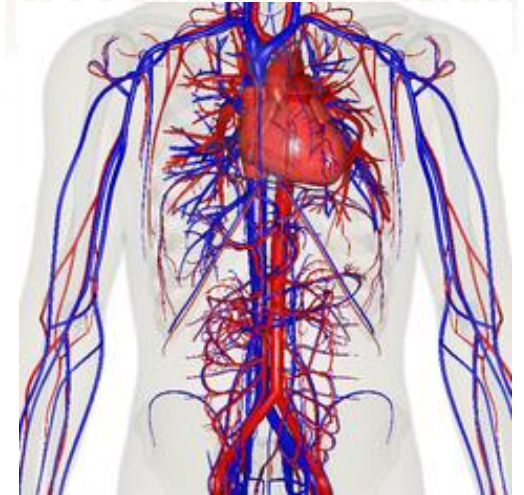


TRAILBLAZER ADVENTURER
INNOVATOR DEFENDER CHALLENGER
ADVENTURER TRAILBLAZER DEFENDER VISIONARY
VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY

Peripheral Vascular Disease

Greg Harding M.D.
Vascular Surgeon



Health Sciences Centre
Winnipeg



UNIVERSITY
OF MANITOBA

Faculty/Presenter Disclosure

- **Faculty:** **Greg Harding M.D.**
- **Relationships with commercial interests:**
 - **None**



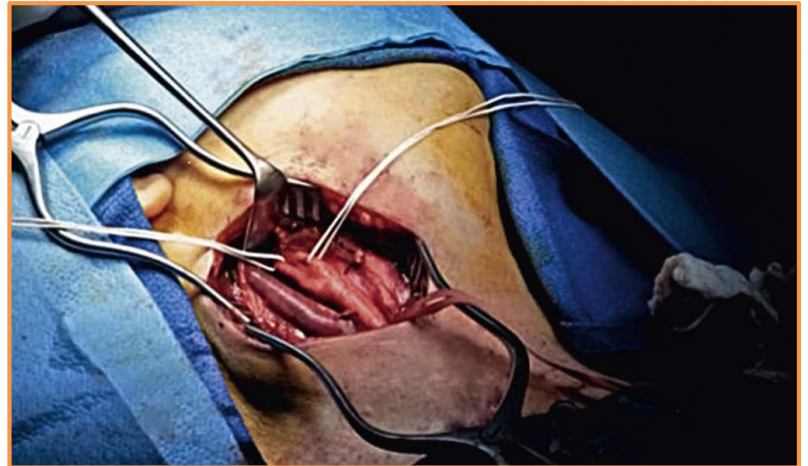
Topics

- Carotid Stenosis
- Chronic Critical Limb Ischemia
- Abdominal Aortic Aneurysm Screening



TRAILBLAZER ADVENTURER
INNOVATOR DEFENDER CHALLENGER
ADVENTURER TRAILBLAZER DEFENDER VISIONARY
VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY

Carotid Stenosis



Health Sciences Centre
Winnipeg



UNIVERSITY
OF MANITOBA

Objectives

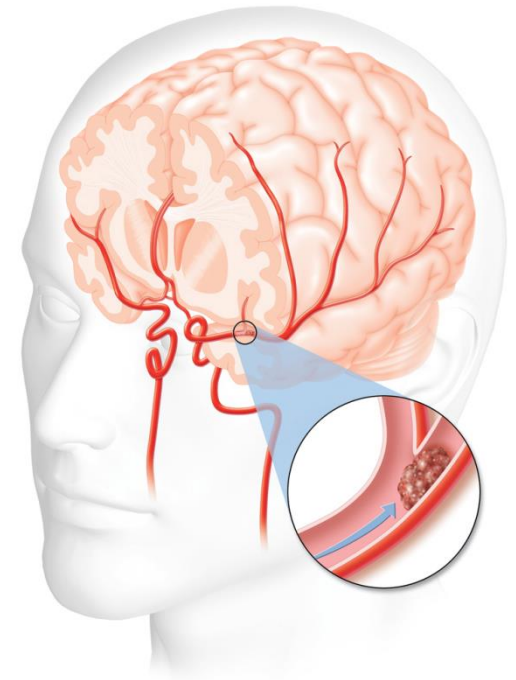
Carotid Stenosis

- Screening in Symptomatic and Asymptomatic Disease
- Timing of Screening in Symptomatic disease
- Benefits for early carotid endarterectomy
- Surgery for Asymptomatic Disease



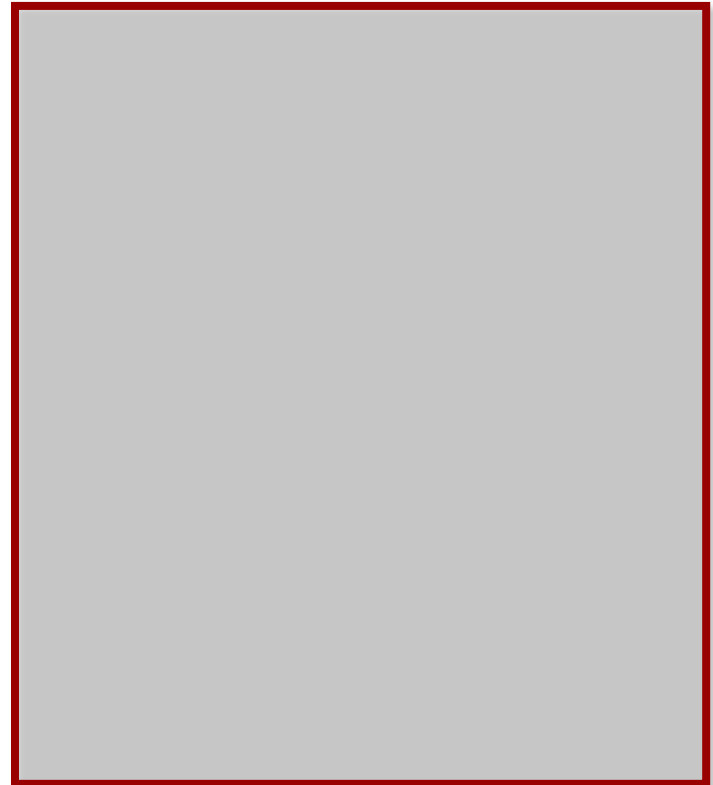
Stroke and Cerebrovascular Disease

- Third Leading Cause of Death in North America
- 170,000 North Americans die of stroke each year
- 800,000 North Americans have a stroke each year



Cerebrovascular disease Risk Factors

- Age
- Gender
- Hypertension
- Diabetes
- Smoking
- Elevated Cholesterol



Stroke and TIA Defined

- **Stroke:** sudden focal neurological deficit of vascular origin lasting >24 hours, or brain infarction or hemorrhage detected by CT or MRI
- **TIA:** sudden focal neurological deficit of vascular origin lasting <24 hours



Causes of Stroke

- Ischemic (85%)
 - Thrombosis (atheromatous plaque rupture and thrombus formation)
 - Embolism (from carotid stenosis or from the heart (a fib, recent MI))
 - Lacunar stroke (idiopathic occlusion of a small artery, results in pure motor or sensory symptoms)

 - Hemorrhagic (15%)
 - Subarachnoid (e.g. ruptured cerebral aneurysm)
 - Intracranial hemorrhage
-



Causes of Stroke

Carotid Atherosclerosis (15% of strokes)

– **Major preventable cause of stroke**

- Risk factor modification
- Carotid Endarterectomy



Presentation of TIA/Stroke

- Vision changes (hemianopia)
- Difficulty speaking (aphasia or dysarthria)
- Unilateral weakness and/or numbness
- Amaurosis Fugax



Transient Ischemic Attack: Risk Factor for Stroke

- 1700 patients presented to emergency department with a TIA
 - 10 % had a **STROKE** within 90 days
 - **5% had a STROKE in the first 48hrs**



- **Importance of prompt investigation and imaging**

Urgent Carotid Imaging

- **Identify significant carotid stenosis (>70%)**
 - Identify candidates for Carotid Endarterectomy



Ultrasound

- **Excellent first line imaging modality to identify patients with a 70-99% Carotid stenosis**
- Low cost
- High number of strokes prevented
- Pretty easy to get
- Excellent Specificity and Sensitivity



CT Angiogram

- Excellent test
- Very fast
- A little harder to get rapidly unless in emergency department
- Visualize intracranial, Aortic arch anatomy and brain
- Good for planning surgery
- Requires Contrast and radiation
- Calcium can be problematic



CTA Angiogram



Contrast Enhanced MR Angiogram

- Excellent test
- High resolution imaging from Arch to intracerebral vessels
- Not always readily accessible
- May overcall stenosis
- Difficulty when evaluating tightly stenotic or occluded vessels



Results:

Identify >70% Stenosis

	Sensitivity	Specificity
Ultrasound	85-92%	77-99%
CTA	68-95%	91-97%
MRA (contrast)	88-96%	89-96%



All Good Tests!

Luca Saba, Michele Anzidei, Roberto Sanfilippo, Roberto Montisci, Pierleone Lucatelli, Carlo Catalano, Roberto Passariello, Giorgio Mallarini, Imaging of the carotid artery, **Atherosclerosis, Volume 220, Issue 2, February 2012, Pages 294-309**



UNIVERSITY
OF MANITOBA

Ischemic Stroke Prevention

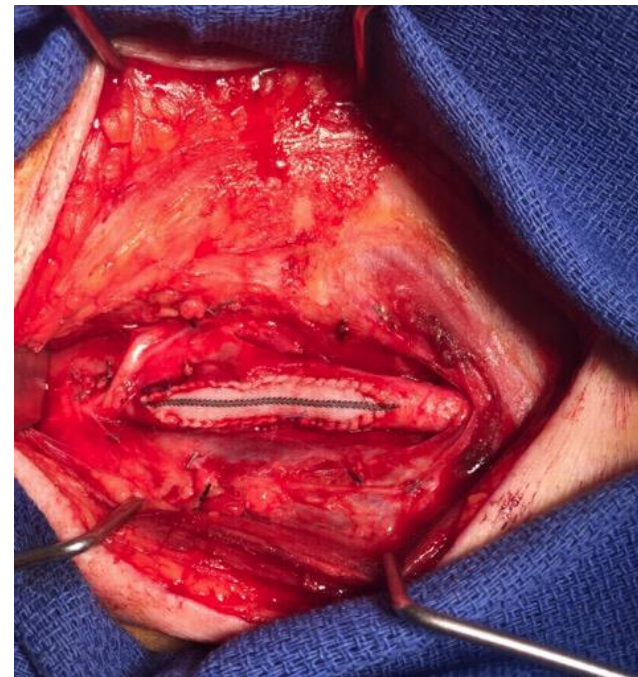
Carotid stenosis:

- Cardiovascular risk factor management
 - ASA or Clopidogrel
 - (no real benefit for the addition of Clopidogrel to ASA)
 - Statin
 - BP Control



Ischemic Stroke Prevention

- **Vascular Surgery Referral for Carotid Endarterectomy if $>70\%$ stenosis**
- **We will see right away!**



Carotid Endarterectomy
and Patch Angioplasty



Timing of Carotid Endarterectomy

TIA <48hrs ago:

- Urgent Carotid endarterectomy
- TIA or SROKE with good recovery **48hrs to 30 Days**
 - Carotid endarterectomy soon as possible
 - Guidelines: within 2 weeks acceptable
- TIA/stroke **after one month-**
 - Elective Carotid Endarterectomy



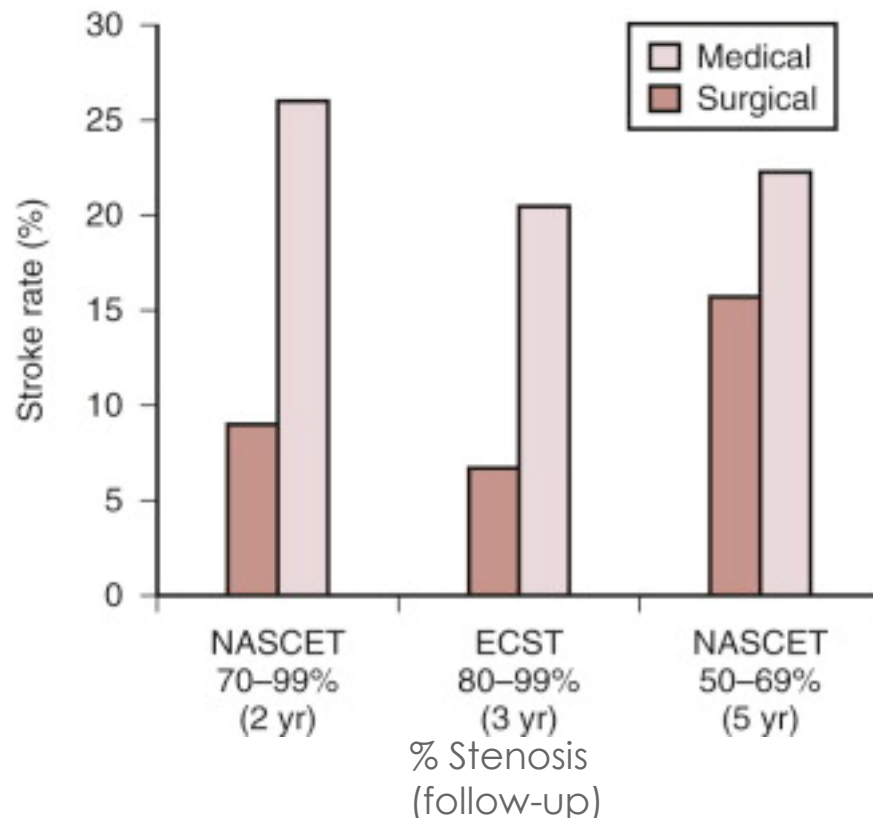
The Evidence: Carotid Endarterectomy for Stroke Prevention



The Evidence:

Symptomatic Carotid Stenosis: 70-99%

- Significant benefit for Endarterectomy+ medical Tx vs. Medical Tx alone
- **Two Year Risk of Stroke:**
 - Medical: 26%
 - Endarterectomy: 9%
- **Two Year Absolute Risk reduction: 17%**



Asymptomatic Carotid Stenosis Screening



Asymptomatic Carotid Stenosis Ultrasound Screening

- Prevalence of a $>70\%$ Carotid stenosis in the general population is 0.5-1%
- Bruit
 - Prevalence of carotid stenosis $>75\%$ only 1.2% (1)
- Dizziness
 - In isolation not a Carotid Symptom
- Neck Pain
- **Screening of the General Population not recommended (2)**

1. Zhu CZ, Norris JW. Role of carotid stenosis in ischemic stroke. Stroke 1990;21:1131-4.

2. Perry JR, Szalai JP, Norris JW. Consensus against both endarterectomy and routine screening for asymptomatic carotid artery stenosis. Canadian Stroke Consortium. Arch Neurol 1997;54:25-8.



UNIVERSITY
OF MANITOBA

Asymptomatic Carotid Stenosis High Risk Groups

- Can consider Ultrasound screening
 - Patients with clinically significant peripheral vascular disease (not AAA)
 - Patients over the age of 65 years with one or more risk factors
 - CAD
 - Smoking
 - Hypercholesterolemia
 - 1st degree relative with stroke
 - Hypertension
 - The more risk factors the higher the probability of stroke
- **Benefit for Carotid Endarterectomy in the asymptomatic setting is small**
 - **May be best to manage medically**

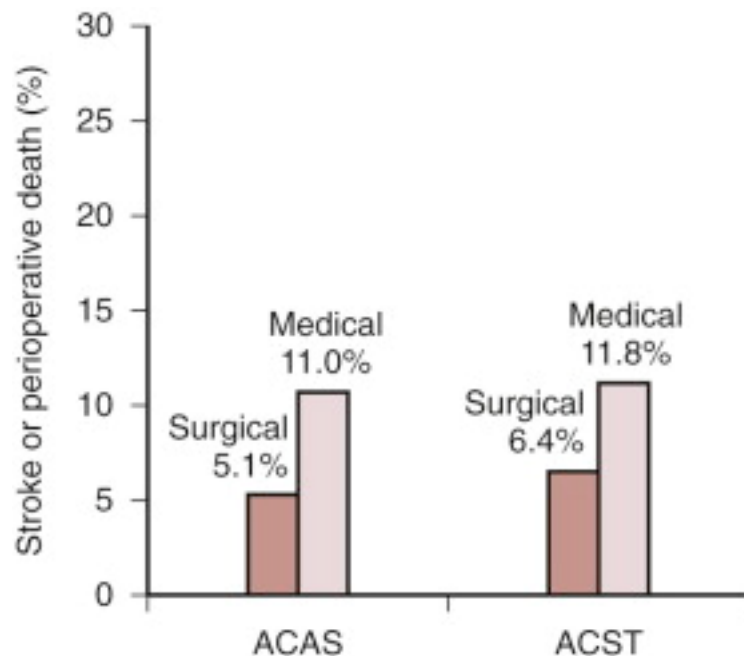
Qureshi AI, Janardhan V, Bennett SE, Luft AR, Hopkins LN, Guter-
man LR. Who should be screened for asymptomatic carotid artery
stenosis? Experience from the Western New York stroke screening
program. J Neuroimaging 2001;11:105-11.



The Evidence: Asymptomatic Carotid Stenosis (60-99%)

- Significant benefit for endarterectomy
- One year stroke risk:
 - Medical 2%
 - Endarterectomy 1%
- **Absolute benefit only 1%/year**
- **2% perioperative risk of stroke**
- **Often observe Asymptomatic patients**
 - Especially if elderly

5 year Stroke Risk



Summary: Carotid Stenosis

- Ultrasound very good screening Test for Carotid stenosis
- TIA requires rapid evaluation with Ultrasound to identify patients with a $>70\%$ carotid stenosis
- 10% of patients with TIA will have a stroke in 90 days
- Screening the general population for carotid disease not recommended
- Consider screening in certain High Risk groups based on their willingness to undergo intervention, age, life expectancy
- Benefit for Carotid Endarterectomy in Asymptomatic disease is very small



TRAILBLAZER ADVENTURER
INNOVATOR DEFENDER CHALLENGER
ADVENTURER TRAILBLAZER DEFENDER VISIONARY
VISIONARY ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY

Chronic Critical Limb Ischemia



Health Sciences Centre
Winnipeg



UNIVERSITY
OF MANITOBA

Objectives

Chronic Critical Limb Ischemia (CLI)

- Identify the three components of CLI
- Recognize the importance of rapid investigation and intervention
- Natural History of Patients with CLI



Critical Limb Ischemia

1. Ischemic Rest Pain

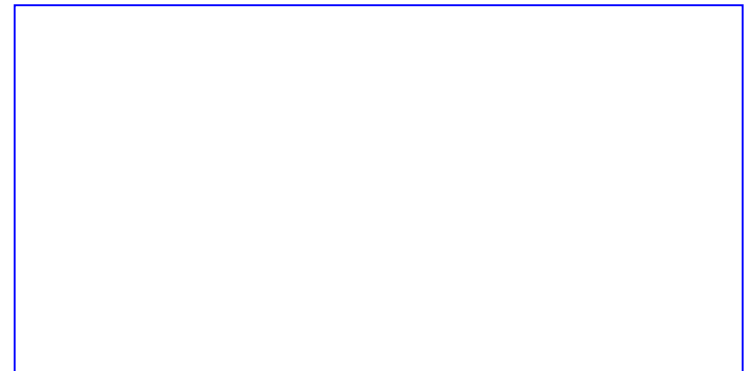
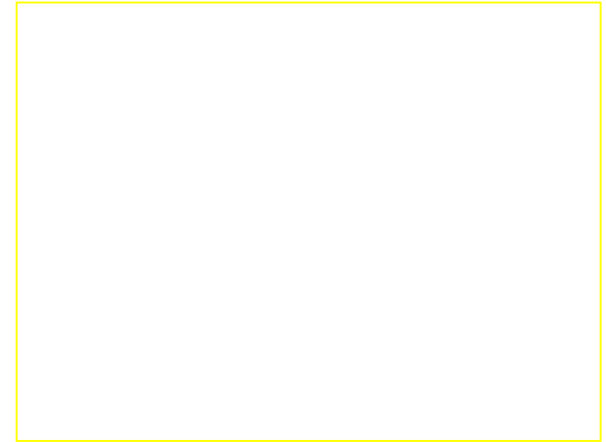
- Ache, pain, numbness of foot/Toes
- Most uncomfortable at night while lying in bed
- Interferes with sleep
- Relief with dependent position of limb
- Ischemic Rubor



Critical Limb Ischemia

2. Ischemic ulceration

- Found distally at ends of toes or over bony prominences on feet
- Dry, devitalized, black
- Often painful
- No distal pulses



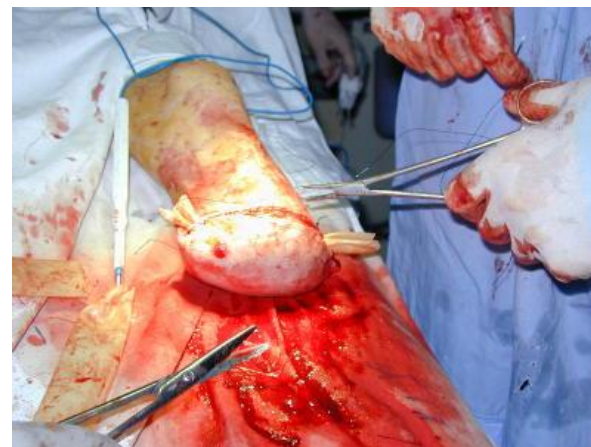
Critical limb Ischemia

3. Gangrene



Critical Limb Ischemia

- Without intervention (1 year):
 - Rest Pain:
 - 50% lose their limb
 - Gangrene
 - 80% lose their limb
- **Referral to Vascular Surgery**
 - (I try to see within one week)



Physical Exam

- Examination of the leg and feet
 - Rubor, Ulcer, Gangrene
- Lack of Hair
- Lack of pulses
- Pallor on elevation and rubor on dependency

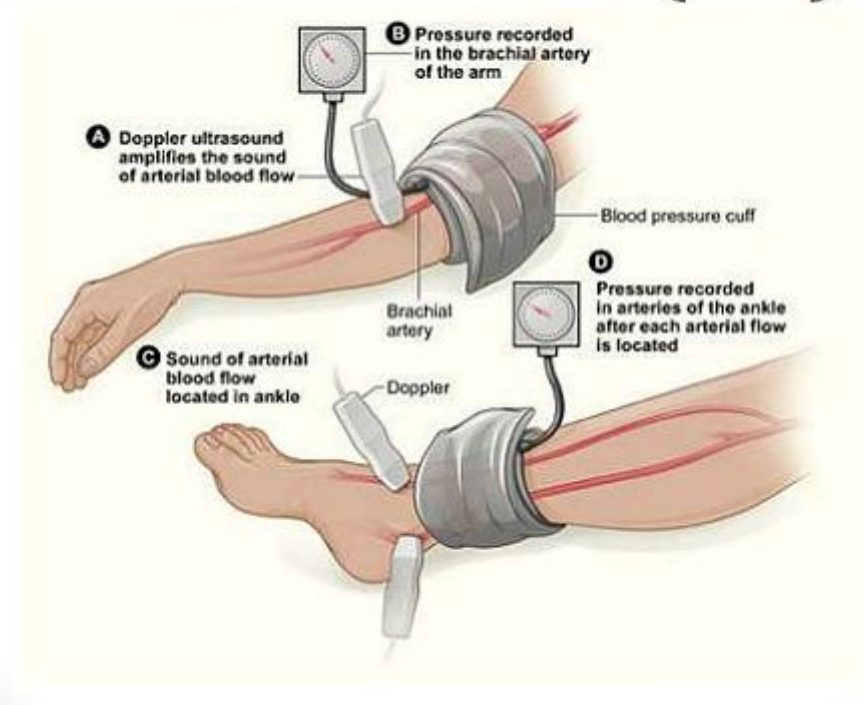


Investigations

If not sure:

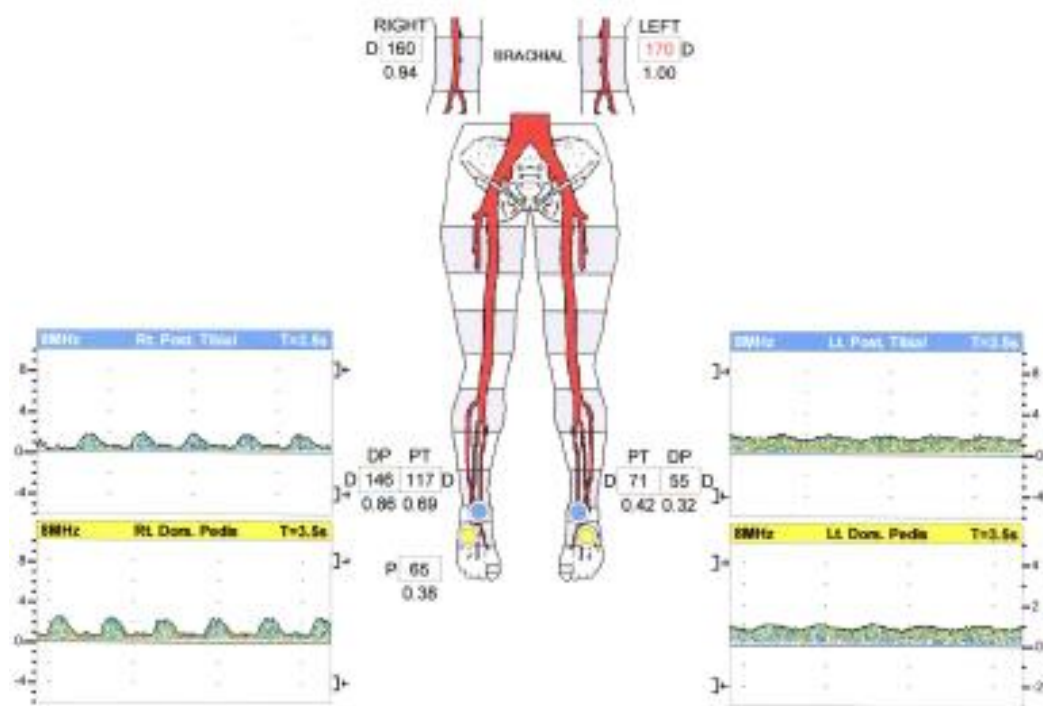
- **Ankle Brachial Index**
 - Office
 - Community Nursing
 - Vascular Lab (HSC and Grace)

Ankle Brachial Index (ABI)



Investigations

- **Does not make the diagnosis**
 - Clinical picture
- **ABI <0.5**
 - Ankle pressure <60mmHg
- **Absolute toe pressure to Heal**
 - Diabetic: <60mmHg
 - PVD: <30mmHg
- **Anyone with ABI <0.9 is high risk for cardiovascular mortality**



Notes

The pressures measured at ankle level indicate minimal obstruction in the right limb + severe obstruction in the left limb. The pressures measured in RT1 indicate good distal perfusion. Unable to attain pressures on LT1.



Investigations



Conventional Angiogram

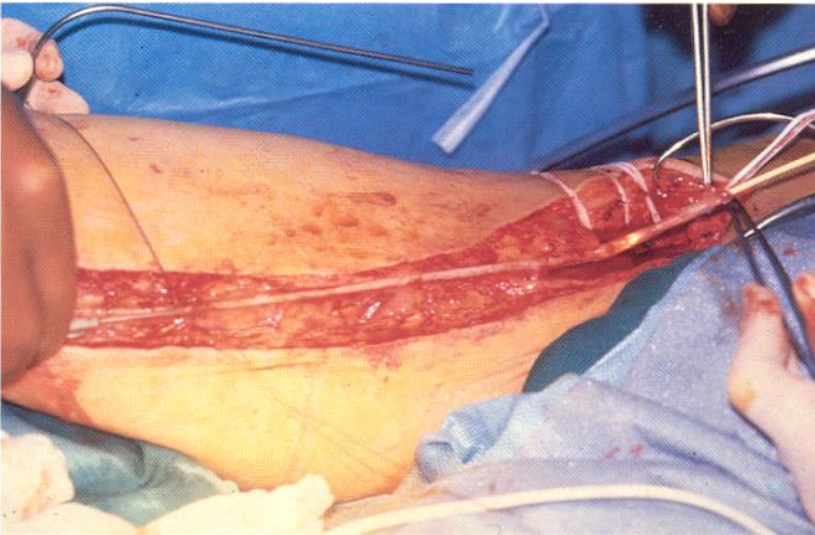


CT Angiogram



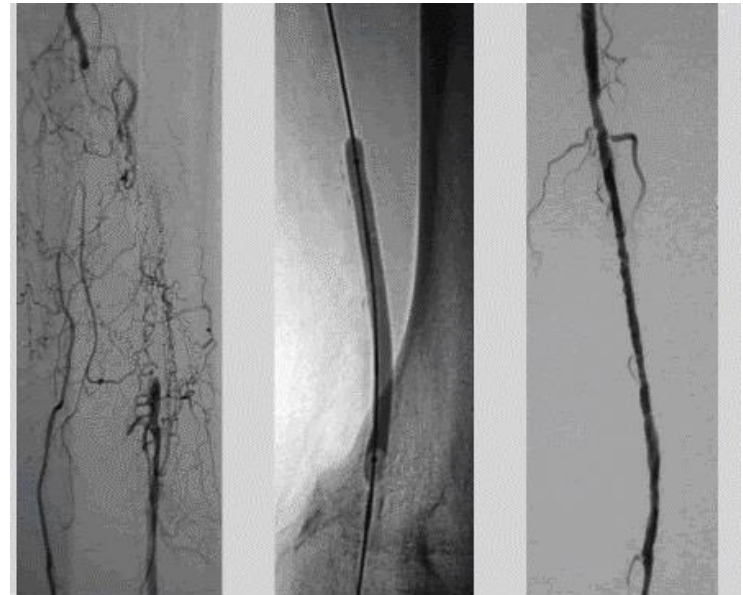
Intervention

Bypass Surgery



- Graft Patency is 70% at 5 years
- Limb salvage is 80% at 5 years

Angioplasty



- Angioplasty patency 50% at 1 year

Albers M, et al.: Meta-analysis of alternate autologous vein bypass grafts to infrapopliteal arteries. J Vasc Surg.

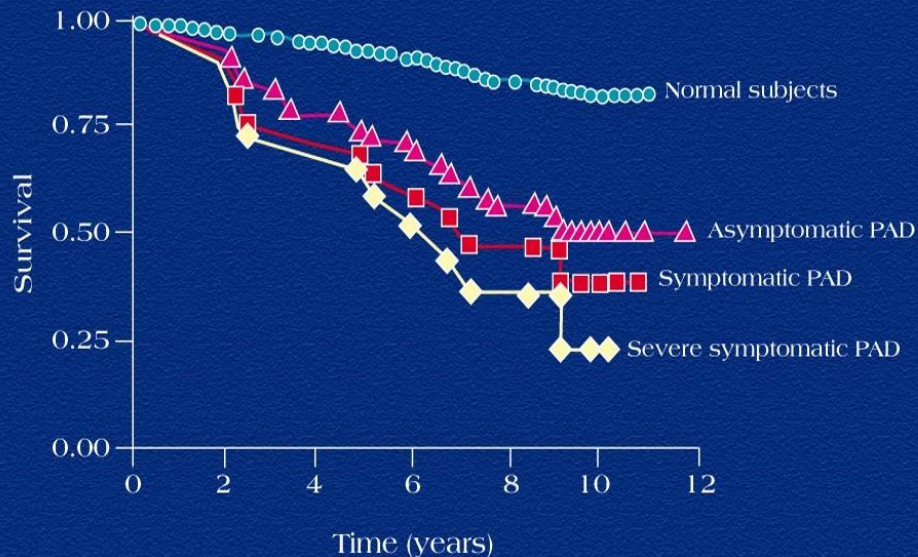
Romiti M, et al.: Meta-analysis of infrapopliteal angioplasty for chronic critical limb ischemia. J Vasc Surg. 47:975-981 2008



UNIVERSITY
OF MANITOBA

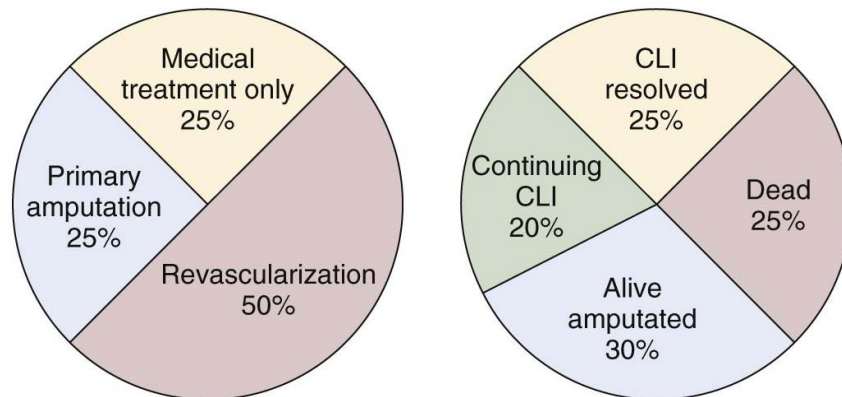
Critical Limb Ischemia is a Marker for Mortality

PAD: Marker for Mortality



Criqui MH et al. *N Engl J Med* 1992;326:381-386.

Primary treatment → A year later



Norgren L, et al: TASC II Working Group, Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). J Vasc Surg 45:S11, 2007.



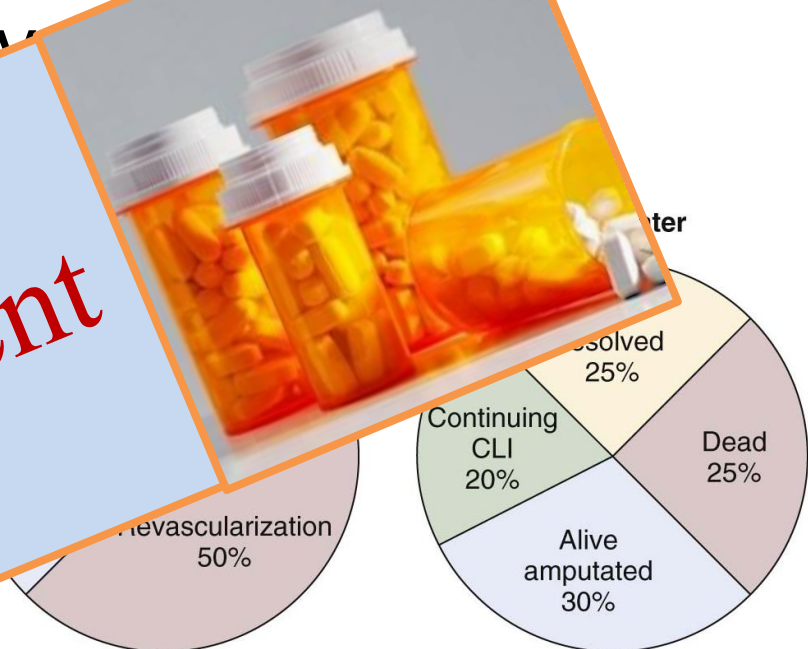
Critical Limb Ischemia is a Major Cause of Mortality

PAD: Marker for Mortality



Aggressive Risk Factor Management Required

Criqui MH et al. *N Engl J Med* 1992;326:381-386.



Norgren L, et al: TASC II Working Group, Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). J Vasc Surg 45:S11, 2007.)



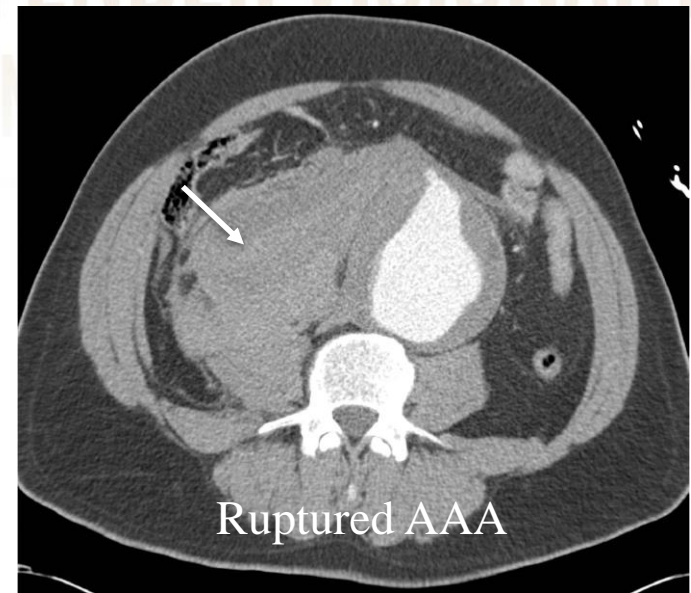
Summary: Critical Limb Ischemia

- Three features
 - Rest Pain
 - Ulcer
 - Gangrene
- Risk of Limb loss is high
 - Urgent investigation and referral
- Marker for cardiovascular mortality
 - Aggressive Risk factor Management



TRAILBLAZER ADVENTURER
INNOVATOR DEFENDER CHALLENGER
ADVENTURER TRAILBLAZER DEFENDER VISIONARY

Abdominal Aortic Aneurysm Screening



Health Sciences Centre
Winnipeg



UNIVERSITY
OF MANITOBA

Objectives

Abdominal Aortic Aneurysm (AAA) Screening

- Risk of rupture
- Who is at risk for AAA
- Who Benefits from Screening
- How to Screen
- How to follow once AAA Identified
- When to Refer



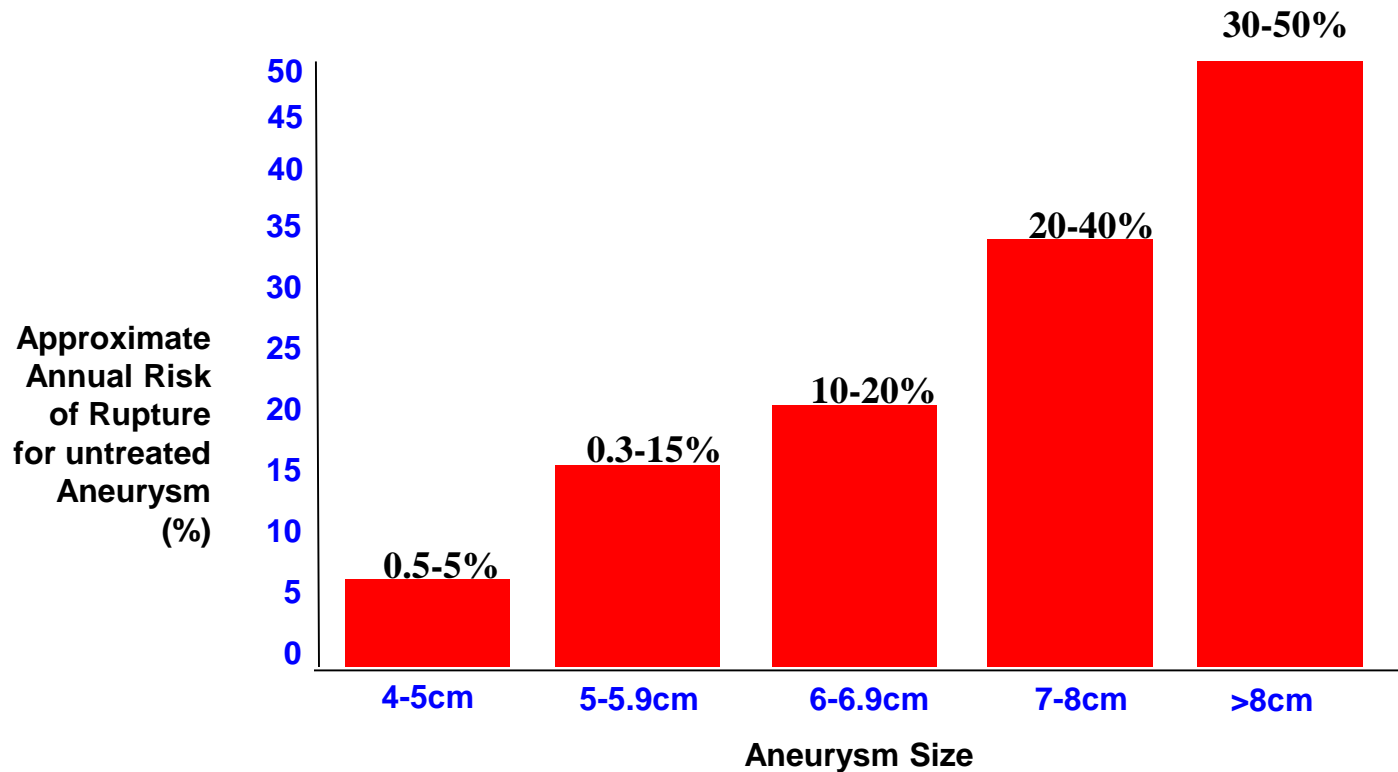
Why you have a role in preventing Abdominal Aortic Aneurysm (AAA) rupture

- You are the first to see the patient
- Survival Benefit for screening
- Good Treatment Available



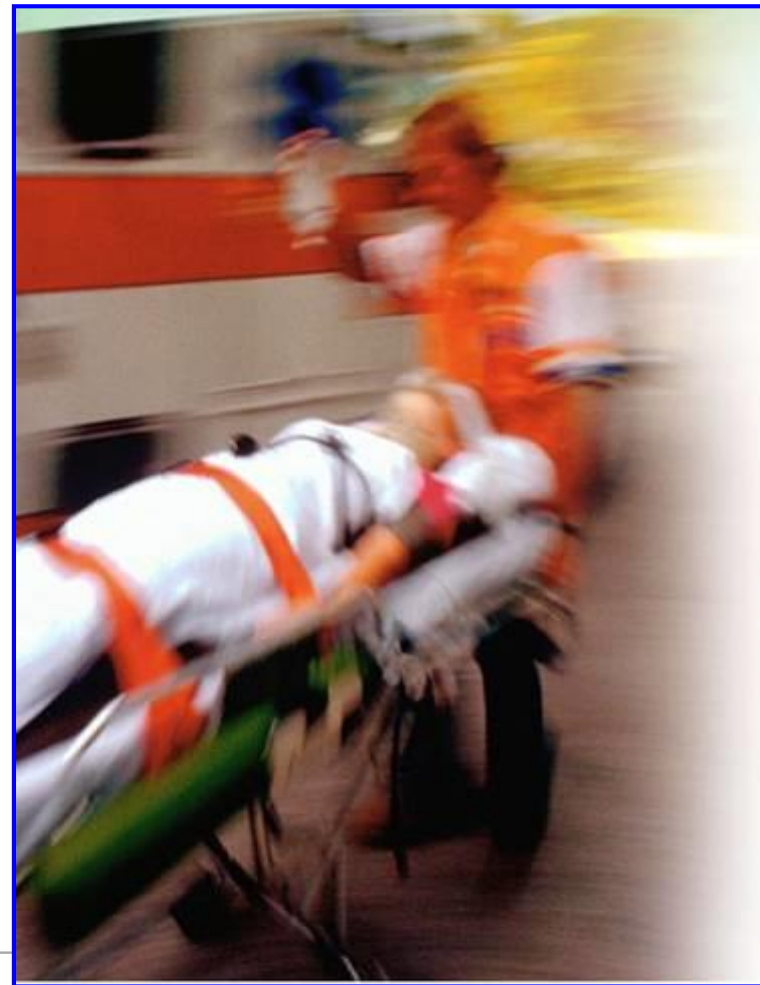
Annual AAA Rupture Risk

When the aneurysm diameter reaches 5.5cm (5cm in a female), the risk of rupture is higher than the operative risk.



Ruptured AAAs are fatal in 80% of cases

- Mortality is high due to rapid circulatory collapse.
- Less than 50% of emergency cases arrive in the ER alive
- 50% who arrive in ER alive survive conventional AAA repair.



Who are the patients at risk?

Independent Risk factors for detecting
an Unknown 4cm or larger AAA
during Ultrasound Screening

Male

65 years or older

Smoking history

Hypertension

High Cholesterol

COPD

Ischemic Heart
disease

Male or
Female

55 years or
older

with

Family history
of AAA

The Usual Suspects



UNIVERSITY
OF MANITOBA

ADVENTURER TRAILBLAZER CHALLENGER DEFENDER VISIONARY INNOVATOR
TRAILBLAZER CHALLENGER DEFENDER VISIONARY INNOVATOR EXPLORER TRAILBLAZER CHALLENGER DEFENDER VISIONARY INNOVATOR EXPLORER



UNIVERSITY
OF MANITOBA

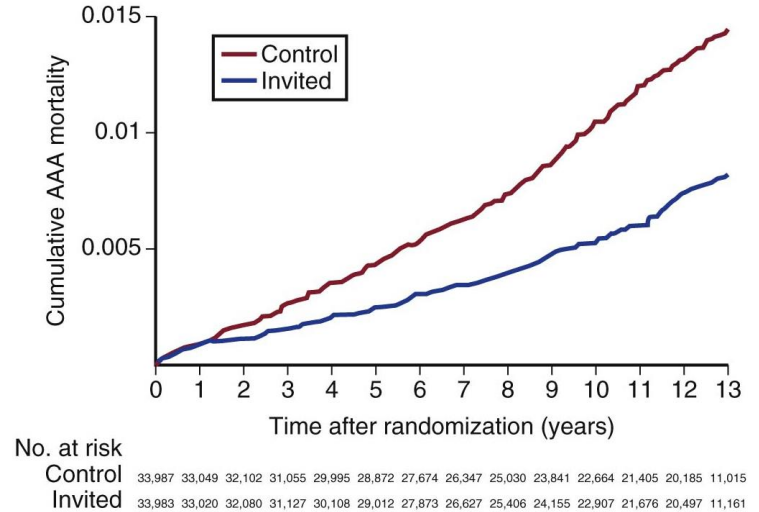
How can you Screen an AAA? Ultrasound

- **Ultrasound** scan has proven to be the most reliable and cost-effective way to Screen for Abdominal Aortic Aneurysms
- Sensitive test for all AAA sizes
- Painless and non-invasive
- It is cost-effective



The Evidence (for Men)

- Four Randomized trials
- 127,891 men between the ages of **65 and 79** years of age
- Ultrasound effective in reducing AAA mortality
- **4% reduction in all cause Mortality**
 - 3-5 years (RR 44%)
 - 7 to 15 years (RR 53%)
- Number needed to screen to save one life
 - 350-700



From Thompson SG, et al: On behalf of the Multicentre Aneurysm Screening Study (MASS) Group: Final follow-up of the Multicentre Aneurysm Screening Study (MASS) randomized trial of abdominal aortic aneurysm screening. Br J Surg 99:1649-1656, 2012.)

• Fewer than screening for Breast Cancer and Colon Cancer



The Evidence (for Women)

- Not as well studied in randomized trials
- No Benefit for screening average risk women
- Perhaps benefit for women (65-75)
 - Smokers
 - Cerebrovascular disease
 - Ischemic Heart disease
 - Family History



Table 3: National and international guidelines on screening for abdominal aortic aneurysm

Organization	Recommendations
Canadian Task Force on Preventive Health Care (current guideline, 2017)	<p>The task force has three recommendations on screening for AAA:</p> <ul style="list-style-type: none"> • We recommend one-time screening with ultrasonography for AAA for men aged 65 to 80 years (weak recommendation; moderate quality of evidence). • We recommend not screening men older than 80 years for AAA (weak recommendation; low quality of evidence). • We recommend not screening women for AAA (strong recommendation; very low quality of evidence).
Canadian Task Force on Preventive Health Care (1991) ⁵⁴	In 1991, the task force concluded that the evidence on screening for AAA was insufficient to recommend for or against screening.
Canadian Society for Vascular Surgery (2008) ⁵⁸	<p>The Canadian Society for Vascular Surgery recommends that national and provincial ministries of health develop a comprehensive population-based ultrasonography screening program for AAA detection and referral. This is an unrated recommendation.</p> <p>They further propose that all men aged 65 to 75 years be screened with ultrasonography for an AAA, with additional selective screening for those at high risk for AAA, including women older than 65 years at high risk owing to smoking, cardiovascular disease and family history; and men younger than 65 years with a family history of AAA. This is an unrated recommendation.</p>
US Prevention Services Task Force (2014) ⁵⁷	<p>The US Prevention Services Task Force recommends one-time screening for AAA with ultrasonography in men aged 65 to 75 years who have ever smoked. This is a grade B risk-based recommendation. The task force also recommends selectively screening for AAA in men of this age who have never smoked. This is a grade C risk-based recommendation.</p> <p>The task force concludes that current evidence is insufficient to assess the balance of benefits and harms of screening for AAA in women aged 65 to 75 years who have ever smoked. This is a grade I recommendation, meaning no recommendation is made. Finally, they recommend against screening for AAA in women who have never smoked. This is a grade D recommendation, because the harms of screening for AAA in these women may be greater than potential benefits.</p>
American College of Preventive Medicine (2011) ⁵⁹	The American College of Preventive Medicine recommends that men aged 65 to 75 years who have ever smoked should be screened for an AAA, while it recommends against routine screening for women. This is an unrated risk-based recommendation.
American College of Cardiology and American Heart Association (2006) ⁶⁰	The American College of Cardiology and the American Heart Association recommend one-time screening for AAA in men aged 65 to 75 years who have ever smoked (Class I) and for men aged 60 years or older who have a family history of AAA (Class IIa). This is a grade B risk-based recommendation.
European Society for Vascular Surgery (2011) ⁶¹	The European Society for Vascular Surgery recommends that men be screened for AAA at age 65 years. This is a grade A (level 1a) recommendation. Screening should be considered at an earlier age in men at higher risk – for example, those who smoke, have other cardiovascular disease, or have a family history of AAA. This is a grade C (level 4) risk-based recommendation.

Note: AAA = abdominal aortic aneurysm.



Canadian Task Force (2017)

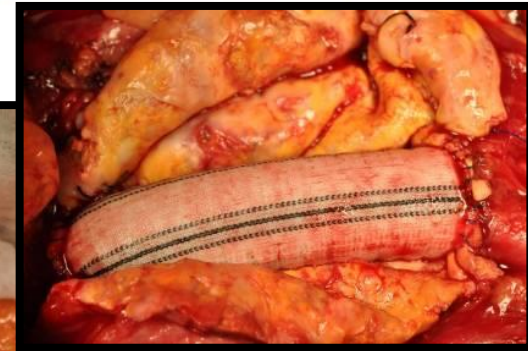
Table 3: National and international guidelines on screening for abdominal aortic aneurysm

Organization	Recommendations
Canadian Task Force on Preventive Health Care (current guideline, 2017)	<p>The task force has three recommendations on screening for AAA:</p> <ul style="list-style-type: none">• We recommend one-time screening with ultrasonography for AAA for men aged 65 to 80 years (weak recommendation; moderate quality of evidence).• We recommend not screening men older than 80 years for AAA (weak recommendation; low quality of evidence).• We recommend not screening women for AAA (strong recommendation; very low quality of evidence).

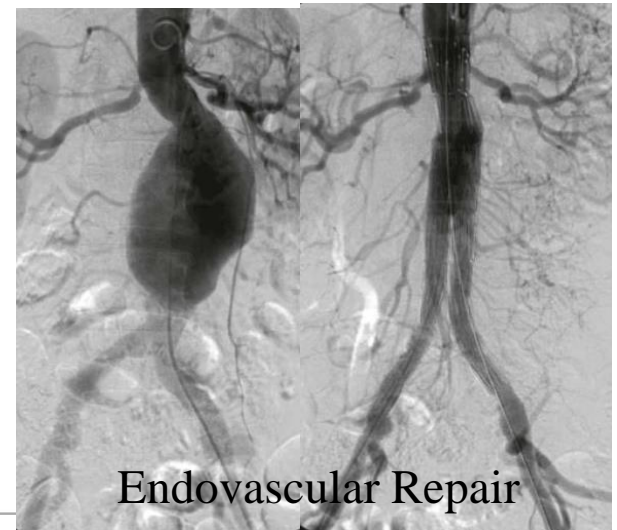


AAA Follow-up

- $<3\text{cm}$ no follow up
- $3\text{cm}-4.5\text{cm}$ repeat ultrasound every year
- $>4.5\text{cm}$ repeat every six months
- Refer to vascular at any time
 - Certainly once reaches $>4.5\text{cm}$
- Repair at 5.5cm in men
- Repair at 5cm in women



Open Repair



Endovascular Repair

Summary: Aortic Aneurysm Screening

- Risk of rupture increases as size increases
 - Repair at 5.5cm in males
 - Repair at 5cm in female
- Men between 65-79 years of age gain most benefit from screening
- No Benefit in average risk Women
 - Maybe for women with other Cardiovascular risk factors
- Can Refer to vascular surgery anytime, but certainly when reaches around 4.5 cm.





Thanks!

Gregory E.J. Harding MD, FRCSC

Vascular Surgeon

Assistant Professor

Undergraduate Program Director; Surgery

University of Manitoba

gharding2@hsc.mb.ca



Health Sciences Centre
Winnipeg



UNIVERSITY
OF MANITOBA