VASCULAR HEALTH
CLINICS

VASCULAR SURGERY: AAA, CAROTID DISEASE AND PERIPHERAL ARTERIAL DISEASE (PAD)

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DISCLOSURE

VASCULAR HEALTH CLINICS

Author does not have any disclosures

ABDOMINAL AORTIC ANEURYSMS

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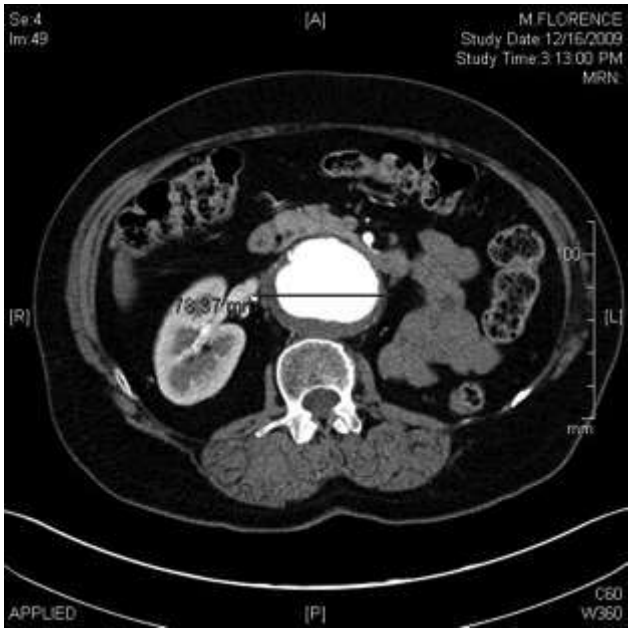
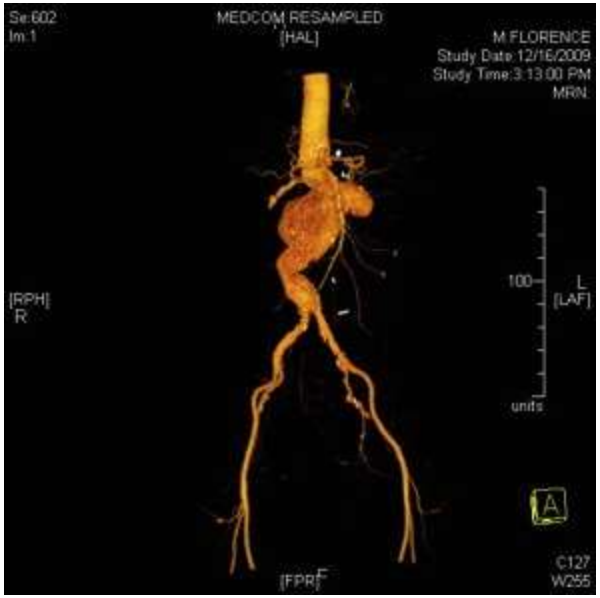
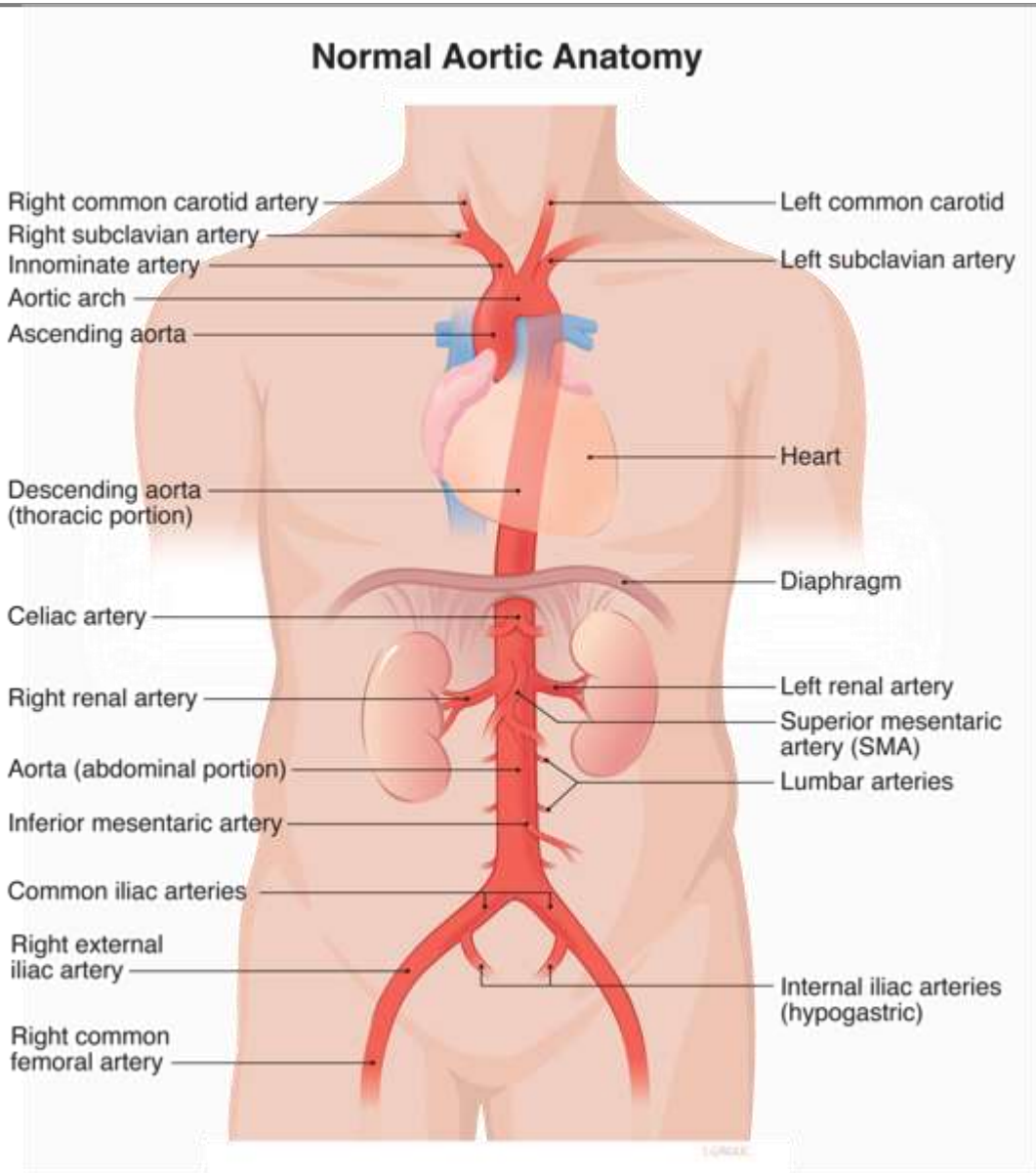
VASCULAR HEALTH CLINICS





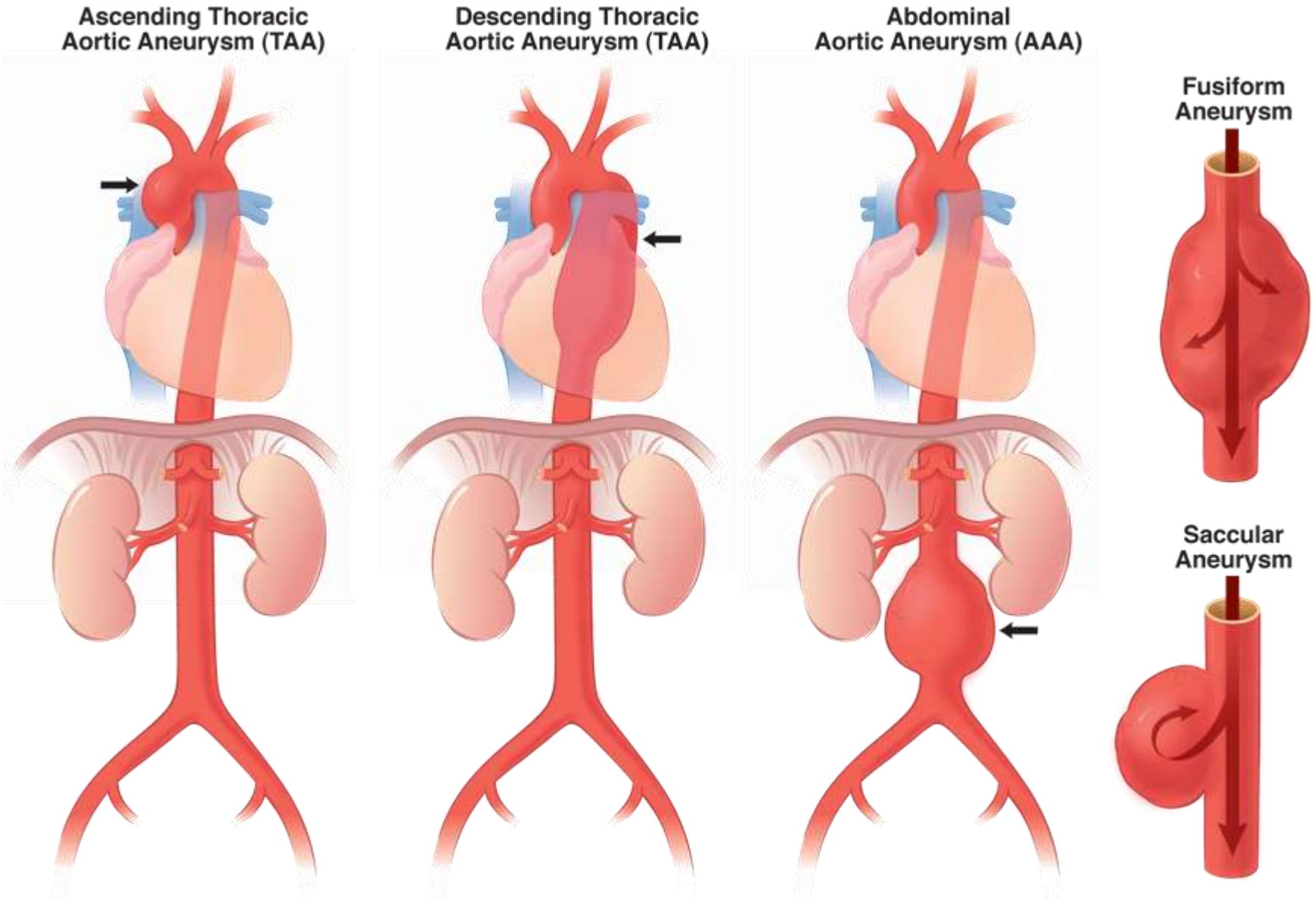
ABDOMINAL AORTIC ANEURYSMS

VASCULAR HEALTH CLINICS



ABDOMINAL AORTIC ANEURYSMS

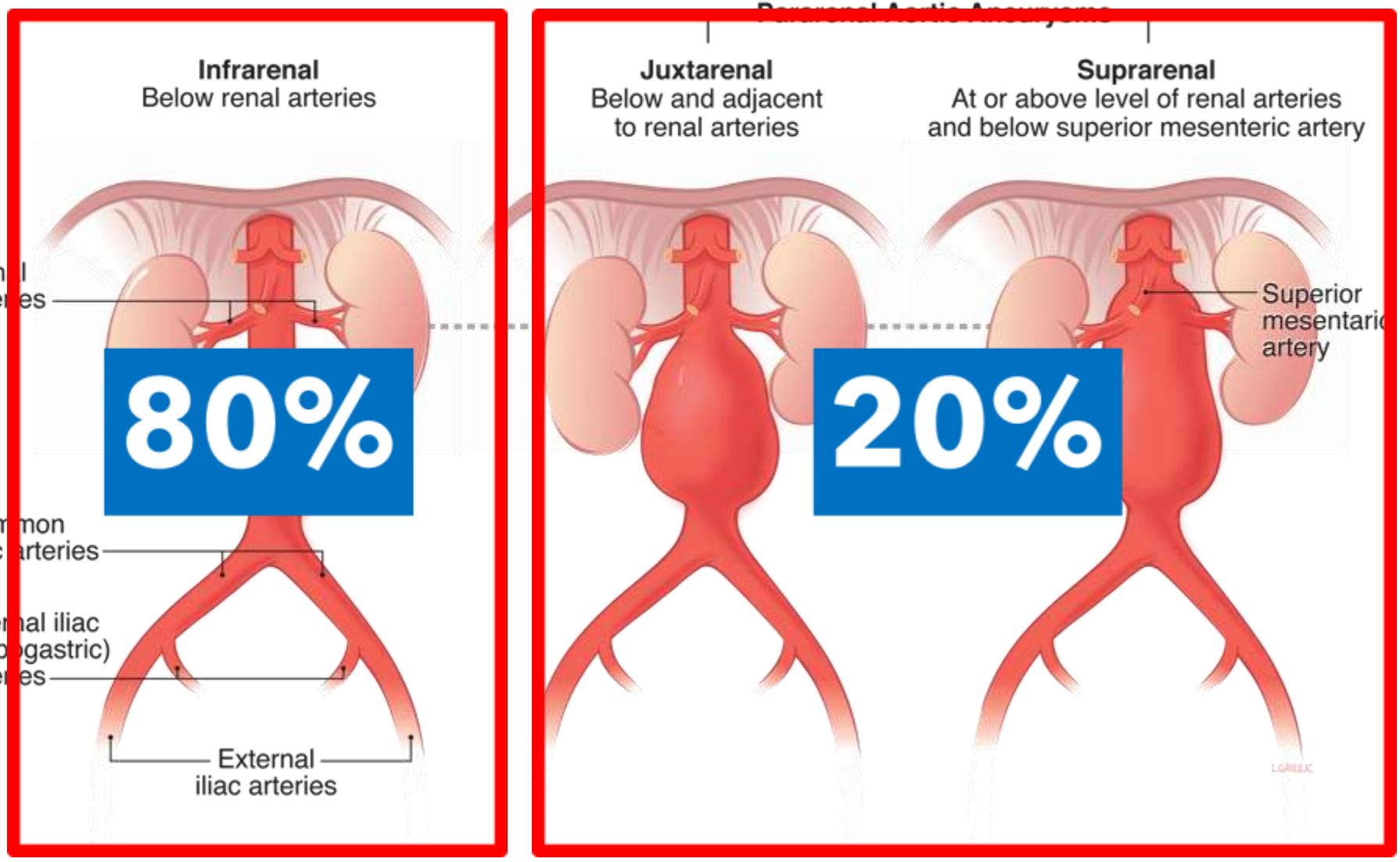
VASCULAR HEALTH CLINICS

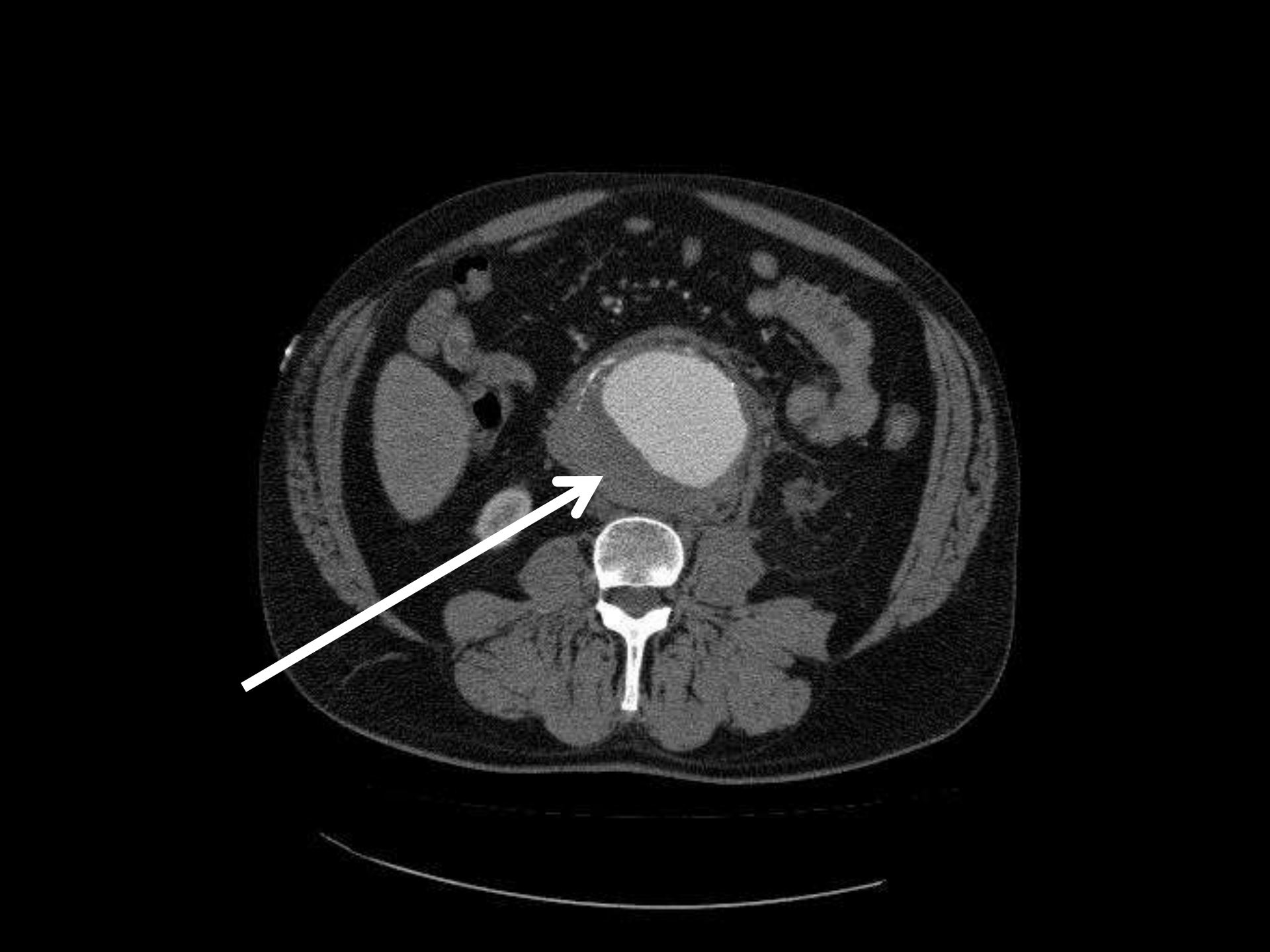


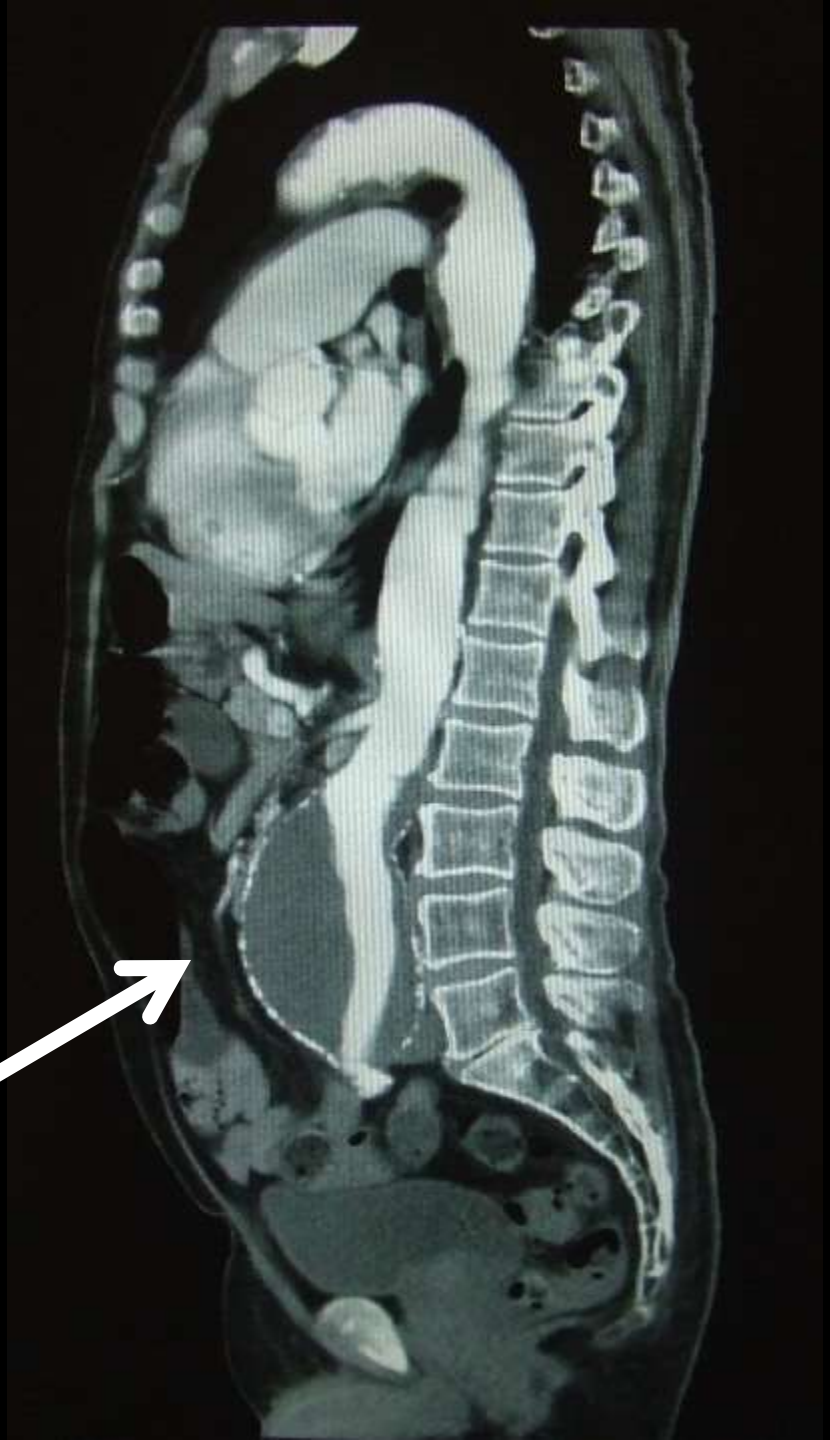
ABDOMINAL AORTIC ANEURYSMS

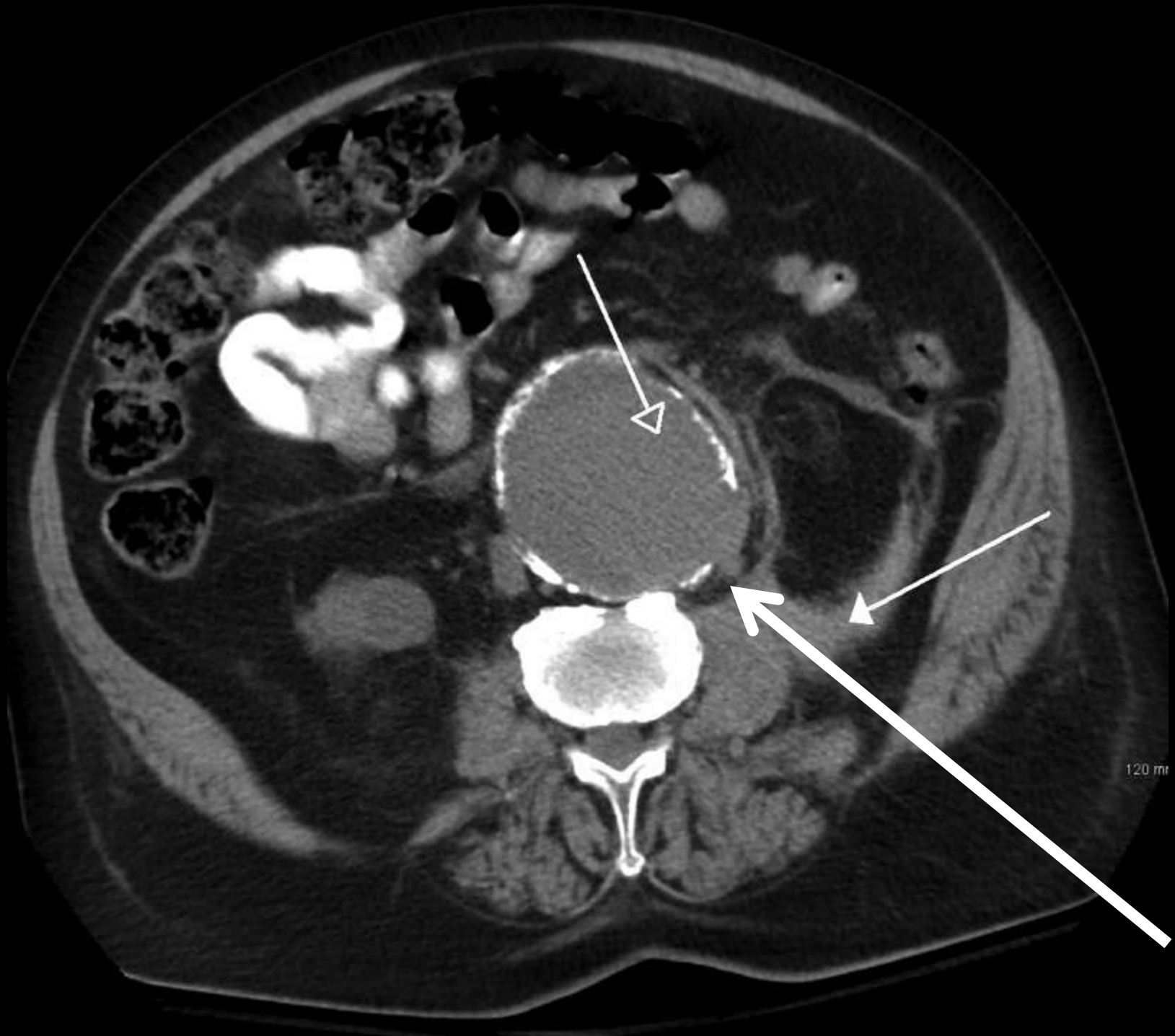
VASCULAR HEALTH CLINICS

Types of Abdominal Aortic Aneurysms









ABDOMINAL AORTIC ANEURYSMS

VASCULAR HEALTH CLINICS

- 50% of all patients die of ruptured AAA before reaching the hospital
- 30-40% die who reached the hospital
- Overall 80-90% mortality in ruptured AAA

AORTIC ANEURYSMS FACTS

VASCULAR HEALTH CLINICS

- Infrarenal aorta: 1.8-2.2 cm in diameter
- Aneurysm defined as 2X normal diameter
- Growth rate 4.5 cm AAA (0.4 cm/yr, 10%/yr)
- Peripheral aneurysms in 3.5% (pop > femoral)

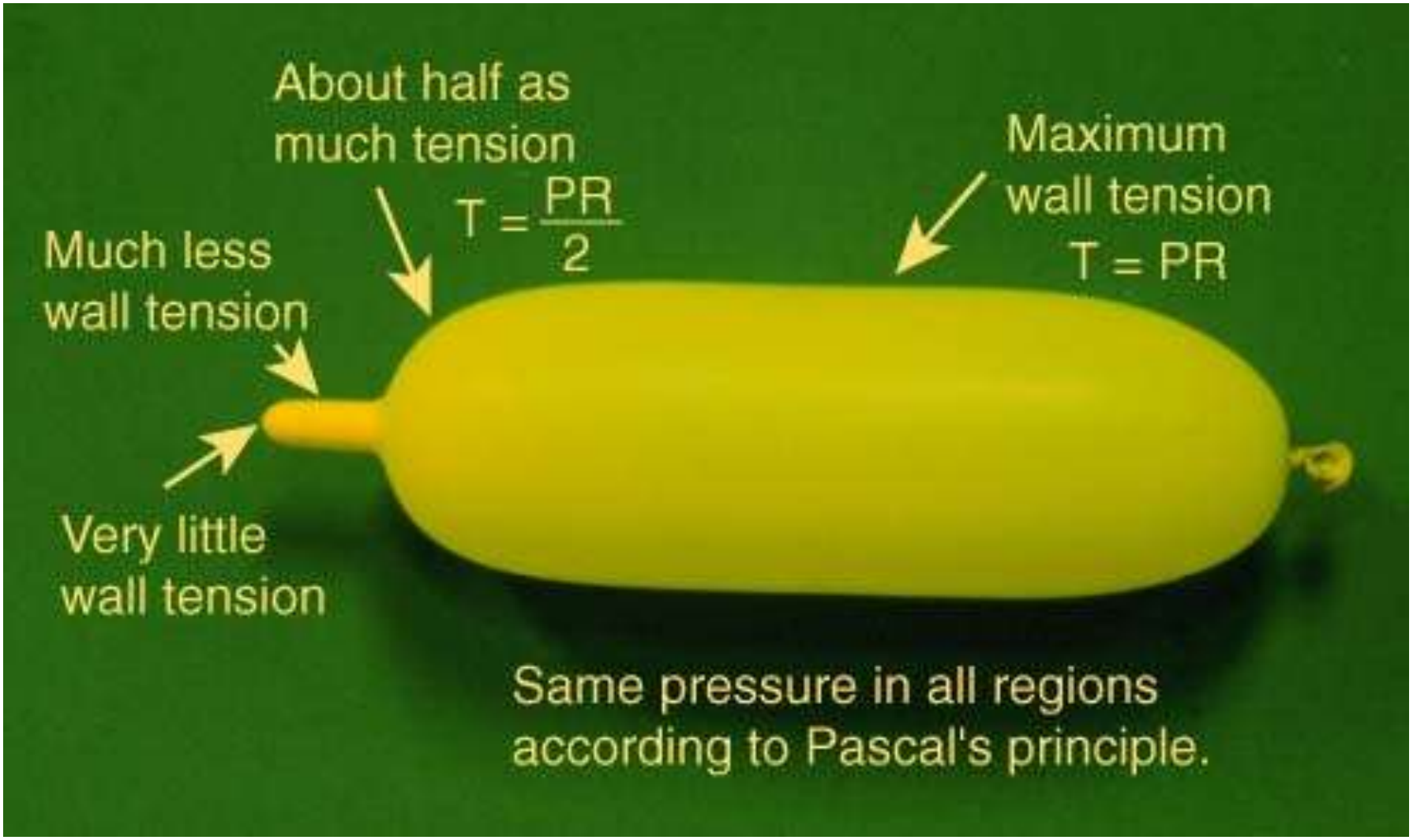
AAA RISK FACTORS

VASCULAR HEALTH CLINICS

- Male gender (6X > females)
- Smoking (5X nonsmokers)
- Caucasian (2.5X > African American)
- Family History (1.9X)
- Age (1.7X per 7 years)
- CAD (1.5X)
- Hypercholesterolemia (1.4X)
- COPD (1.2X)

LAPLACE LAW

VASCULAR HEALTH CLINICS



AORTIC ANEURYSM FACTS

VASCULAR HEALTH CLINICS

- Rationale for repair is prevention of rupture!
- Laplace's Law
- Risk of Rupture

Size (cm)	Annual Rupture Risk
<4.0	0.3%
4.0-4.9	1.5%
5.0-5.9	6.5%
6.5	20%
7.5	35%

FACTORS ASSOCIATED WITH RUPTURE

VASCULAR HEALTH CLINICS

- Female gender (4.5X > Male)
- Smoking
- COPD
- Family History
- Hypertension
- Connective Tissue Disease (Marfans, Ehlers-Danlos)

SCREENING FOR AAA

VASCULAR HEALTH CLINICS

Society of Vascular Surgery, Medicare Screening

- Any Male who has smoked (65-75 yo)
- Any Male or Female with a family history of AAA
- Eliminates referral requirement as part of the Welcome to Medicare Physician Exam
- Eliminates the one-year time limit for all beneficiaries who are at risk for AAA
- This remains a one-time screening

ASSESSING THE AAA PATIENT

VASCULAR HEALTH CLINICS

- Ultrasound
  Used to diagnose and monitor AAA until aneurysm approaches size at which repair considered

- Computed Tomography
  Used in preop assessment of AAA

* 3-4 mm difference between US and CT scan

SURGERY VS OBSERVATION

VASCULAR HEALTH CLINICS

1. Risk for AAA rupture without surgery
2. Operative risk of repair
3. Patient's life expectancy
4. Personal preference of patient

1. RISK OF RUPTURE

VASCULAR HEALTH CLINICS

- Size matters:
  - Aneurysm > 5cm 6-16% and > 7cm 33%
- Saccular aneurysm have higher rupture rate
- HTN, COPD, active smoking is independent predictors of rupture
- (+) Family Hx tend to rupture
- Expansion rate (> 5 mm over 6 months)

2. OPERATIVE RISK OF REPAIR

VASCULAR HEALTH CLINICS

- Mortality after:
  - Elective open AAA ~ 5%
  - EVAR 1.7%

3. PATIENTS LIFE EXPECTANCY

VASCULAR HEALTH CLINICS

- Very difficult to assess due to patient's co-morbidities

Age	Life Expectancy after AAA repair (years)
60	13
70	10
80	6

4. PERSONAL PREFERENCES

VASCULAR HEALTH CLINICS

- Fear of AAA vs. Fear of surgery
- Anecdotal experiences of friends and family

MEDICAL MANAGEMENT OF AAA

VASCULAR HEALTH CLINICS

- Smoking Cessation - Single most important modifiable risk factor

- Exercise Therapy - Evidence suggests may benefit small aneurysms

- Beta Blockers - May decrease the rate of expansion?

- ACE inhibitors - Evidence is mixed, however, implicated in less aneurysm rupture

MEDICAL MANAGEMENT OF AAA

VASCULAR HEALTH CLINICS

- Doxycycline - Antibiotic activity against chlamydia species and suppresses expression of MMP

- Statins - associated with reduced aneurysm expansion rates. Decreases MMP-9 in aneurysm wall

CLINICAL PRESENTATION

VASCULAR HEALTH CLINICS

- Asymptomatic
- Pulsatile mass
- Embolic phenomenon
- Compressive symptoms
- Acute onset of abdominal and back pain
- Hemorrhage and cardiovascular collapse

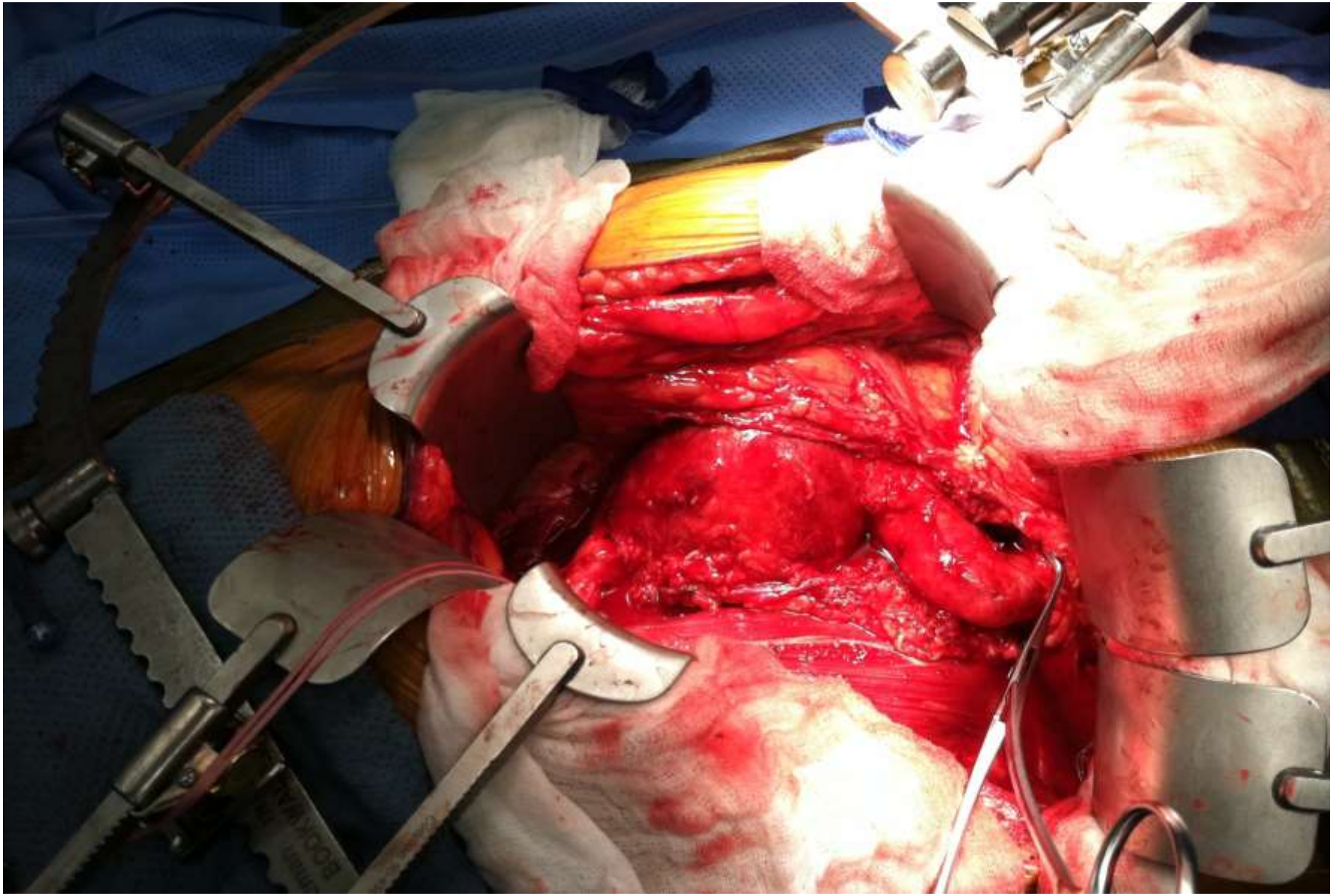
WHEN TO OPERATE?

VASCULAR HEALTH CLINICS

- >5.5 cm (5.0 cm)
- UK Small AAA Trial (Lancet 1998) & Aneurysm Detection and Management Trial (ADAM) (NEJM 2002)
- No difference in survival in 4.0-5.5 cm AAA when randomized to a strict surveillance vs immediate repair (follow-up 5 yrs)
- >60% of surveillance pts underwent repair

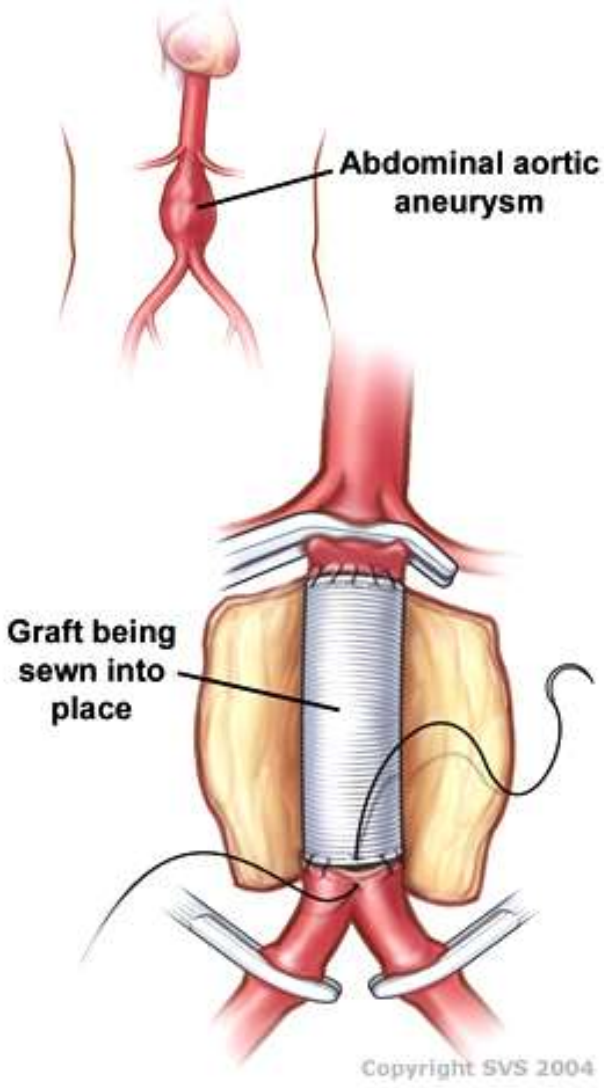
OPEN REPAIR AAA

VASCULAR HEALTH CLINICS



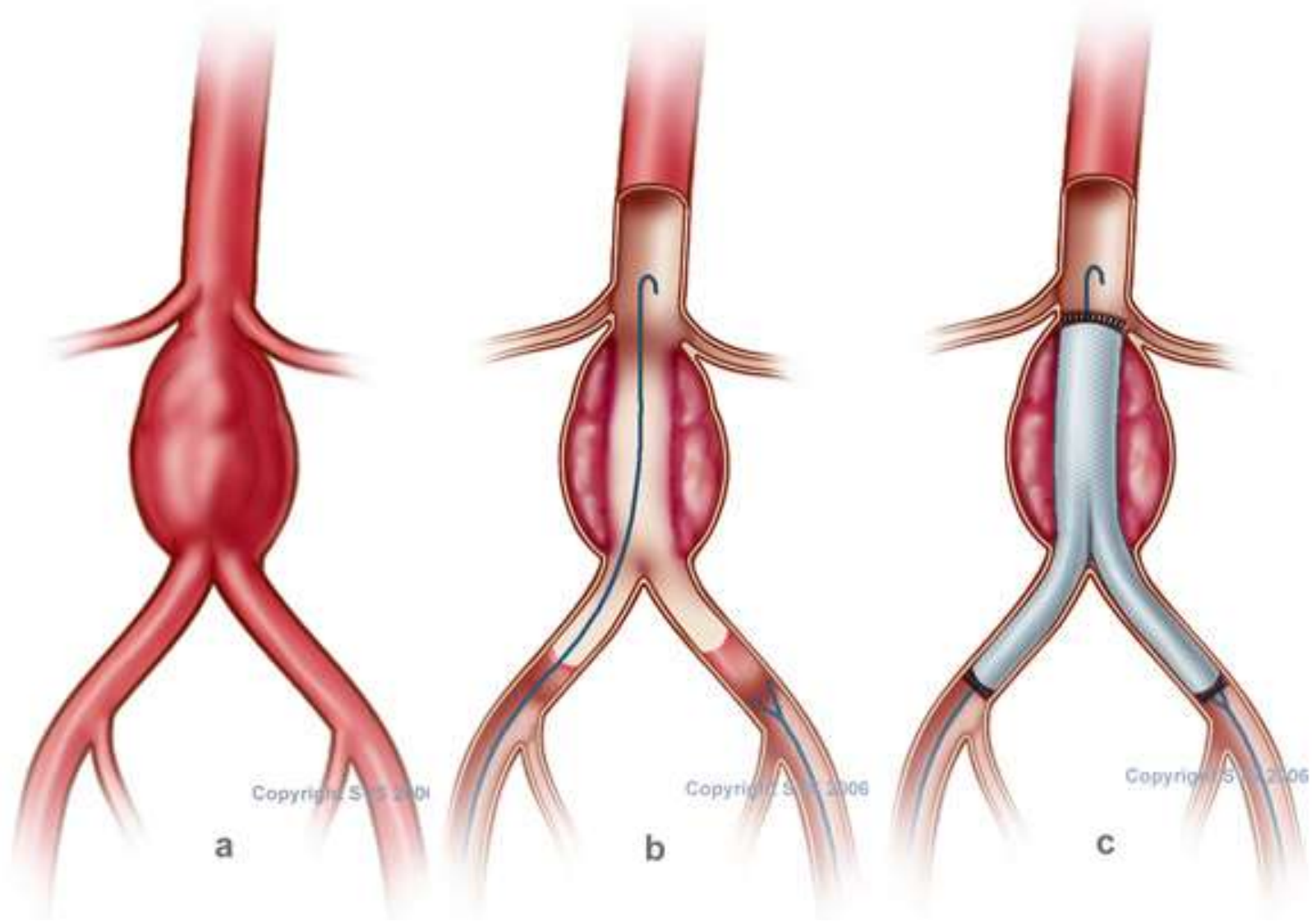
OPEN REPAIR AAA

VASCULAR HEALTH CLINICS



EVAR REPAIR AAA

VASCULAR HEALTH CLINICS



EVAR REPAIR AAA

VASCULAR HEALTH
CLINICS

EVAR REPAIR AAA

VASCULAR HEALTH CLINICS

AAA: WHEN TO OPERATE?

VASCULAR HEALTH CLINICS

- Repair must outweigh the risk of rupture
- 30-day in-hospital mortality (3.8% to 8.2%) for elective open repair
- Same size criteria for elective open vs endovascular repair (EVAR)
- EVAR is associated with decreased morbidity and mortality in the early post-operative period

OPEN VS EVAR

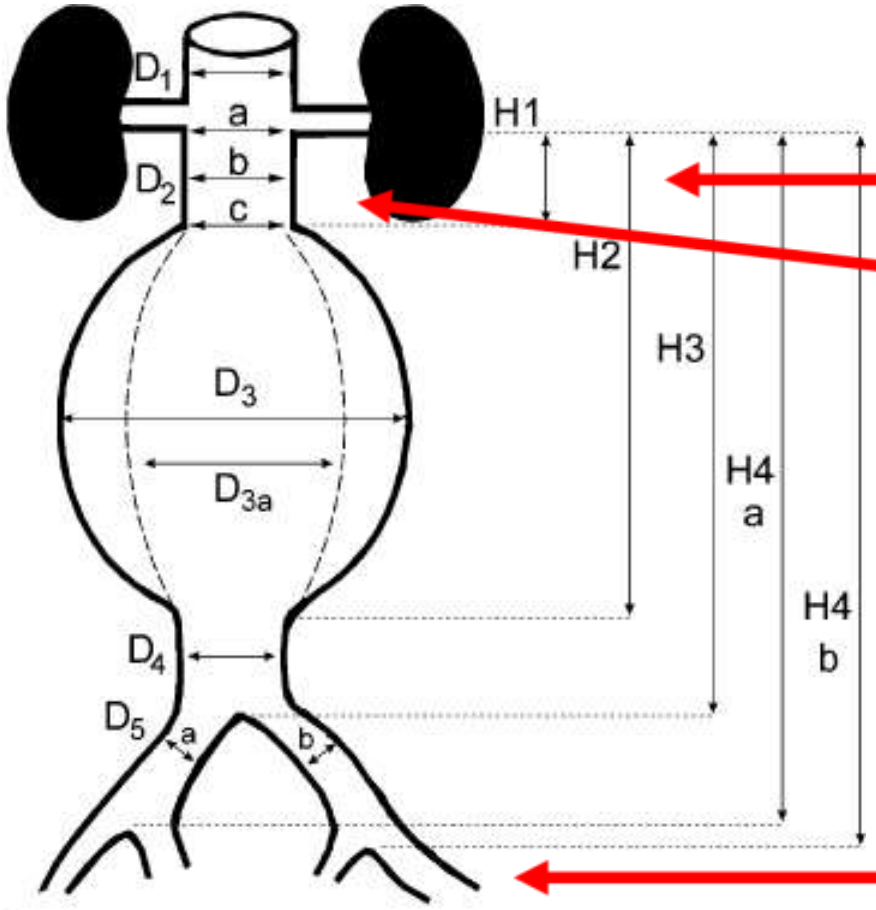
VASCULAR HEALTH CLINICS

	EVAR I		DREAM	
	Open	EVAR	Open	EVAR
N	539	543	178	173
30 Day Mortality	4.7%	1.7%*	4.6%	1.2%*
Late All Cause Mortality	29% (4yr)	26% (4yr)	11% (2yr)	11% (2yr)
Late AAA Related Mortality	7% (4yr)	4% (4yr)	5%(2yr)*	2% (2yr)

* $p \leq 0.05$

EVAR ELIGIBILITY REQUIREMENTS

VASCULAR HEALTH CLINICS



15 mm neck length

<3.0 cm neck diameter

Access Vessels

A

CONTRAINDICATION TO EVAR

VASCULAR HEALTH CLINICS

- Short proximal neck
- Thrombus present in proximal landing zone
- Conical proximal neck
- >120° angulations of the proximal neck
- Critical inferior mesenteric artery
- Significant iliac occlusion
- Tortuosity of iliac vessels

AAA DEVICE SELECTION

VASCULAR HEALTH CLINICS

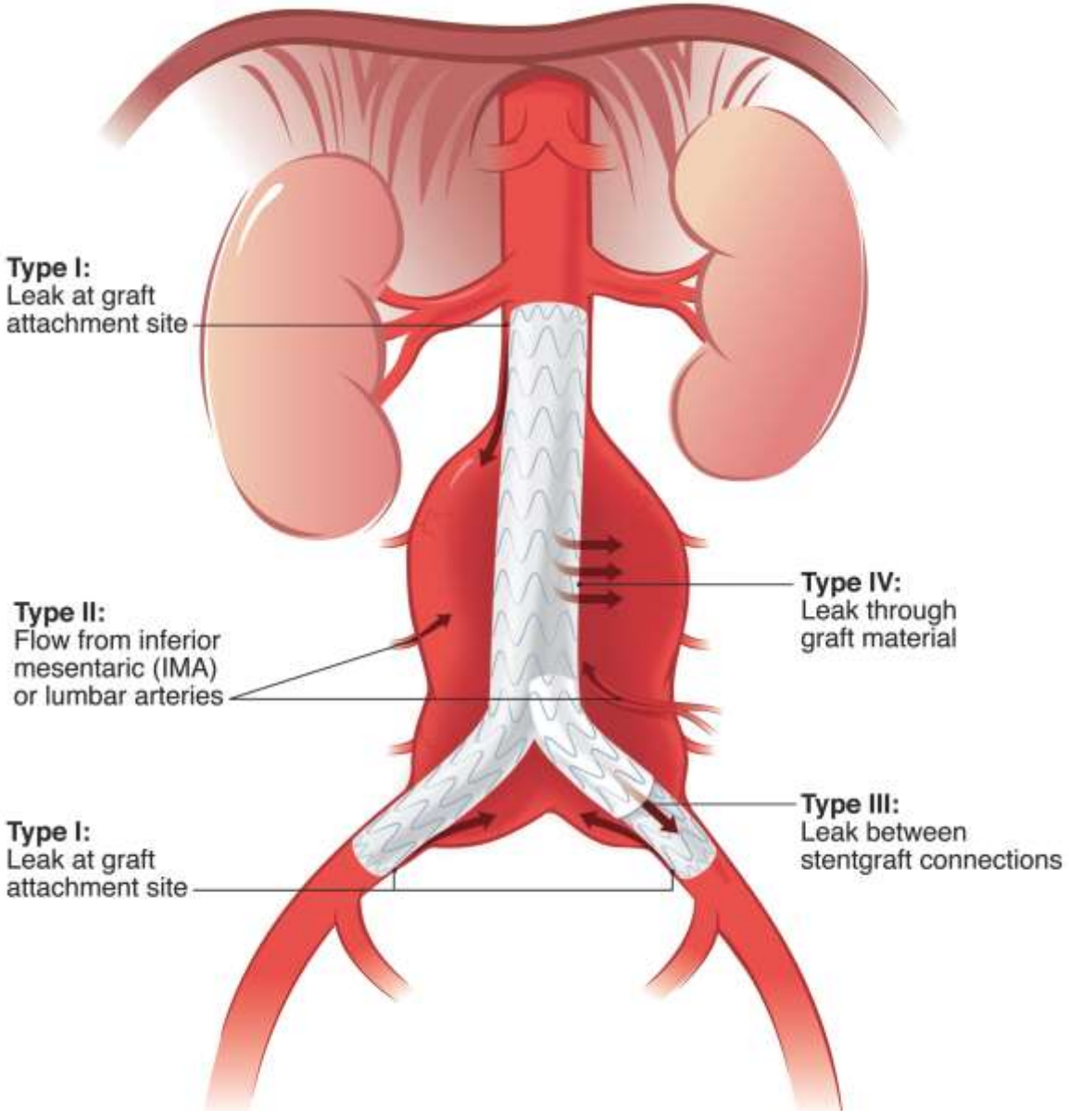
EVAR COMPLICATIONS

VASCULAR HEALTH CLINICS

- 30 day mortality ranges 0-6% (1.2%)
- Reduced cardiac/pulmonary complications
- Contrast nephropathy
- Stent deployment issues
- Local trauma to access vessels
- Endoleaks

AORTIC ANEURYSM ENDOLEAKS

VASCULAR HEALTH CLINICS



EVAR POSTOPERATIVE FOLLOWUP

VASCULAR HEALTH CLINICS

- Successful exclusion and depressurization with shrinkage of the aneurysm sac
- CTA at 6 months and yearly
- Renal issues
- Patient compliance issues

ADVANTAGES

VASCULAR HEALTH CLINICS

EVAR

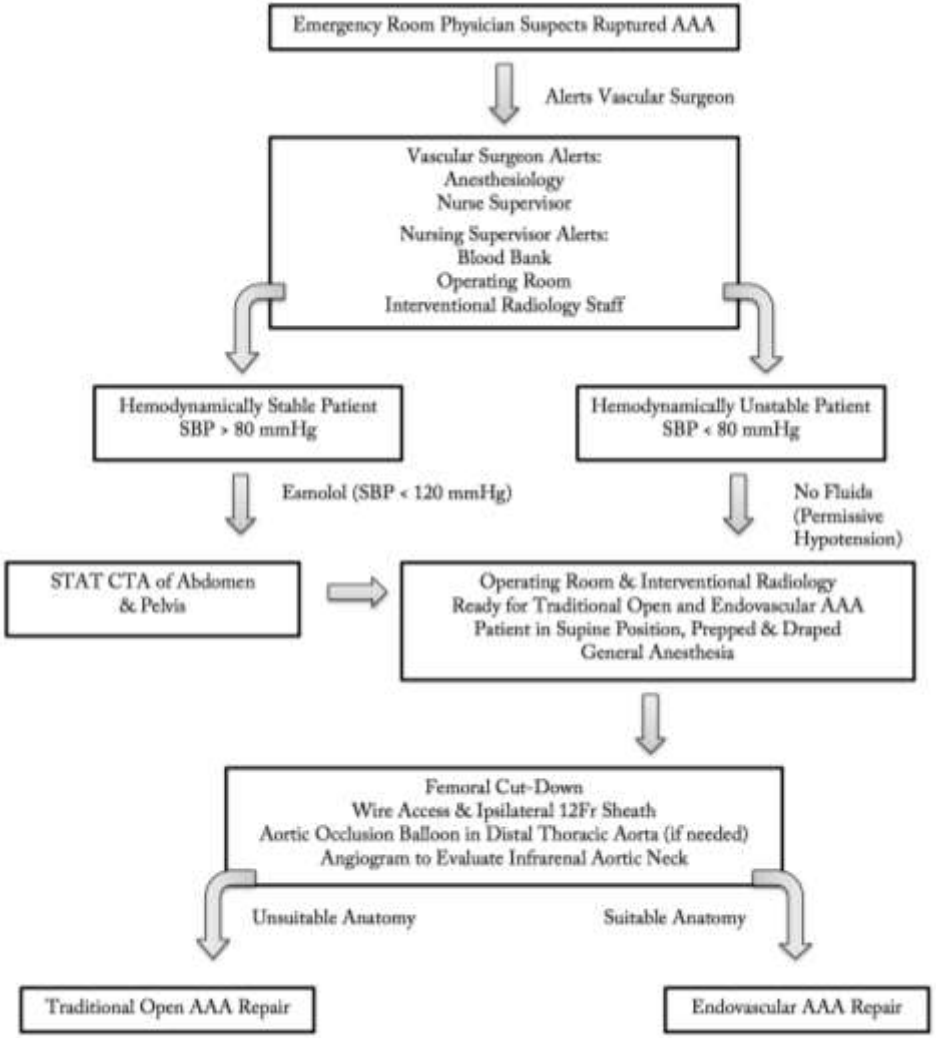
- Lower perioperative mortality/morbidity
- Shorter hospital stay
- No ICU/Ventilator Care
- Fewer transfusions
- Strict followup
- Shorter operative time
- No ventral hernias

Open Repair

- Less frequent need for reintervention
- No routine follow-up imaging
- No endoleaks
- ? Lower Cost

RUPTURE PROTOCOL

VASCULAR HEALTH CLINICS

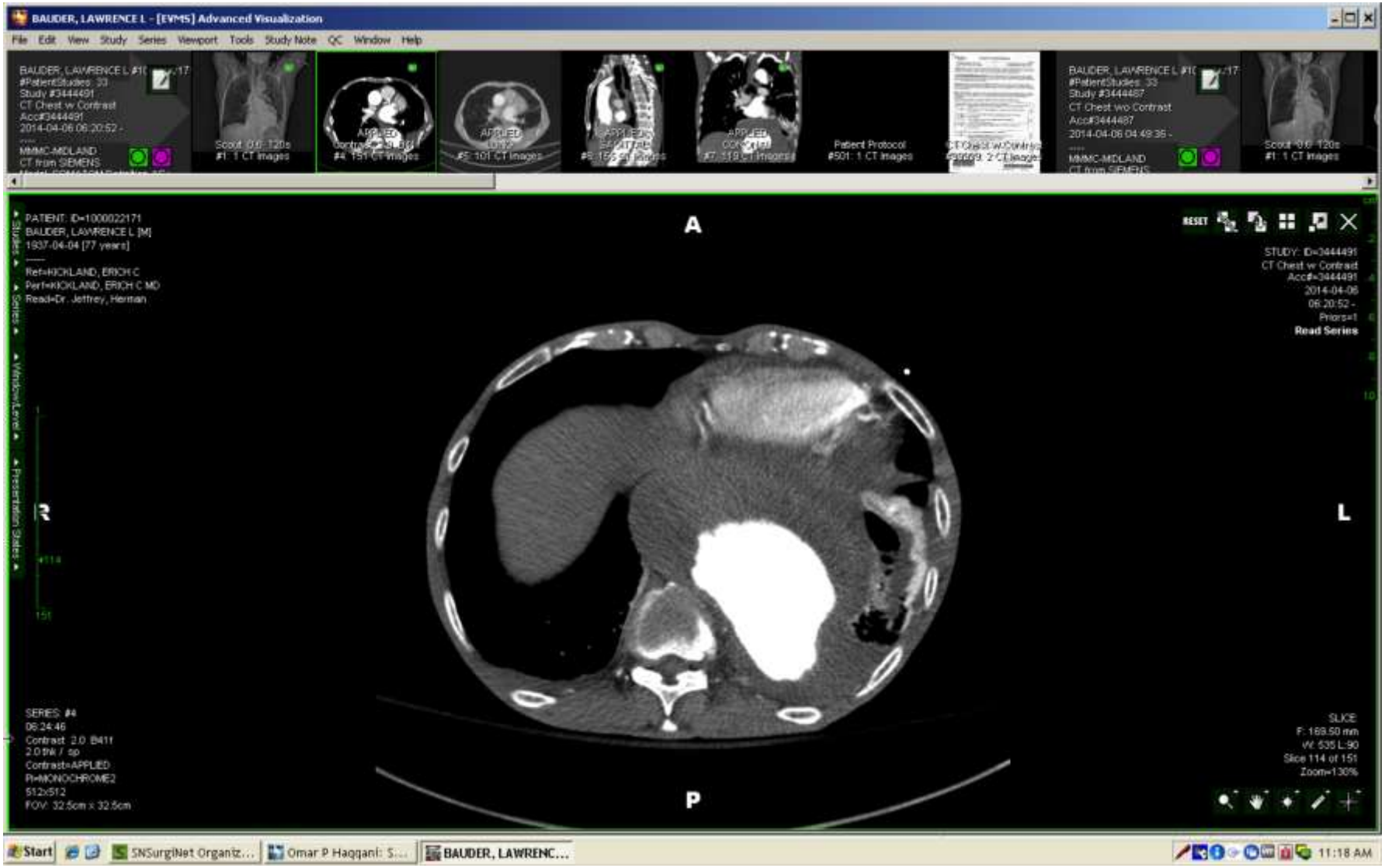


RUPTURED THORACIC ANEURYSM

VASCULAR HEALTH CLINICS

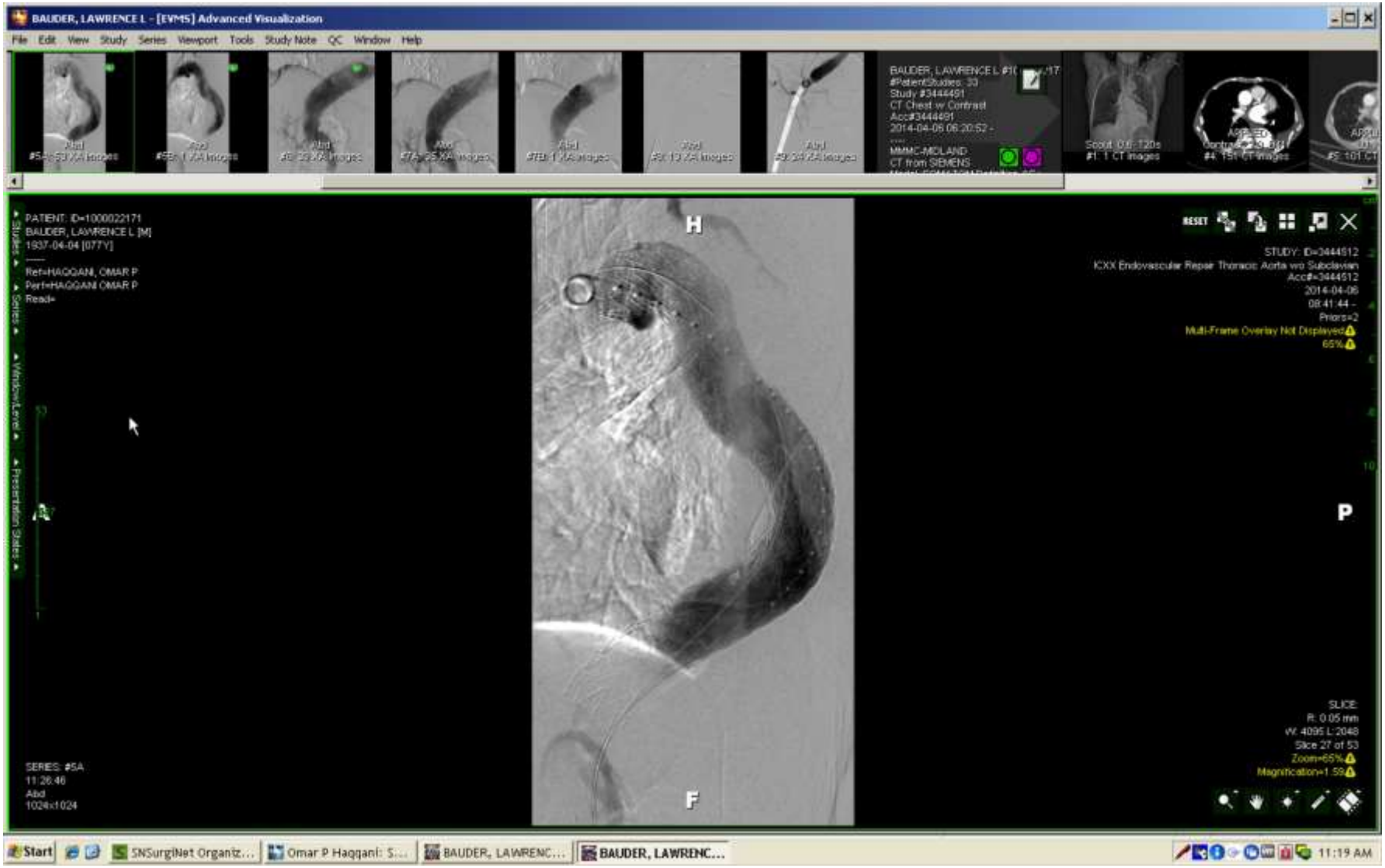
RUPTURED THORACIC ANEURYSM

VASCULAR HEALTH CLINICS



RUPTURED THORACIC ANEURYSM

VASCULAR HEALTH CLINICS



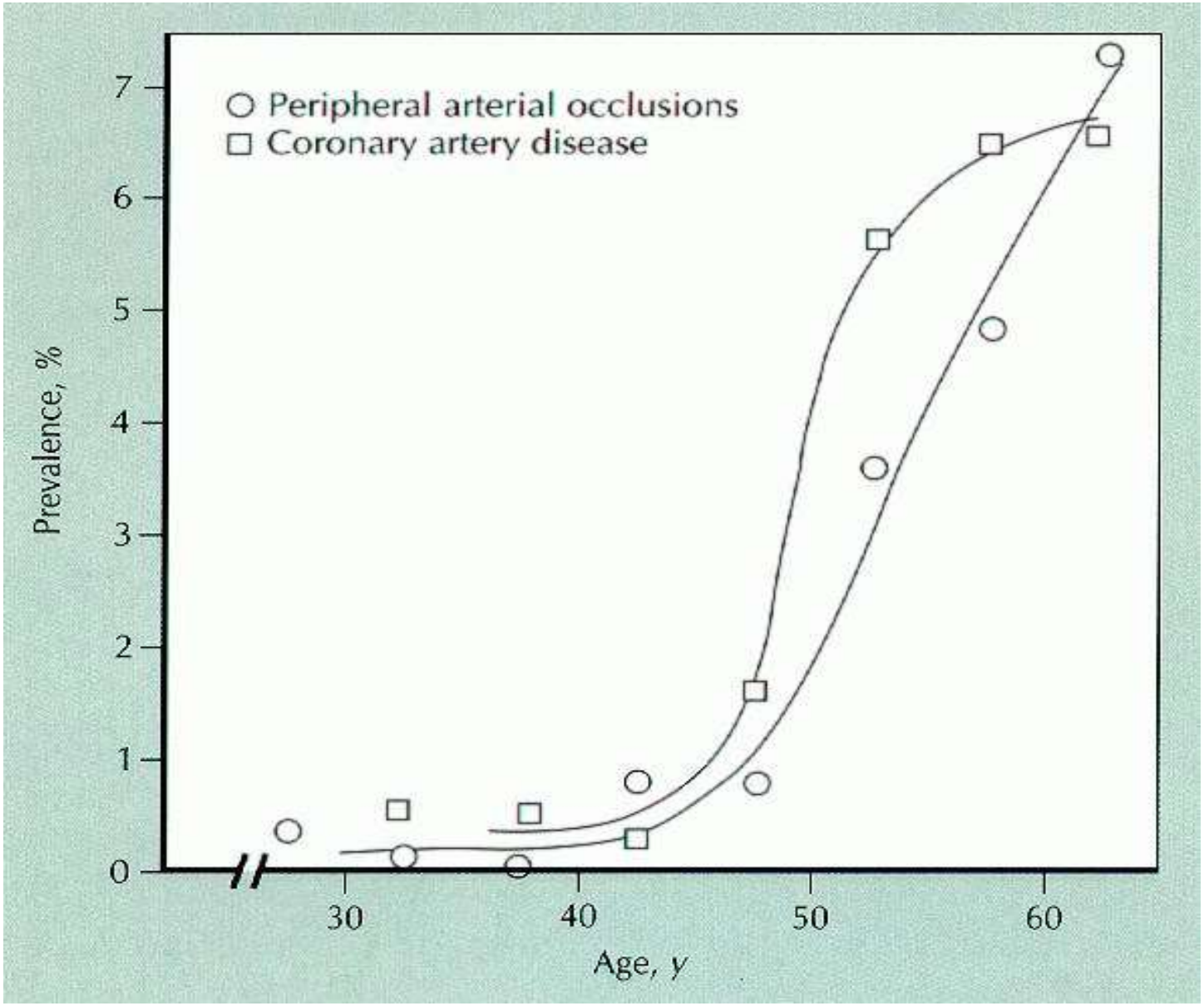
RUPTURED THORACIC ANEURYSM

VASCULAR HEALTH CLINICS

PERIPHERAL ARTERIAL DISEASE

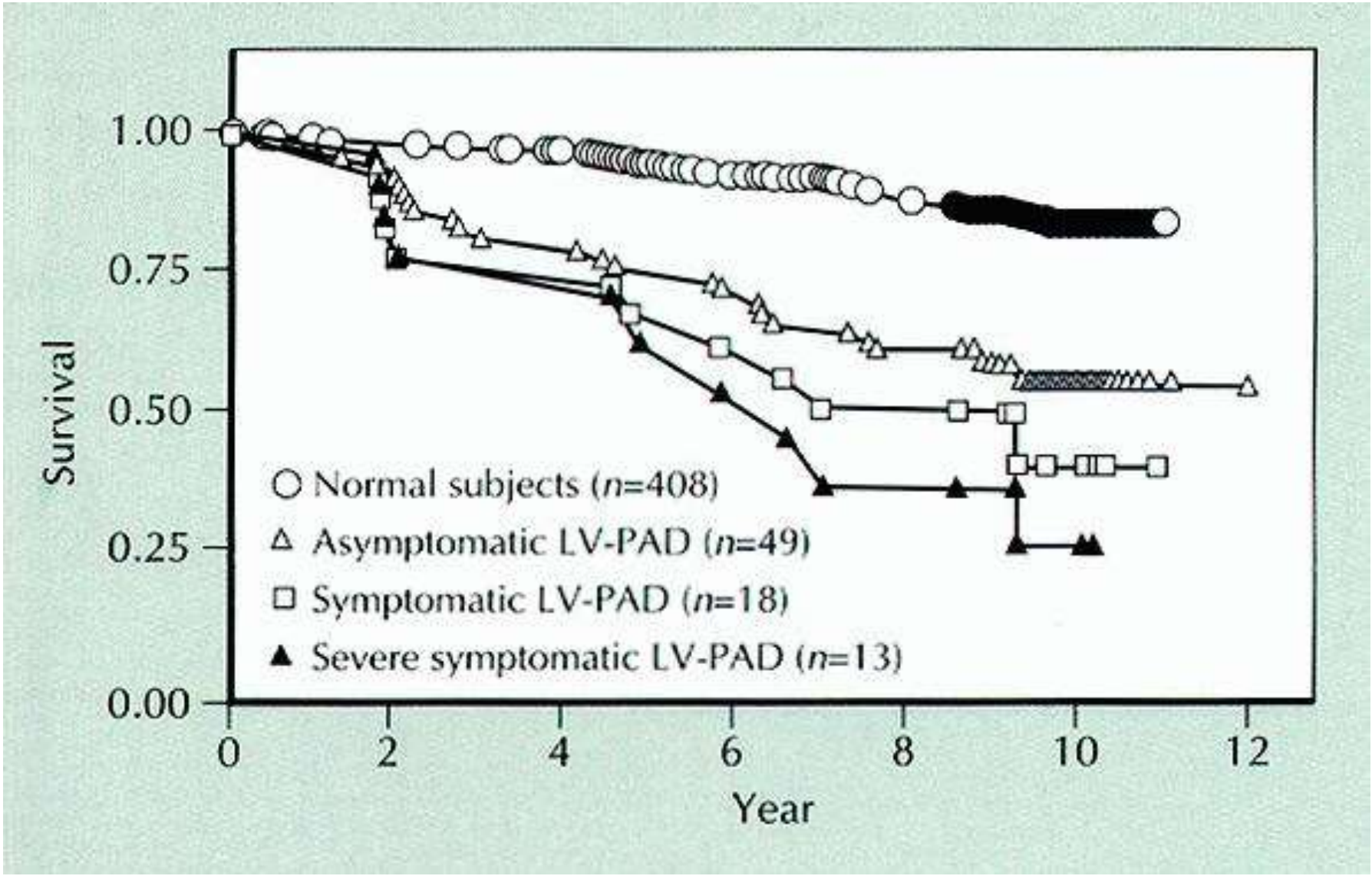
AGE DISTRIBUTION OF PAD

VASCULAR HEALTH CLINICS



IMPACT OF PAD ON MORTALITY

VASCULAR HEALTH CLINICS



ATHEROSCLEROTIC RISK FACTORS

VASCULAR HEALTH CLINICS

Traditional Risk Factors

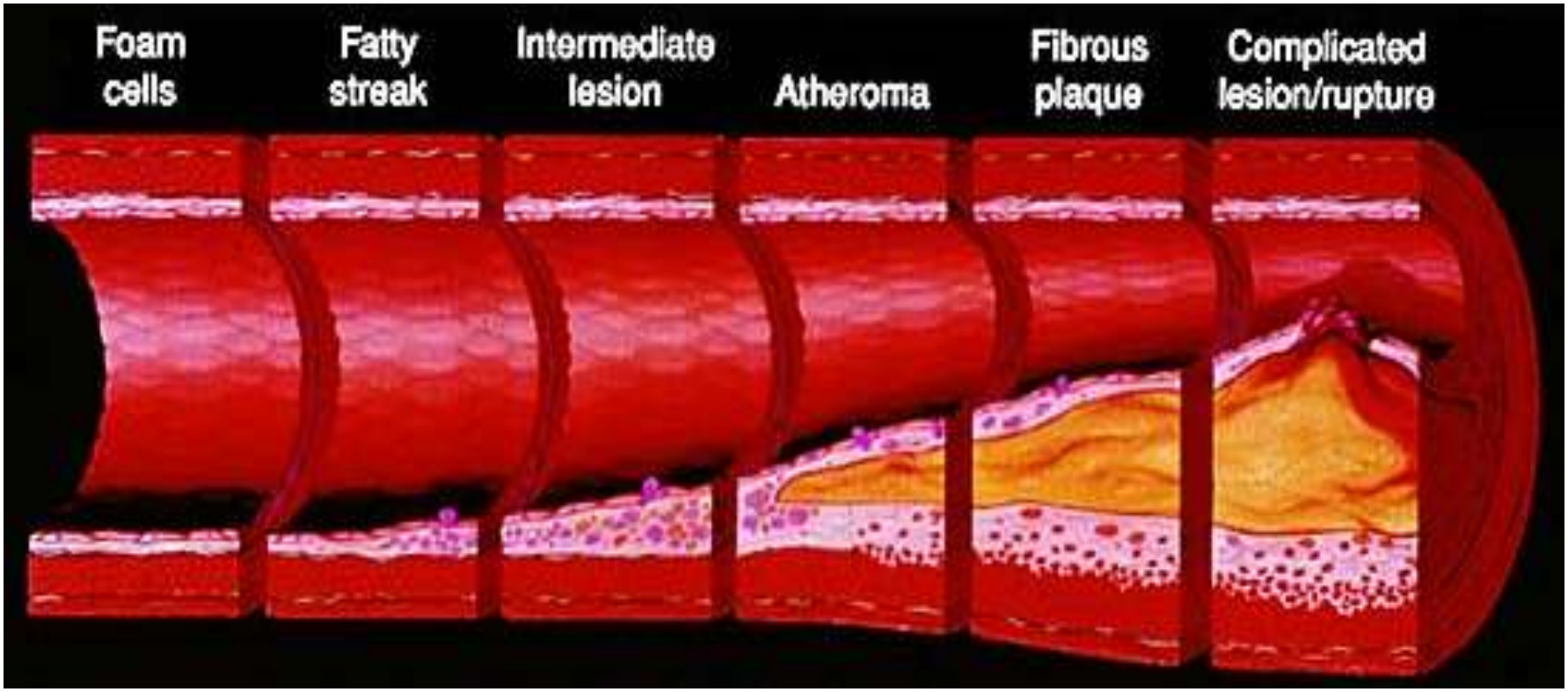
- Age
- Family history of CAD
- Cigarette smoking
- Hypertension
- Low HDL-C
- High total and LDL-C
- Diabetes mellitus
- Obesity

Novel Risk Factors

- D-Dimer
- Lipoprotein (a)
- Serum amyloid A
- CMV, HSV, C. Pneumoniae
- Homocysteine
- Estrogen deficiency
- Plasma fibrinogen
- Factor VII
- C-reactive protein

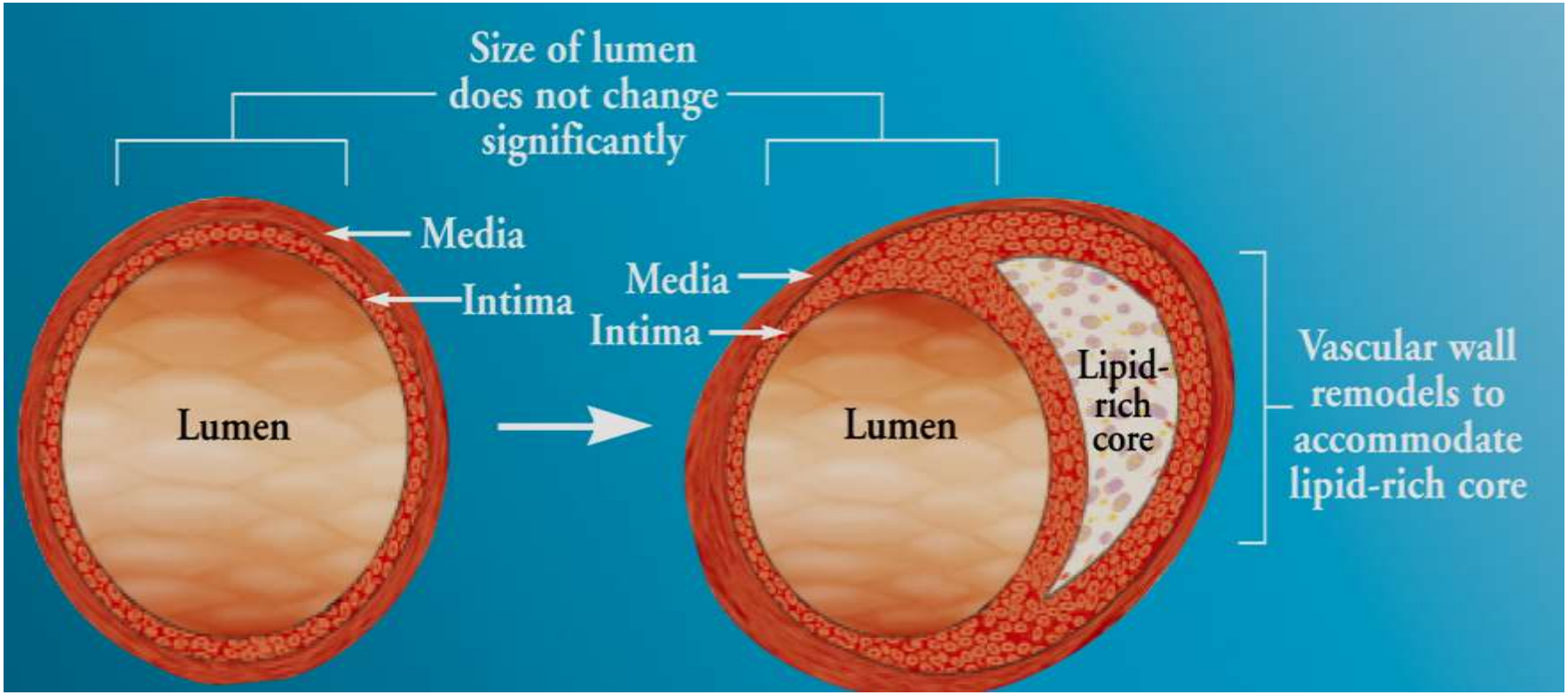
ARTERIAL PATHOPHYSIOLOGY

VASCULAR HEALTH CLINICS



ARTERIAL PATHOPHYSIOLOGY

VASCULAR HEALTH CLINICS



ARTERIAL PATHOPHYSIOLOGY

VASCULAR HEALTH CLINICS

Autoregulation:

- dilation of peripheral arterioles distal to stenosis
- collateral pathway formation
- enhanced muscle metabolism/O2 extraction

Claudication and rest pain:

- accumulation of anaerobic metabolites lactic acid, adenosine monophosphate

MANAGEMENT OF PAD PATIENTS

VASCULAR HEALTH CLINICS

Lifestyle modification

- Smoking cessation
- Regular exercise training
- Diet

Pharmacological treatment

- Antiplatelet therapy
- Control risk factors (e.g. hypertension, blood glucose)
- Vasodilators for symptomatic relief?

CLAUDICATION

VASCULAR HEALTH CLINICS

- Pain in calf, thigh, or buttock
- Occurs after consistent level of exercise
- Resolves with rest
- Aching, cramping sensation
- Benign condition
- 3% to 15% amputation rate over 3 years (depends on tobacco use)

REST PAIN

VASCULAR HEALTH CLINICS

- Dull, aching pain of foot or toes
- Relieved by dependency, worsened by supine position
- May have paresthesia and pallor
- Demands prompt attention
- Does not lead to limb loss in 100%

LIMB THREATENING ISCHEMIA

VASCULAR HEALTH CLINICS

- Pulselessness
- Pallor
- Pain
- Paralysis
- Paresthesia (or anesthesia)
- Demands immediate attention

PHYSICAL EXAMINATION

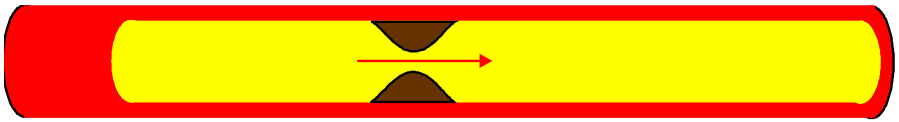
VASCULAR HEALTH CLINICS

- Decreased pulses
- Bruits (carotid, femoral, abdominal)
- Hair loss, muscle atrophy
- Atrophic, shiny skin
- Ulceration/gangrene (toes or foot)
- Dependent rubor

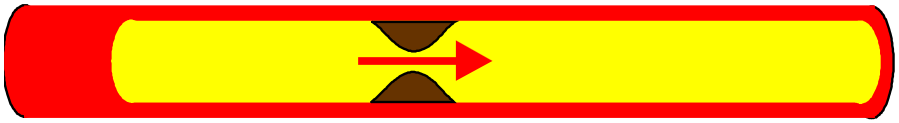
PHYSICAL EXAMINATION

VASCULAR HEALTH CLINICS

Low Flow: rest



High Flow: exercise



Increased flow leads to greater energy loss across stenosis and hence greater pressure drop

DIABETIC FOOT INFECTION

VASCULAR HEALTH CLINICS

- Neuropathy
- Impaired immune function
- Greater prevalence of arterial disease
- Impaired inflammation

DIABETIC NEUROPATHY

VASCULAR HEALTH CLINICS

- Segmental demyelinization: distal > proximal
- Paresthesia, loss of touch, vibration, temperature
- "Stocking" distribution
- Affects motor and autonomic nerves

DIABETIC NEUROPATHY

VASCULAR HEALTH CLINICS

- Weakening of intrinsic foot muscles
- Pes Cavus deformity, "Rocker-bottom foot"
- Hammer toe, extensor subluxation
- Maldistribution of weight over plantar surface

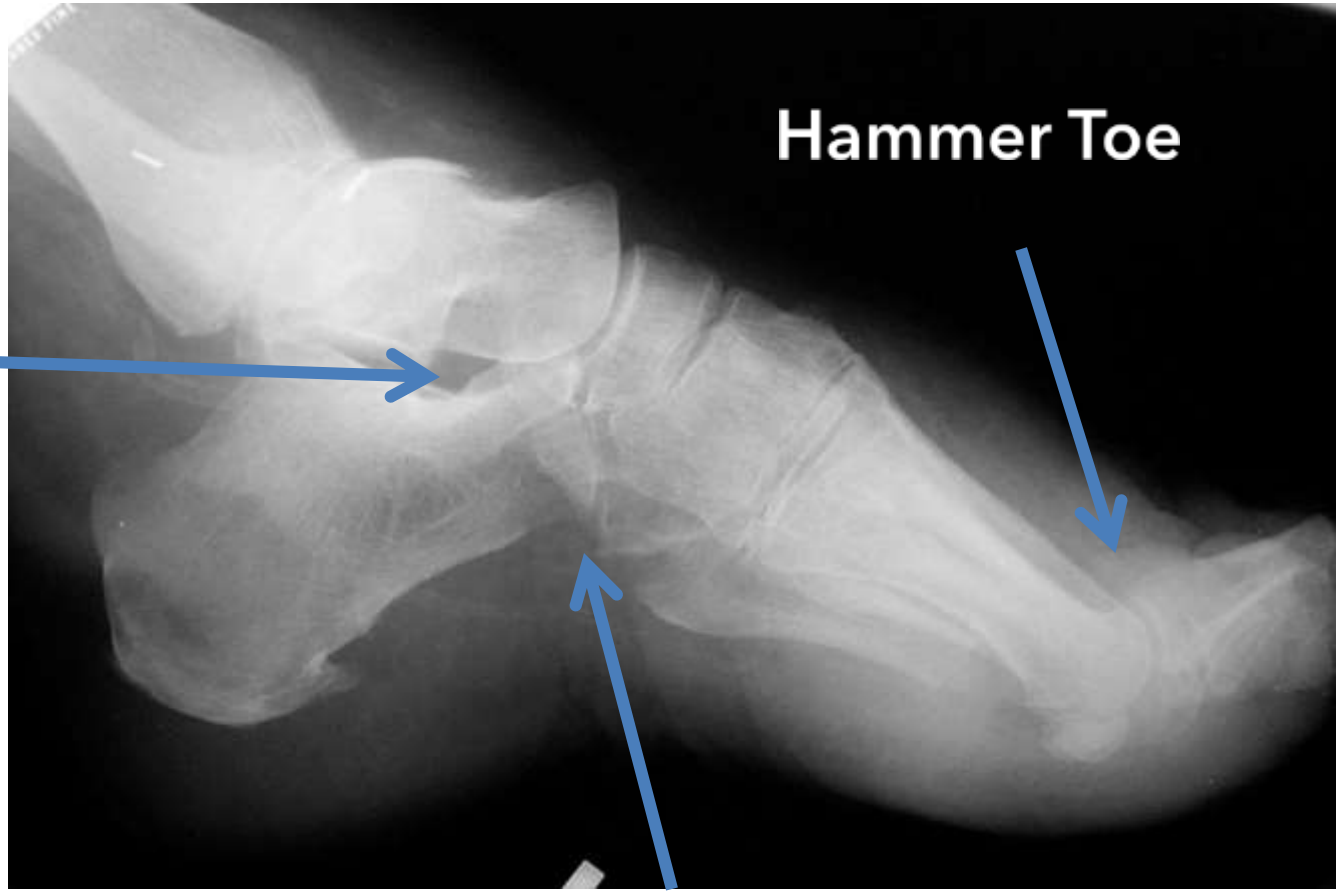
DIABETIC NEUROPATHY

VASCULAR HEALTH CLINICS

DIABETIC NEUROPATHY

VASCULAR HEALTH CLINICS

Subluxed tarsal bone



Pes Cavus deformity

MECHANISM OF INJURY

VASCULAR HEALTH CLINICS

- Poorly fitted shoes
- Foreign body in shoe
- Unrecognized trauma, burn
- Injudicious pedicure
- Problems compounded in elderly population with poor vision

IMPACT OF ISCHEMIA

VASCULAR HEALTH CLINICS

- Digital or foot gangrene
- Necrosis with trivial injury or infection
- Neglected ulcers and infection can rapidly progress

PATIENT ASSESSMENT

VASCULAR HEALTH CLINICS

- Careful examination
- Signs of toxicity
- Fever, leukocytosis
- Hyperglycemia most sensitive indicator
- Frequent delay in diagnosis
- Minimal pain and inflammation
- Casual observer can easily miss deep abscess

PATIENT ASSESSMENT

VASCULAR HEALTH CLINICS

- Careful assessment by vascular surgeon
- Aggressive manipulation, probing
  - unroof eschars, bullae
- Radiologic assessment
  - soft tissue swelling, osteomyelitis, tissue gas
- Aggressive drainage and debridement
- Broad spectrum antibiotics

DIABETIC FOOT SEPSIS

VASCULAR HEALTH CLINICS

DIABETIC FOOT SEPSIS

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VASCULAR HEALTH CLINICS

DIABETIC FOOT SEPSIS

VASCULAR HEALTH CLINICS

DIABETIC ULER WITH ISCHEMIA

VASCULAR HEALTH CLINICS

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VASCULAR HEALTH CLINICS

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VASCULAR HEALTH CLINICS

WET GANGRENE

VASCULAR HEALTH CLINICS

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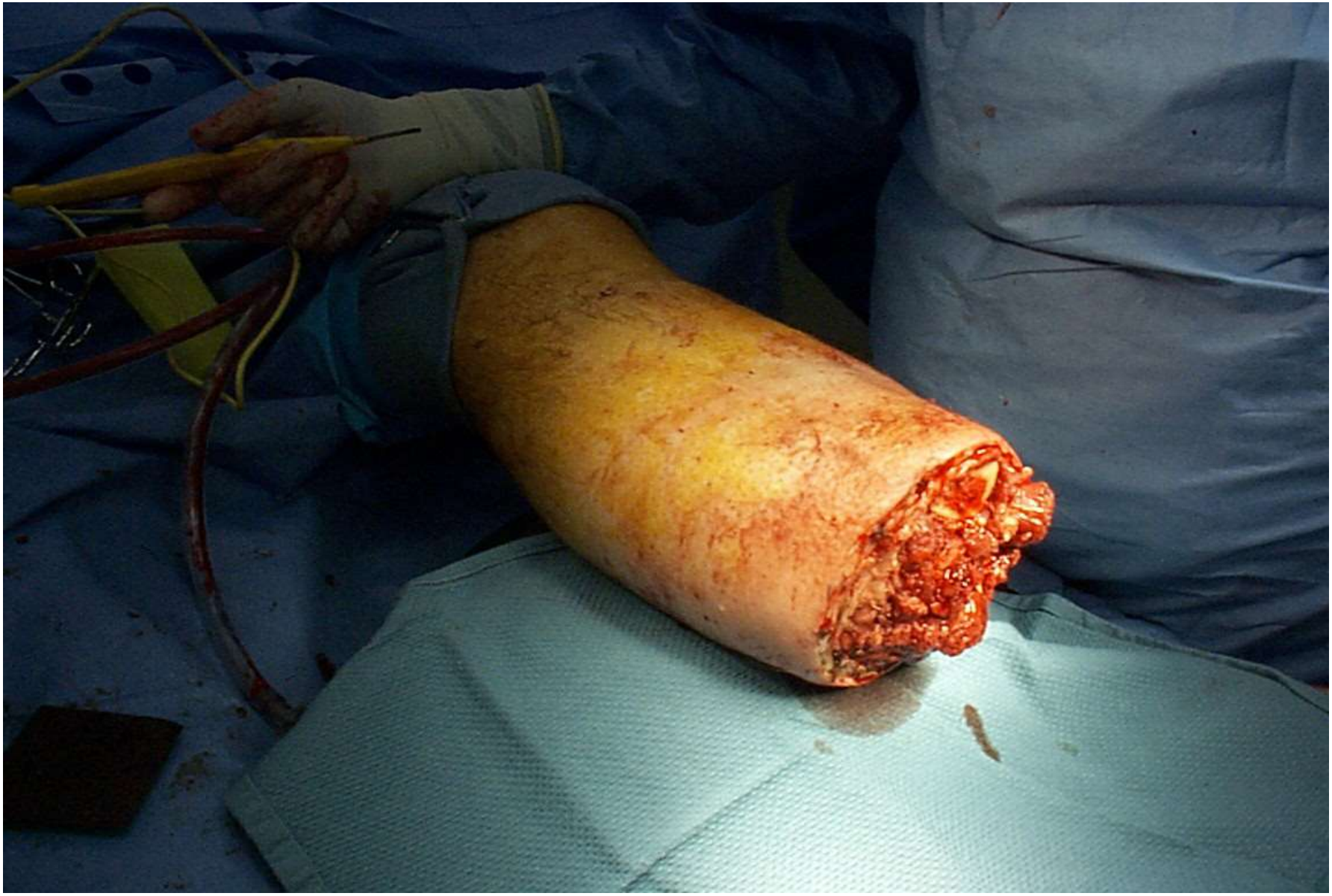


PHYSICAL EXAMINATION

VASCULAR HEALTH CLINICS

- Segmental pressures
- Pulse volume recording
- Duplex ultrasound
- Magnetic Resonance Angiography (MRA)
- Contrast Angiography
- Spiral CT

SEGMENTAL LIMB PRESSURES

VASCULAR HEALTH CLINICS

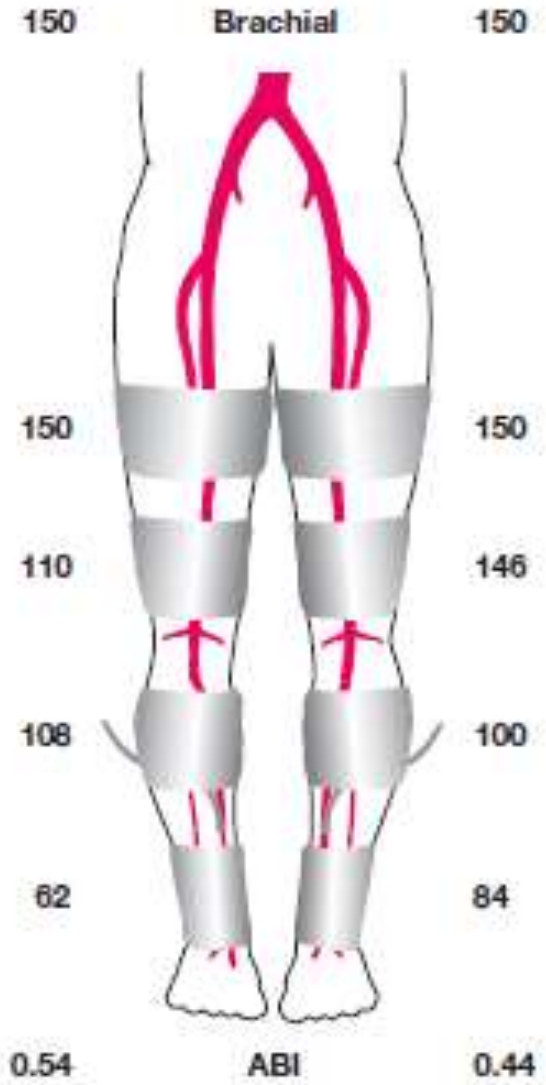
- Insonate best pulse at ankle/foot level
- DP, PT, Peroneal
- Cuff inflation until systolic flow disappears
- Slowly release until flow detected
- Repeat at all levels

SEGMENTAL LIMB PRESSURES

VASCULAR HEALTH CLINICS

SEGMENTAL LIMB PRESSURES

VASCULAR HEALTH CLINICS



SEGMENTAL LIMB PRESSURES

VASCULAR HEALTH CLINICS

Limitations of SLP measurements include:

- Nondetection of isolated moderate stenoses (usually iliac) that produce little or no pressure gradient at rest
- Falsely elevated pressures in patients with diabetes calcified, incompressible arteries
- The inability to differentiate between arterial stenosis and occlusion

SEGMENTAL LIMB PRESSURES

VASCULAR HEALTH CLINICS

Ankle Brachial Index (ABI)

- Doppler systolic occlusion pressure at ankle
- Quantifies arterial obstruction
- Falsely elevated with calcified arteries (diabetics, dialysis patients)

SEGMENTAL LIMB PRESSURES

VASCULAR HEALTH CLINICS

ANKLE BRACHIAL INDEX

VASCULAR HEALTH CLINICS

ABI	Symptoms
> 0.92	Normal
0.5 – 0.9	Claudication
< 0.4	Rest Pain
< 0.4	Tissue loss

TOE PRESSURES AND TOE BRACHIAL INDEX

VASCULAR HEALTH CLINICS

- Diabetes, renal failure results in incompressible tibial arteries (≥250 mmHg) or ABI >1.40
- Toe pressures provides an accurate measurement of distal limb systolic pressures in vessels that do not typically become noncompressible
- A special small occlusion cuff is used proximally on the first or second toe

PULSE VOLUME RECORDING (PVR)

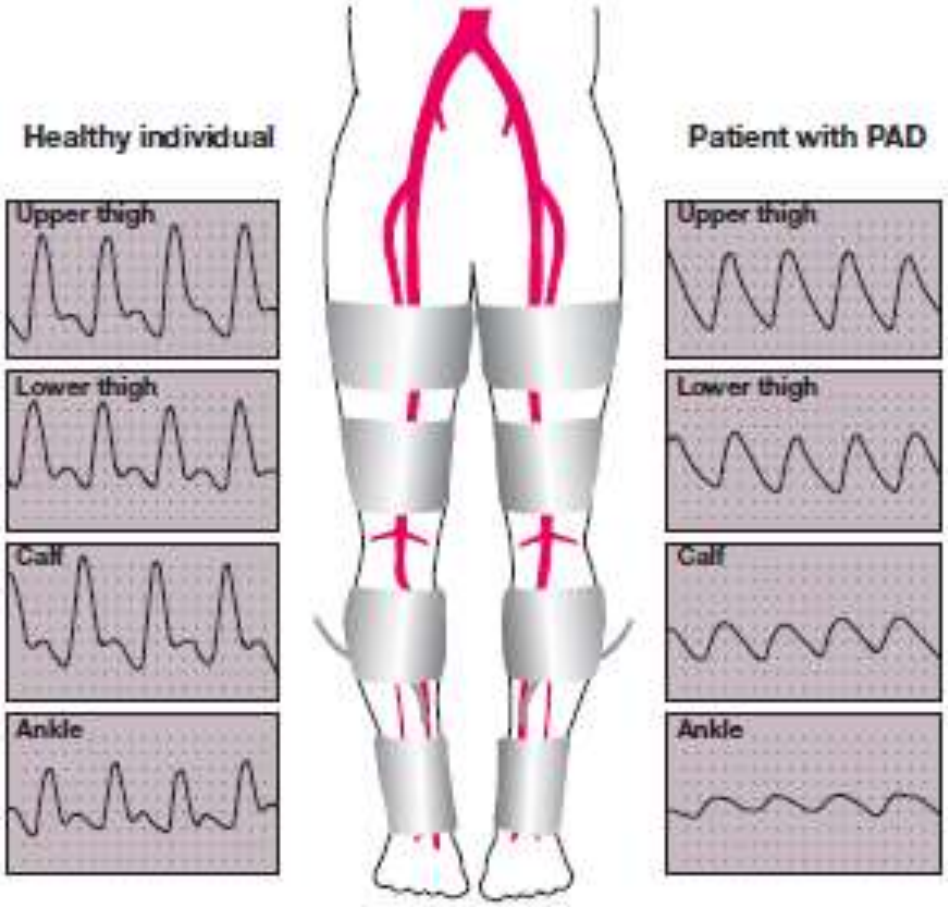
VASCULAR HEALTH CLINICS

- Measures changes in pressure reflecting arterial pulsatility
- Aid in localizing significant occlusive lesions
- Not affected by calcified vessels as the ABI

Healthy | Mild Arterial Disease | Moderate Arterial Disease | Severe Arterial Disease

PULSE VOLUME RECORDING (PVR)

VASCULAR HEALTH CLINICS



In the presence of arterial disease, the slope of the waveforms flattens, the pulse width widens, and the dicrotic notch is lost

CHARACTERISTICS OF ARTERIAL IMAGING

VASCULAR HEALTH CLINICS

Modality	Availability	Relative risk and complications	Strengths	Weaknesses	Contraindications
X-ray contrast angiography	Widespread	High risk Access site complications Contrast nephropathy Radiation exposure	'Established modality'	2D images Limited planes imaging pedal vessels and collaterals in the setting of occlusion requires prolonged imaging and substantial radiation	Renal insufficiency Contrast allergy
MDCTA	Moderate	Moderate risk Contrast nephropathy Radiation exposure	Rapid imaging Sub-millimeter voxel resolution 3D volumetric information from axial slices Plaque morphology	Calcium causes 'blooming artifact' Stented segments difficult to visualize	Renal insufficiency Contrast allergy

CHARACTERISTICS OF ARTERIAL IMAGING

VASCULAR HEALTH CLINICS

Modality	Availability	Relative risk and complications	Strengths	Weaknesses	Contraindications
MRA	Moderate	None	True 3D imaging modality; infinite planes and orientations can be constructed Plaque morphology from proximal segments with additional sequences Calcium does not cause artifact	Stents cause artifact but alloys such as nitinol produce minimal artifact	Intracranial devices, spinal stimulators, pace-makers, cochlear implants and intracranial clips and shunts are absolute contradications
Duplex	Widespread	None	Hemodynamic information	Operator-dependent and time-consuming to image both lower extremities Calcified segments are difficult to assess	None

MANAGEMENT OF PAD INTERVENTIONS

VASCULAR HEALTH CLINICS

Endovascular

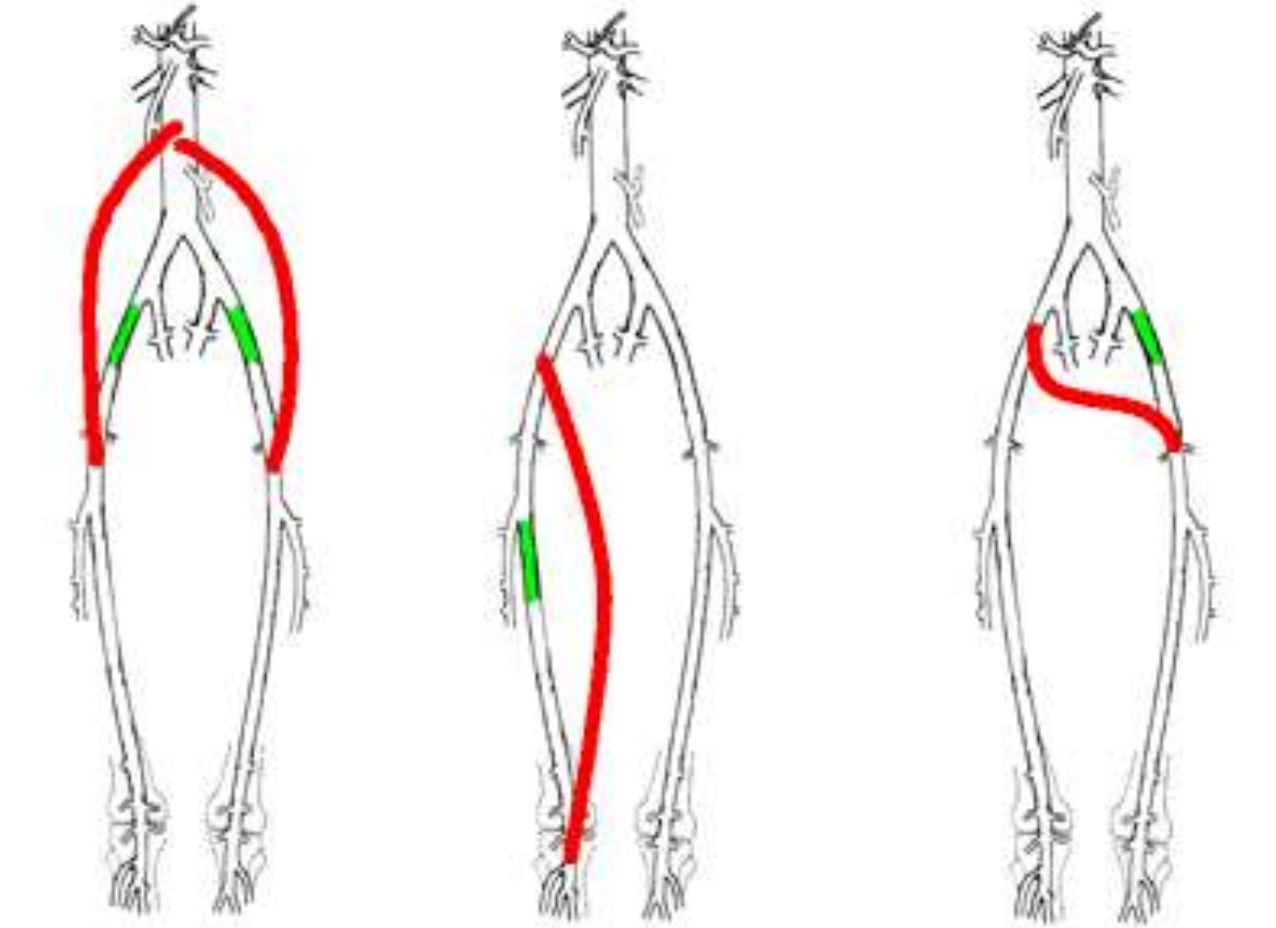
- Revascularization (angioplasty)
- Stent placement

Surgical

- Endarterectomy
- Peripheral bypass graft
- Amputation

RESULTS OF ARTERIAL RECONSTRUCTION

VASCULAR HEALTH CLINICS



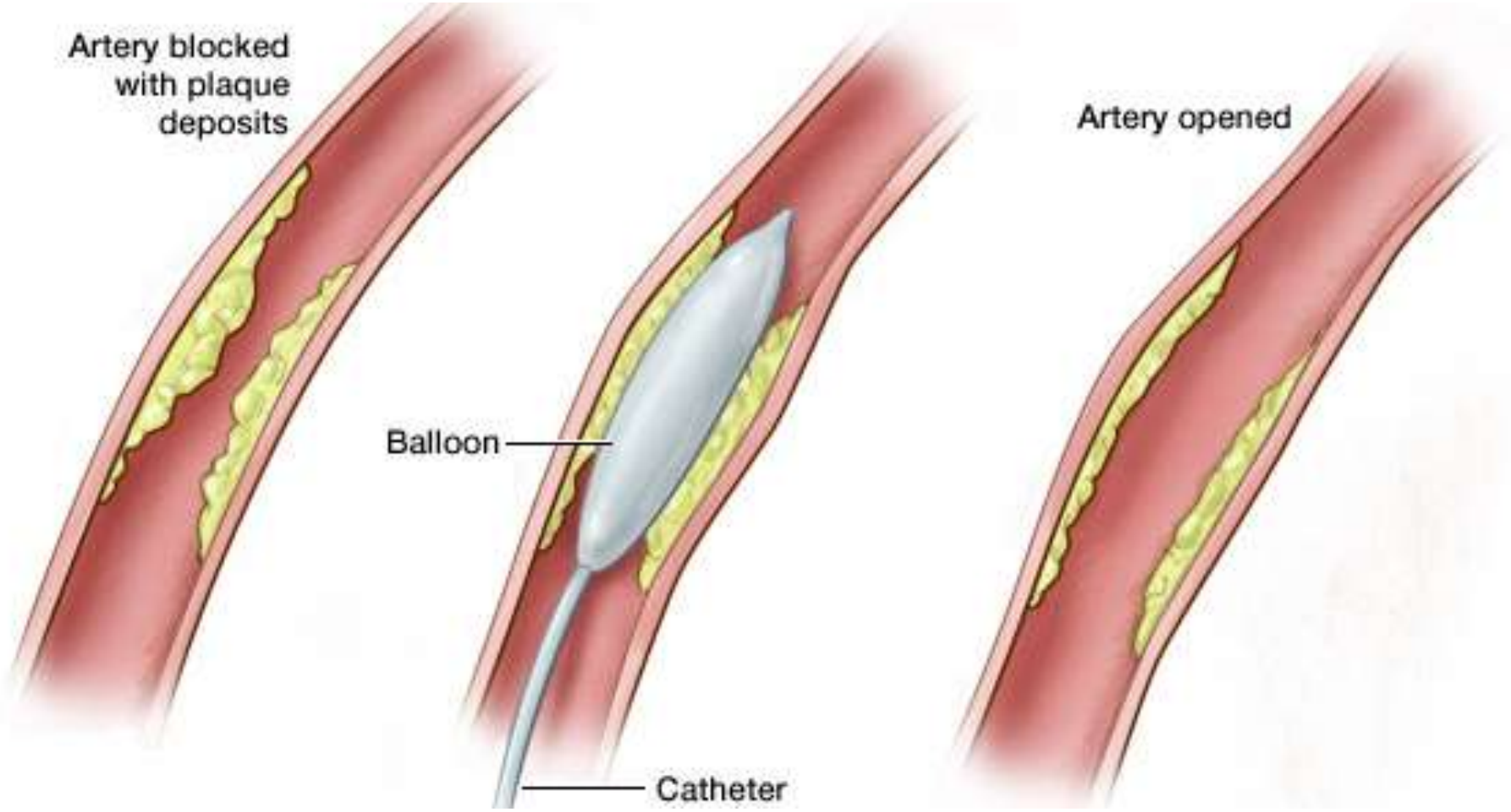
Aorto-Bifemoral Bypass

Femoral-Popliteal Bypass

Femoro-Fermoral Crossover

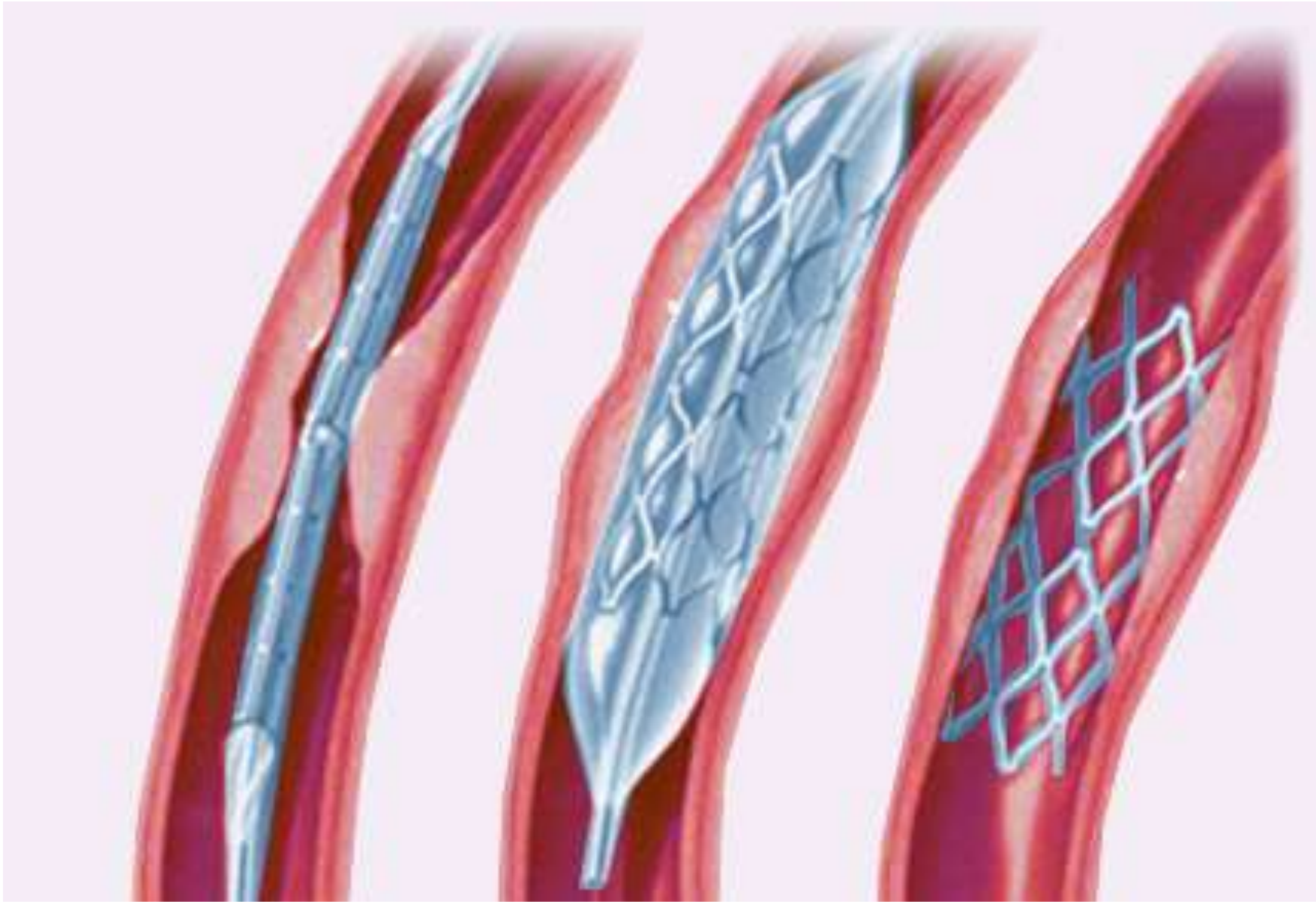
RESULTS OF ARTERIAL RECONSTRUCTION

VASCULAR HEALTH CLINICS



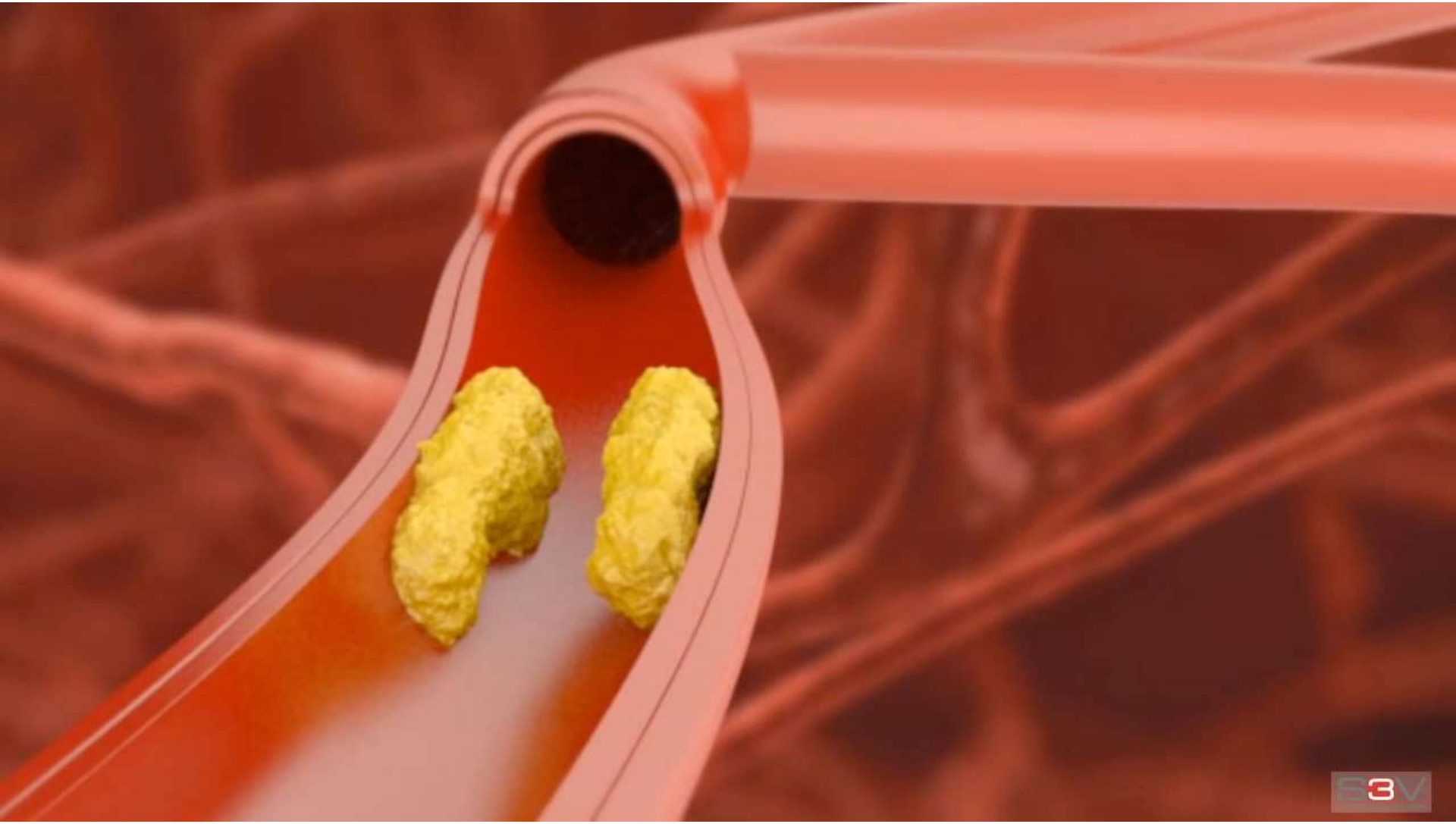
RESULTS OF ARTERIAL RECONSTRUCTION

VASCULAR HEALTH
CLINICS



RESULTS OF ARTERIAL RECONSTRUCTION

VASCULAR HEALTH CLINICS



RESULTS OF ARTERIAL RECONSTRUCTION

VASCULAR HEALTH CLINICS

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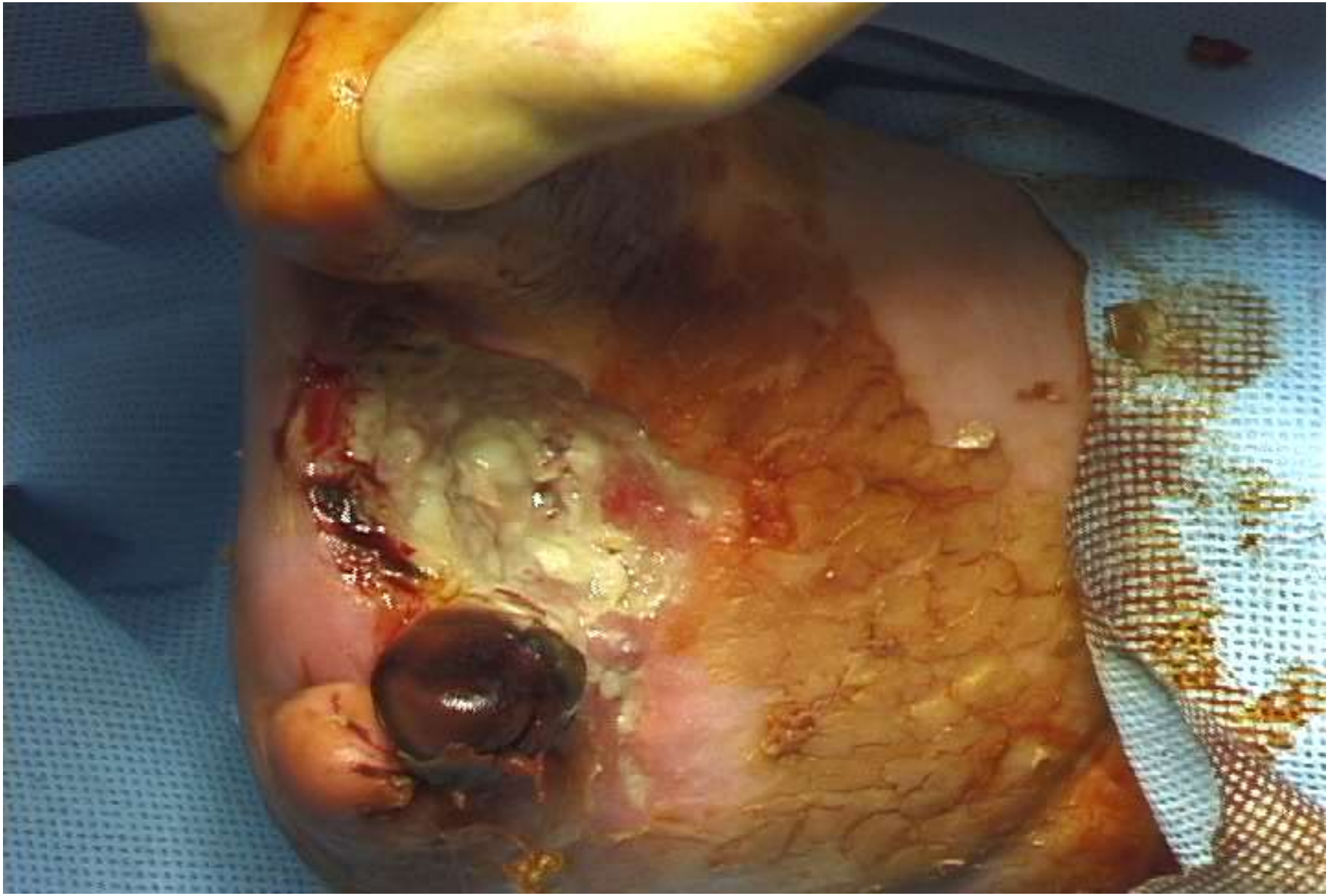
VASCULAR HEALTH CLINICS

WET GANGRENE

VASCULAR HEALTH CLINICS



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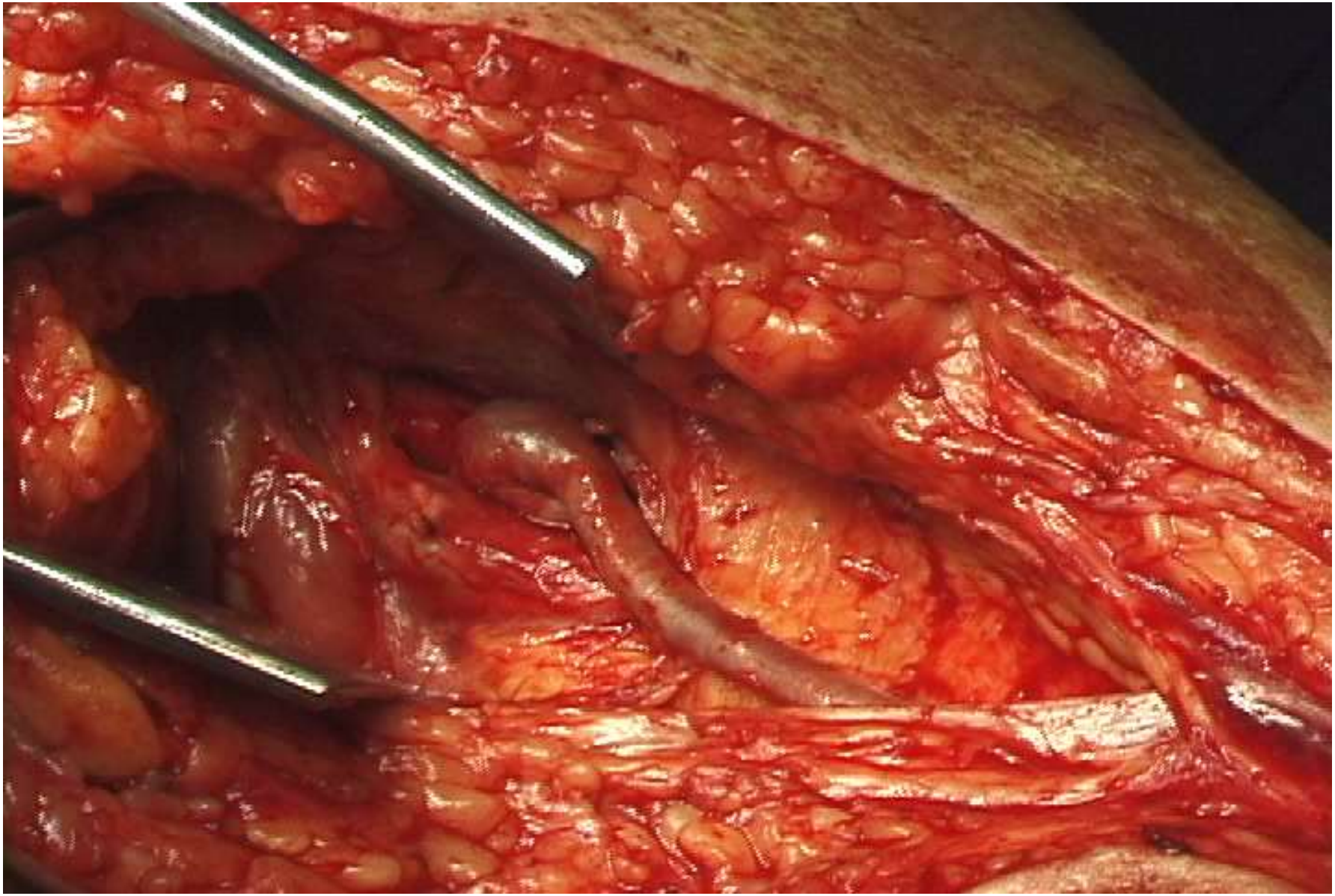

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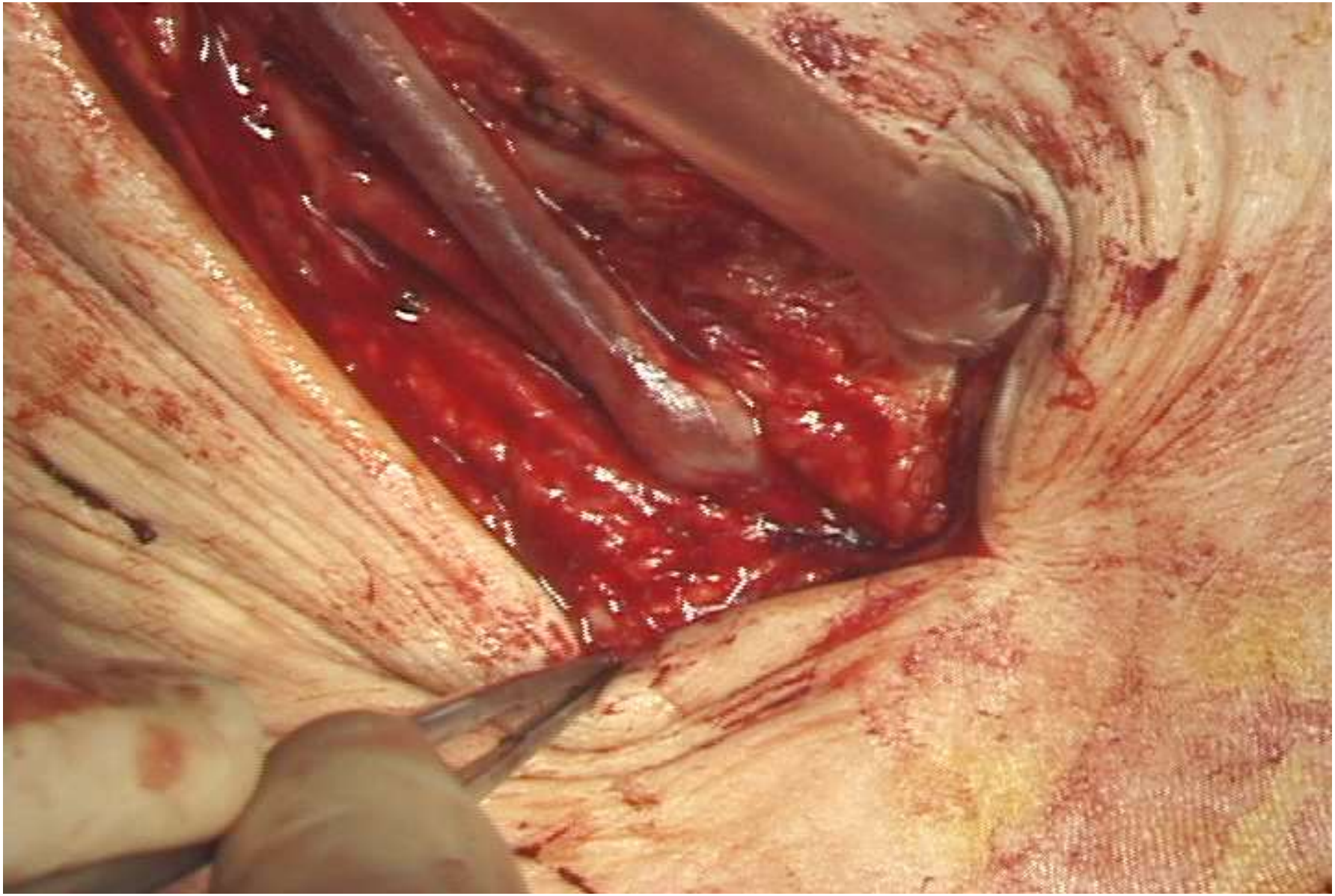

WET GANGRENE

VASCULAR HEALTH CLINICS

WET GANGRENE

VASCULAR HEALTH CLINICS

37 YO DM WITH ESRD

VASCULAR HEALTH CLINICS

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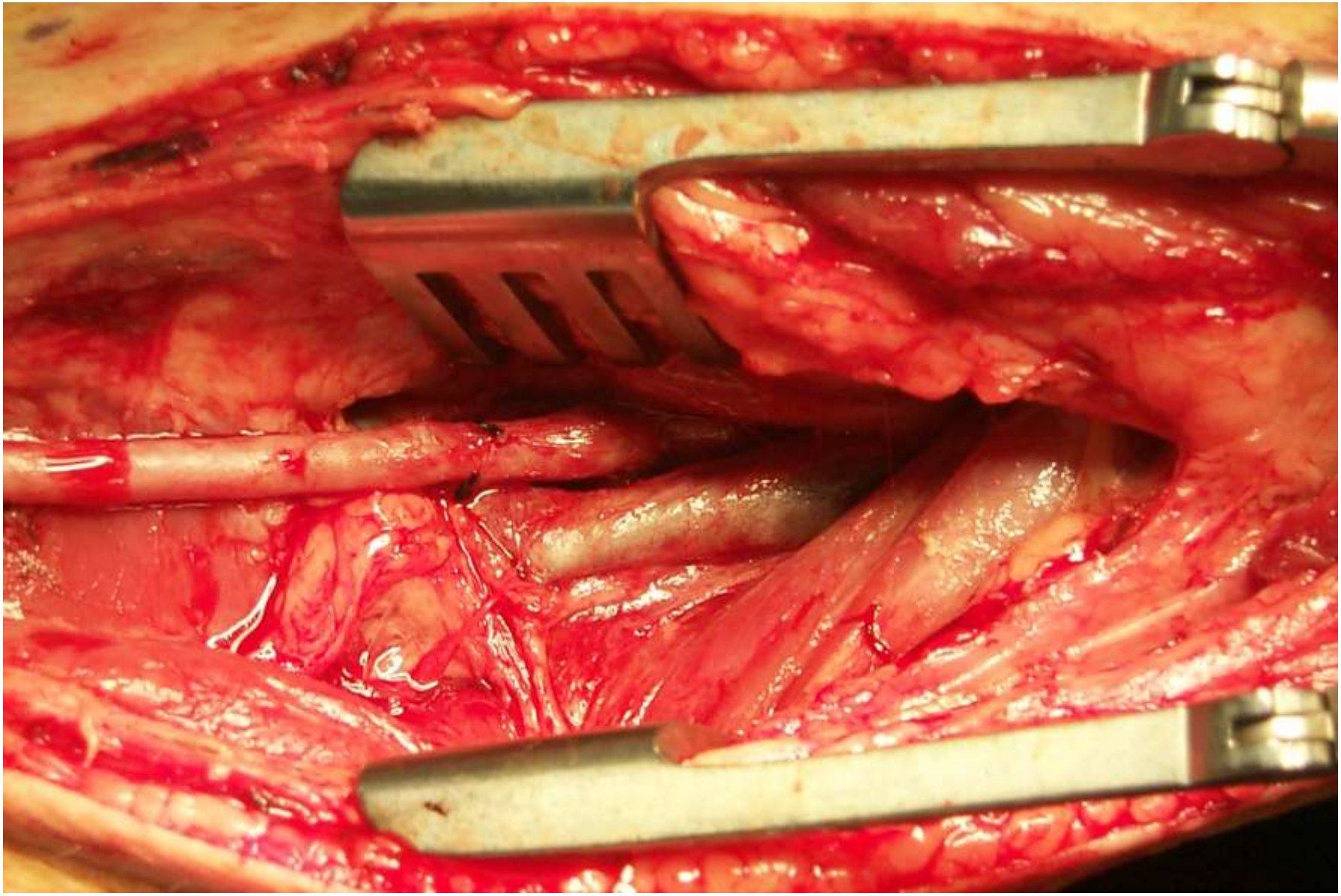


37 YO DM WITH ESRD

VASCULAR HEALTH CLINICS

37 YO DM WITH ESRD

VASCULAR HEALTH CLINICS

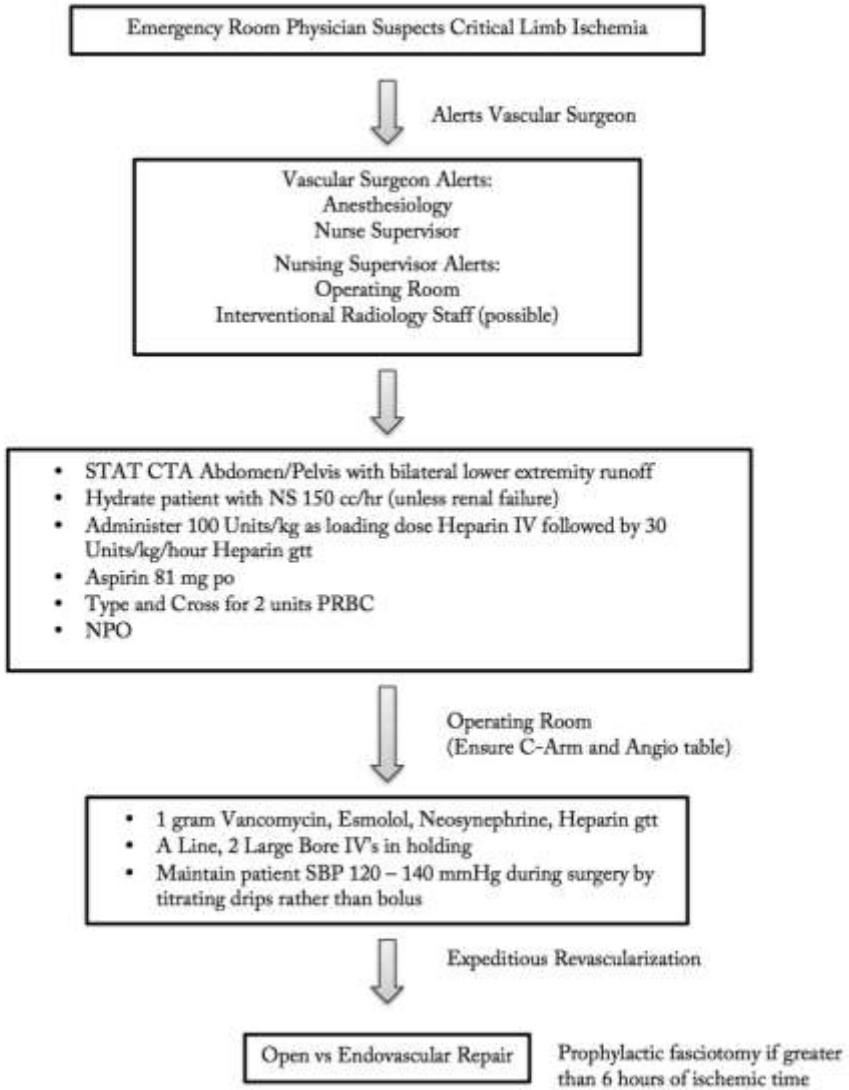
RESULTS OF ARTERIAL RECONSTRUCTION

VASCULAR HEALTH CLINICS

To prevent a delay in treatment early vascular consultation and revascularization important as >85% of amputations may be prevented by early detection and appropriate treatment

CRITICAL LIMB ISCHEMIA

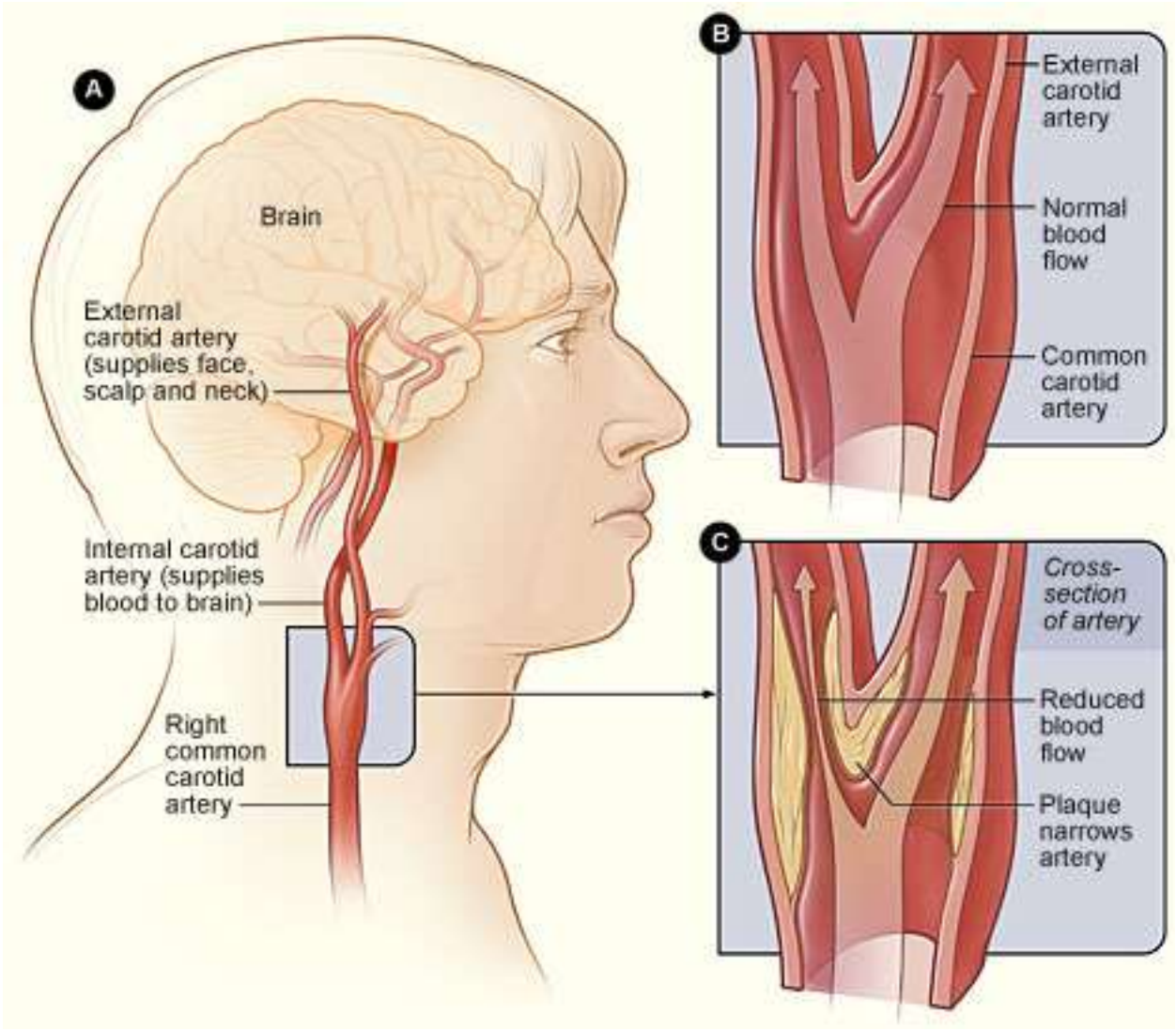
VASCULAR HEALTH CLINICS



CAROTID DISEASE

CAROTID DISEASE

VASCULAR HEALTH CLINICS



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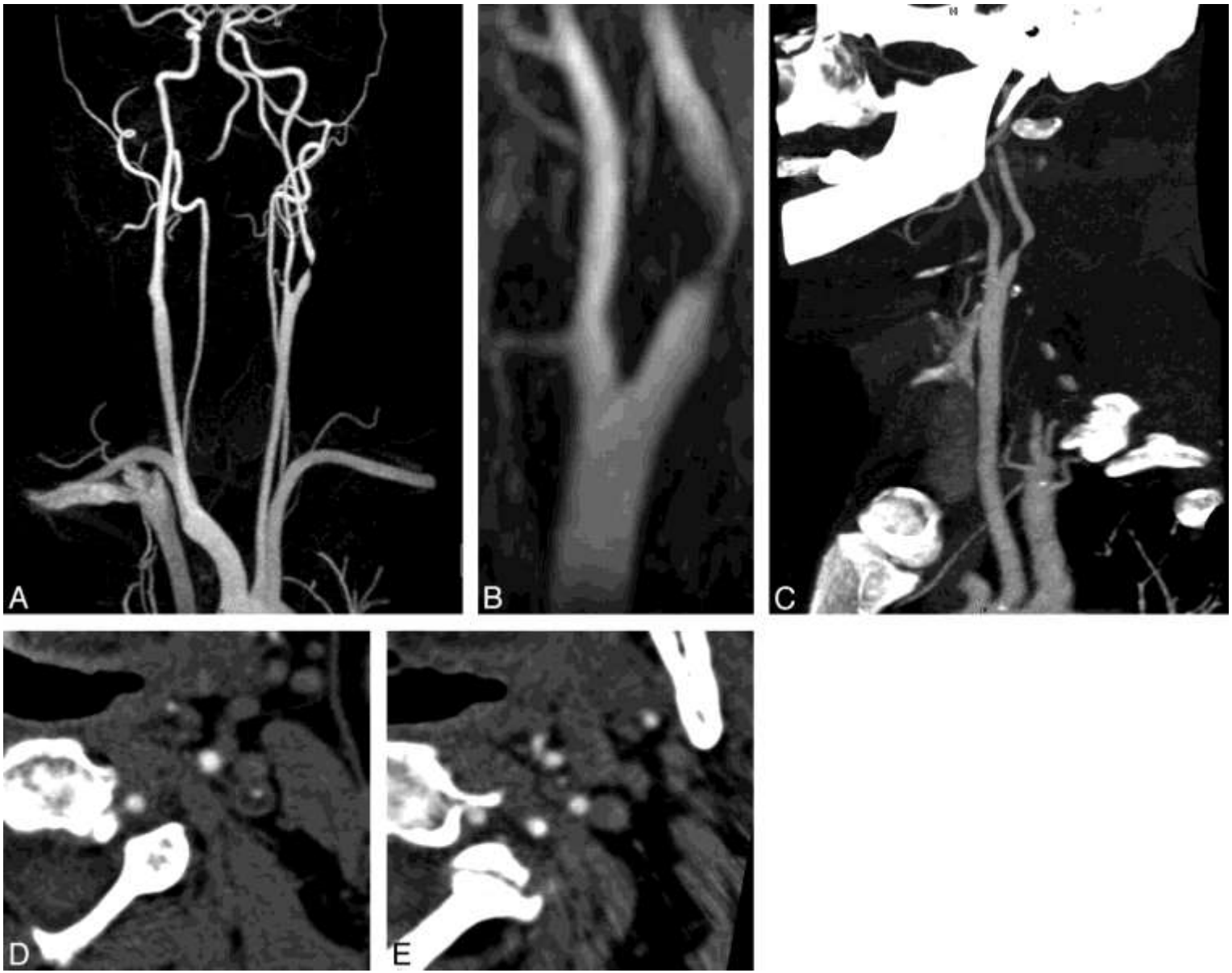

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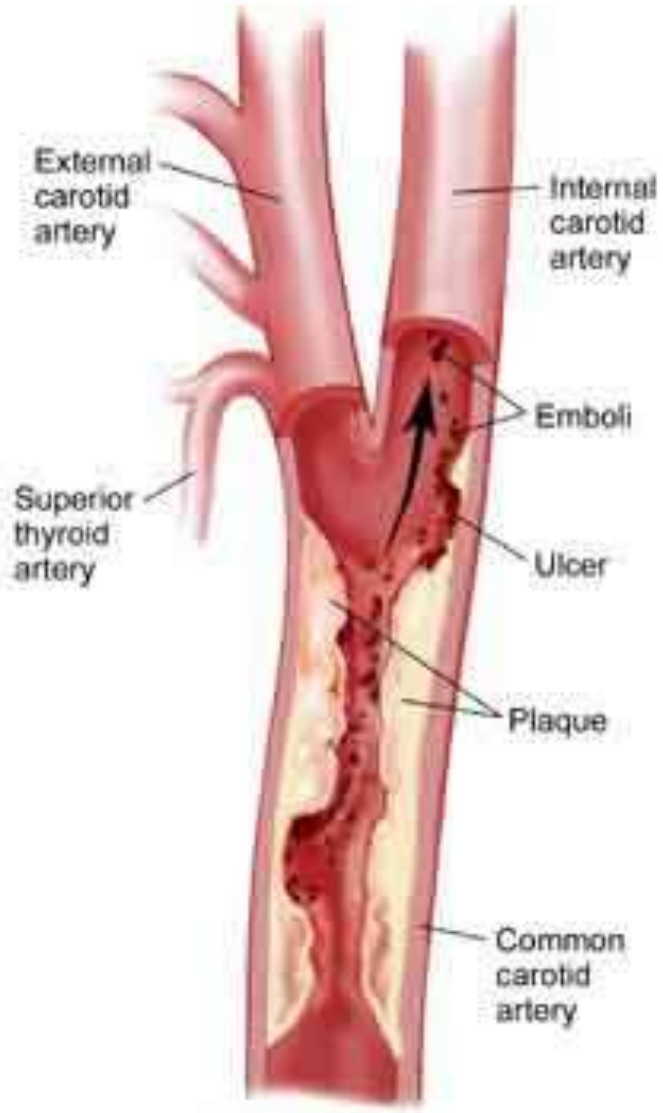
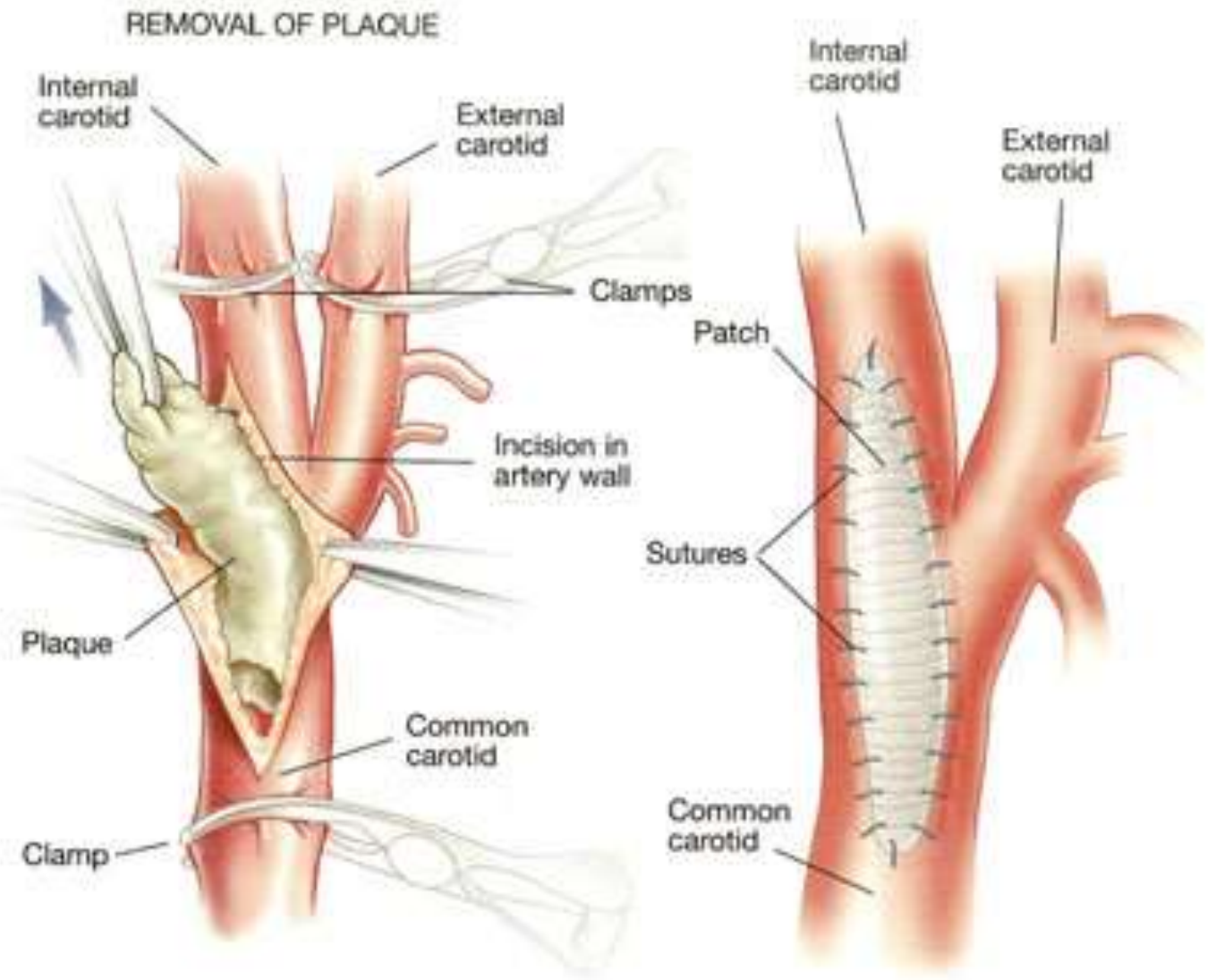


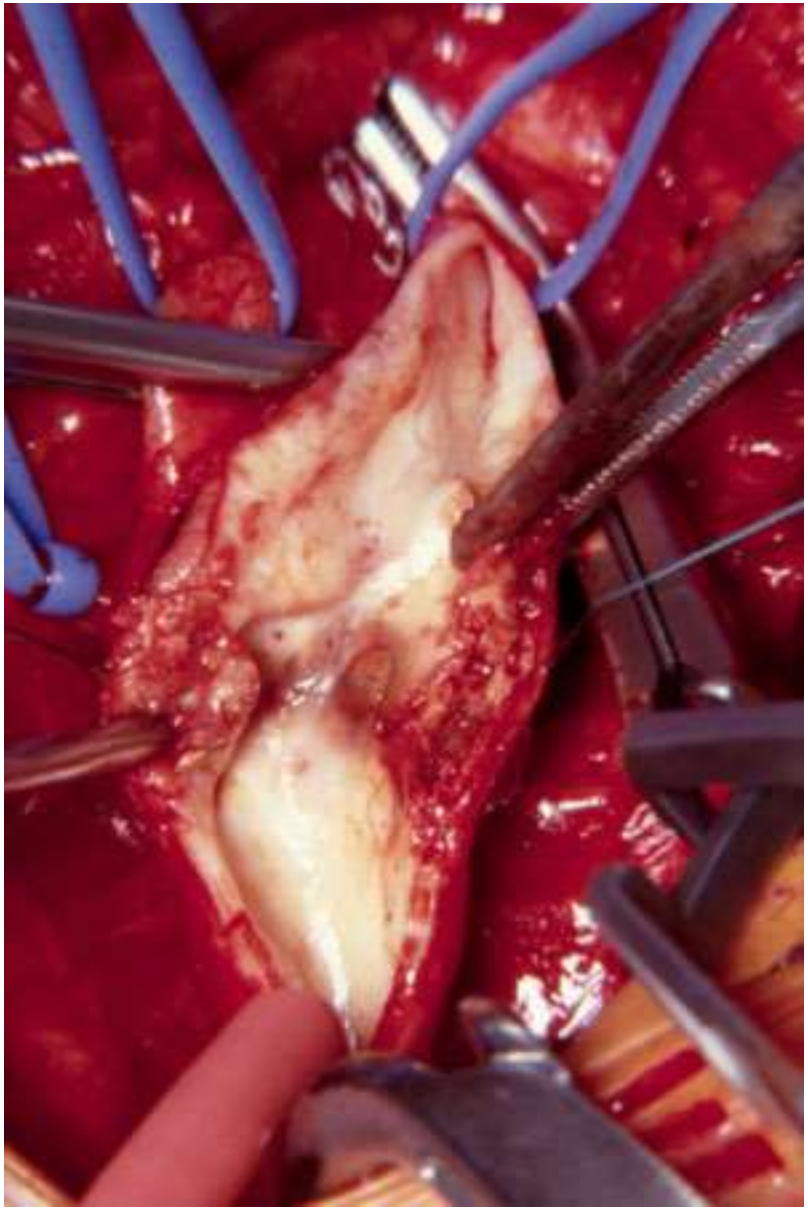
CAROTID DISEASE

VASCULAR HEALTH CLINICS



CAROTID DISEASE

VASCULAR HEALTH
CLINICS



RANDOMIZED CEA TRIALS

VASCULAR HEALTH CLINICS

Symptomatic disease

- NASCET 1991, 1998
- VAST 1991
- ECST 1991

Asymptomatic

- VAAT 1993
- ACAS 1995
- ACST 1995

NORTH AMERICAN SYMPTOMATIC CAROTID ENDARTERECTOMY TRIAL (NASCET)

VASCULAR HEALTH CLINICS

- 50 centers in US and Canada
- Stratified patients into 30-69% and 70-99% stenosis

Eligibility:

- TIAs or minor strokes within 3 mo. of entry into study

NASCET: 70-99% 2-YEAR RESULTS

VASCULAR HEALTH CLINICS

	Medical Rx Alone	Surgical Rx (+BMM)	P Value
Ipsilateral stroke	61/331 (26%*)	26/328 (9%*)	<0.001
Any stroke	64/331 (27.6%*)	34/328 (12.6%*)	<0.001
Any stroke or death	73/331 (32.3%*)	41/328 (15.8%*)	<0.001

* Kaplan-Meier Estimate

NASCET: 50-69% 2-YEAR RESULTS

VASCULAR HEALTH CLINICS

	Medical Rx Alone	Surgical Rx (+BMM)	P Value
Ipsilateral stroke	80/428 (22.2%*)	57/430 (15.7%*)	0.045
Any stroke	113/428 (32.3%*)	85/430 (23.9%*)	0.026
Any stroke or death	156/428 (43.3%*)	120/430 (33.2%*)	0.005

* Kaplan-Meier Estimate

NASCET: <50% 2-YEAR RESULTS

VASCULAR HEALTH CLINICS

	Medical Rx Alone	Surgical Rx (+BMM)	P Value
Ipsilateral stroke	110/690 (18.7%*)	89/678 (14.9%*)	0.16
Any stroke	151/690 (26.2%*)	148/678 (25.7%*)	0.88
Any stroke or death	209/690 (37.0%*)	208(678) (36.2%*)	0.97

* Kaplan-Meier Estimate

EUROPEAN CAROTID SURGERY TRIAL (ECST)

VASCULAR HEALTH CLINICS

- 10 yr period, 2518 patients with CVAs, TIAs or retinal infarctions were randomized to medical vs. surgical + BMM treatment with 3 yrs. follow up
- 80 medical centers in 14 countries
- Medical treatment left up to discretion of physician
- 6mo interval of qualifying event (vs 3mo in NASCET)

ECST: >70% 2-YEAR RESULTS

VASCULAR HEALTH CLINICS

	Medical Rx Alone	Surgical Rx (+BMM)	P Value
Ipsilateral stroke	16.8%	2.8%	<0.0001
Disabling or fatal stroke	11%	6%	<0.05
Any stroke or death	21.9%	12.3%	<0.01

ASYMPTOMATIC CAROTID ATHEROSCLEROSIS TRIAL (ACAS)

VASCULAR HEALTH CLINICS

- 1662 men and women with asymptomatic ≥ 60% stenosis were randomized to best medical therapy vs. surgery plus BMM

NASCET: >60% 3-YEAR RESULTS

VASCULAR HEALTH CLINICS

	Medical Rx Alone	Surgical Rx (+BMM)	P Value
Ipsilateral stroke (+perioperative death/stroke)	92/834 (11%*)	42/825 (5.1%*)	0.006
Any stroke or death	266/834 (31.9%*)	211/825 (25.6%*)	0.08

CAROTID STENTING: CURRENT INDICATIONS

VASCULAR HEALTH CLINICS

- Early recurrent stenosis
- Hostile neck (radiation, radical neck dissection, tracheostomy, infection)
- Surgically inaccessible lesion
- Fibromuscular dysplasia
- High medical risk (hard to define)
- In setting of approved RCT (Not covered by CMS for asymptomatic disease)

SYMPTOMATIC CAROTID PATIENTS

VASCULAR HEALTH CLINICS

- Stenosis ≥50%
  - CEA + BMM
- Stenosis ≥50% and high perioperative risk
  - CAS (as potential alternative)
- Stenosis <50%
  - BMM
- CEA within 2 weeks of symptoms

ASYMPTOMATIC CAROTID PATIENTS

VASCULAR HEALTH CLINICS

- Stenosis ≥ 60% and low risk
  - CEA + BMM
- Stenosis < 60%
  - BMM
- Stenosis ≥ 80% and high anatomic risk for CEA
  - CAS (exceptions)

THANK YOU