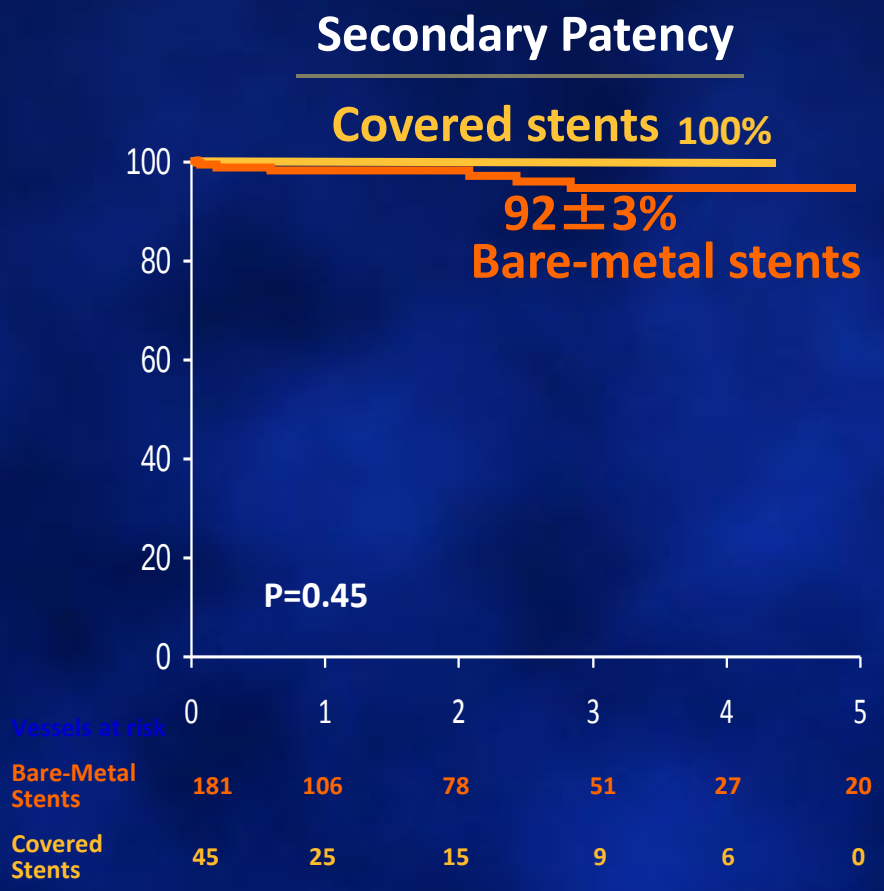
Primary Interventions

Freedom from re-intervention



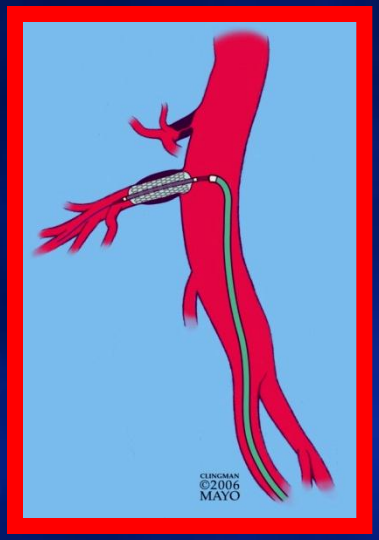
Primary Interventions
Patency





Chronic Visceral Artery Occlusive Diseases

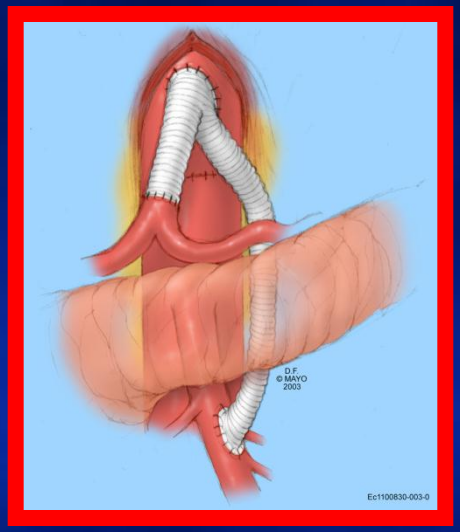
When to Choose Endovascular Repair?



- Most of the time (>70 %)
- All symptomatic patients with focal SMA stenosis
- Good risk patients with “ideal” anatomy
- High risk patients with unfavorable anatomy (longer lesions, calcified lesions, flush occlusions)

Chronic Visceral Artery Occlusive Diseases

When to Choose Open Repair?



- Good risk, young patients with unfavorable anatomy for stents (flush or extensive occlusions, tandem lesions, small vessels, severe calcifications, shaggy aorta)
- Patients who failed endovascular treatment
- Patients with non-atherosclerotic lesions (arteritis, aneurysms, dissections)

Chronic Mesenteric Ischemia
Conclusions

- Early, elective repair of symptomatic CMI is the best way to decrease the excessive mortality of acute mesenteric ischemia

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