Doctor.021

no. 1

CVS

P.B.L

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-additional information for clarification is underlined.

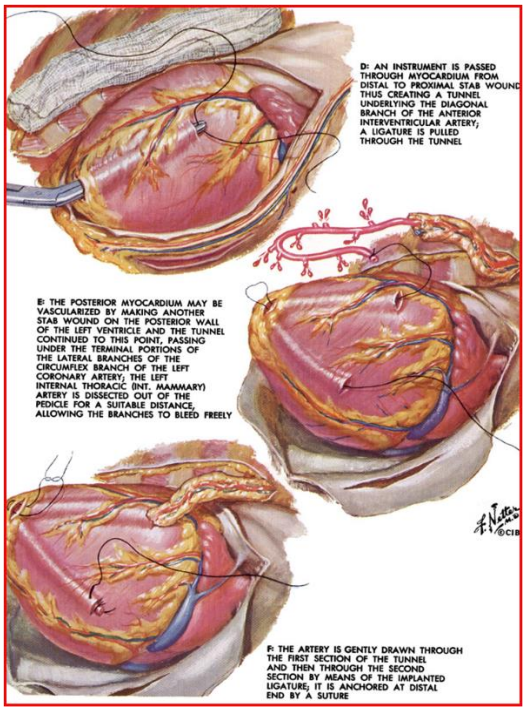
CABG

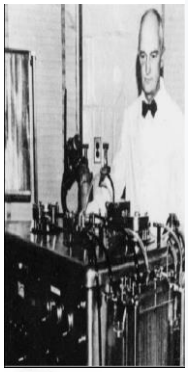
-coronary artery bypass graft pronounced ‘cabbage’.

HISTORY OF CARDIAC SURGERY

-Adult Cardiac Surgery(surgical procedures performed on the heart and great vessels in adults to treat various cardiovascular conditions. These surgeries are often complex and require specialized skills and expertise**): Ischemic Heart Disease** Read only

Alexis Carrel- **The pioneer of cardiac surgery and suturing**	**“In certain cases of angina pectoris, when the mouth of the coronary is calcified, it would be useful to establish a complementary circulation for the lower part of the arteries. I attempted to perform an…anastomosis between the descending aorta and the left coronary. It was, for many reasons, a difficult operation.”** **American Surgical Association, 1910**	This was in 1910 when no tools for good understanding were yet established, so the surgery failed.
Claude Beck	**1930’s- sought to increase myocardial blood flow indirectly with pericardial fat and omentum.**	Beck hypothesized that wrapping pericardial fat and omentum (a fold of peritoneum connecting the stomach with other abdominal organs) around the heart could

		provide a vascular-rich environment that might help improve blood supply to the myocardium. The idea was to encourage the development of collateral circulation, which are alternative pathways for blood to reach the heart muscle in case of arterial blockages.
• **Arthur Vineberg**  	**1940's- Mobilization of left internal mammary artery with implantation of bleeding end into the left ventricle.** **-1964- follow-up study on 140 patients** **33% mortality** **85% relief from angina**	A tunnel in the myocardium is made then the internal mammary artery is buried in to allow new angiogenesis
Mason Sones	**1950's- cine coronary arteriography.** **1962- direct and reproducible *catheterization* of the coronary arteries.**	-This discovery made a breakthrough. It was a milestone

	"Collectively, all of the cardiological advances in this century pale in comparison with this priceless achievement." **Floyd Loop, MD**	that changed all the knowledge on heart diseases and their management. It was the first to prove that we can reach the heart from the peripheral vessels
John H. Gibbon, Jr.   nowadays  old	***During the long night, helplessly watching the patient struggle for life as her blood became darker and her veins more distended, the idea naturally occurred to me that if it were possible to remove some of the blue blood…put oxygen into that blood and allow carbon dioxide to escape from it, and then to inject continuously the now-red blood back into the patient's arteries, we might have saved her life."*** **Heart-lung machine** **May 6, 1953- ASD closure**	-this was another milestone, where they built up the heart lung machine - An atrial septal defect closure was the first surgery done with the help of the heart-lung machine -the outcome was bad, 3 out of 5 died.
1962- David C. Sabiston, Jr.- **Known for his surgery books**	**Aortocoronary saphenous vein bypass**	
1964-KOLOSOV	**LIMA -LAD IN Russia**	Without the usage of the heart-lung machine

-Early and widespread acceptance of coronary bypass was delayed.

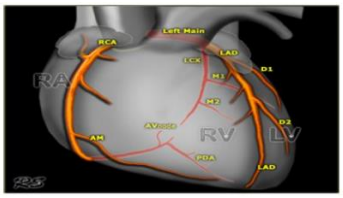
-Best known cooperative studies (1970-80's) were the;

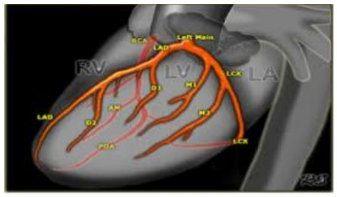
1-VA:VA Cooperative Studies" conducted in the 1970s and 1980s. The VA Cooperative Studies Program is a research program initiated by the U.S. Department of Veterans Affairs (VA) to conduct large-scale, multicenter clinical trials.

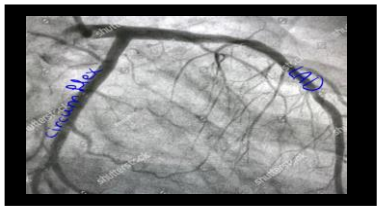
2-Coronary Artery Surgery Study

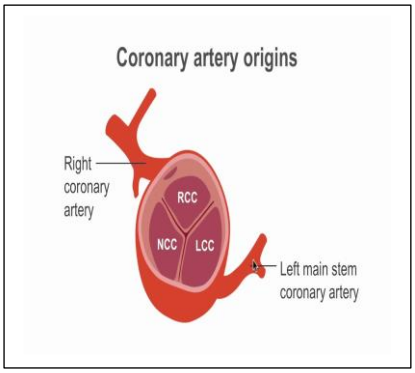
3-European Coronary Surgery Study

CORONARY ARTERY ANATOMY

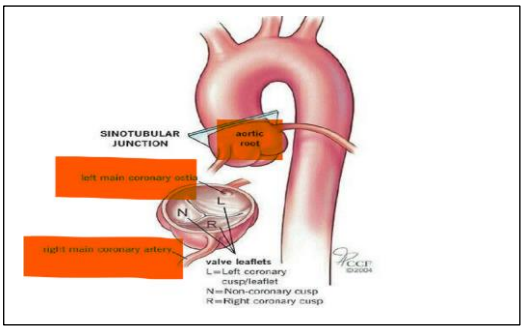








aortic semilunar cusps: in anatomy, we used to say that we have left, right, and posterior cusps. But, in surgery, we call the cusps according to the coronary artery origins; right coronary cusp, left coronary cusp, and noncoronary cusp.

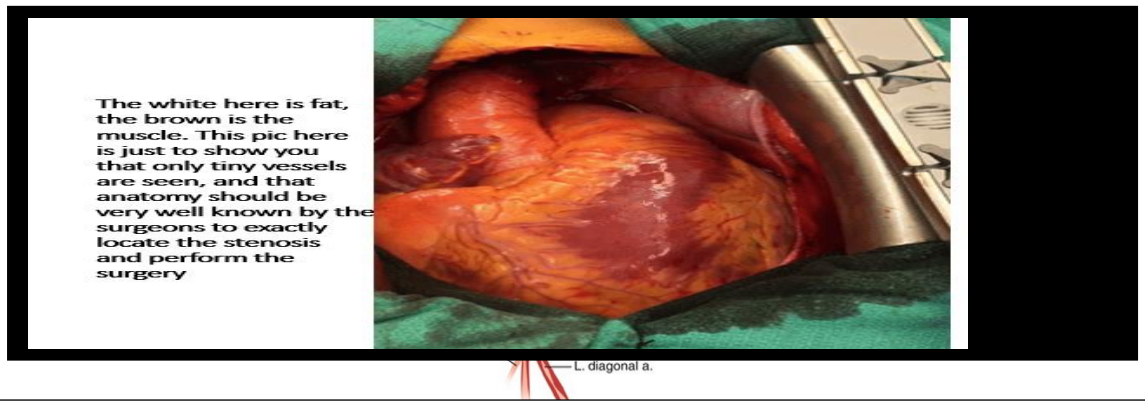


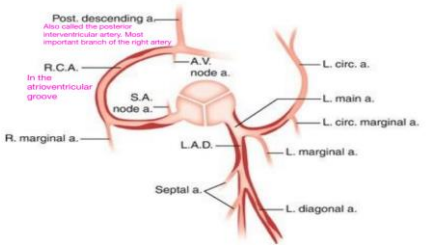
Here we can see the very first 2

branches of the aorta; the right

and left coronary arteries.

-Aortic root is the first part of aorta that leaves lt ventricle.

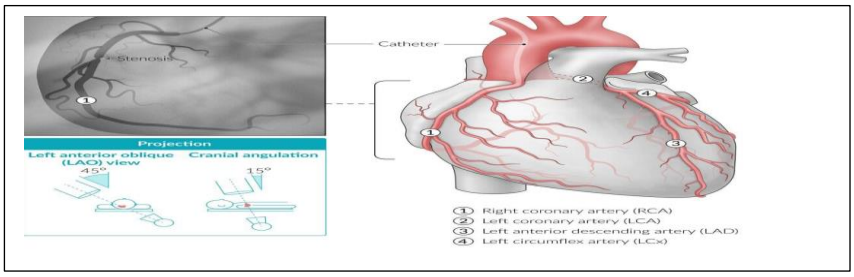




the left main artery (LCA) divides into 2 branches;->left circumflex giving the marginal branches-> left anterior descending giving septal and diagonal branches-look at marginal arteries they are at ridges so so-called LT obtuse marginal artery, right acute marginal artery

A coronary angiogram is performed to diagnose and plan the surgery

This is performed using catheterization to locate where the stenosis is.



--Management

- **Indication For Surgery**
- **Preoperative Evaluation**
- **Conduits decision**
- **Operation Decision**
- **ERAS**

-Indications for Coronary Artery Bypass Grafting: (CABG)

- **Triple vessel disease with DM and decreased EF**

-triple vessel disease includes LAD, Circumflex, RCA+complicated lesions

- **Lf main coronary artery disease (Distal from *point of origin):***

In contrast to the proximal part, the distal part is characterized by more complicated lesions, and calcification and is closer to the bifurcation point.

- **High-risk PCI or not Suitable for PCI:**

High risk percutaneous coronary intervention (HR-PCI) where patient cannot tolerate catheterization. Patients categorized as HR-PCI

typically have lower physiological tolerance for revascularization and it is better to perform surgery (CABG)

• Complications of PTCA

- Percutaneous transluminal coronary angioplasty (PTCA) also called percutaneous coronary intervention (PCI), they both mean the process of dilating a coronary artery stenosis using an inflatable balloon and a metallic stent. This is a common intervention for ischemic heart disease. The balloon and stent are introduced into the arterial circulation via the femoral, radial or brachial artery.

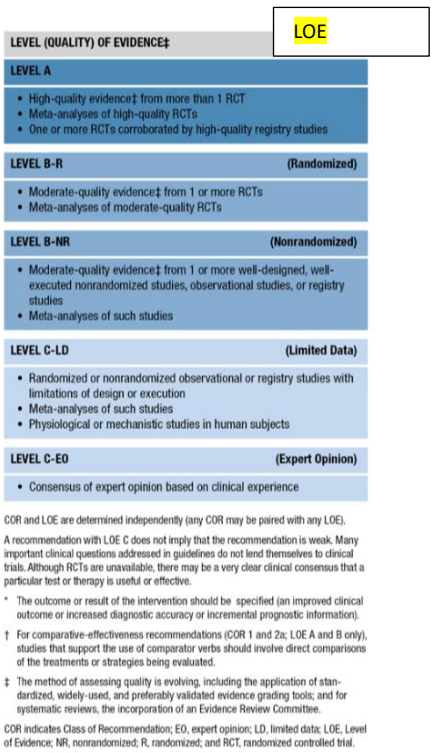
• Mechanical complications of MI: 2 vessels are occluded→severe ischemia in papillary muscles→ papillary muscles rupture, severe acute interventricular septal defect.

• Anomalies of Coronary arteries

--the following points are guidelines you can find them in this article: https://pubmed.ncbi.nlm.nih.gov/34895951/, the doctor didn't add to them important notes:

All indications are evidence based, meaning that trials are made and tested by research, the strongest ones are the double blinded prospective randomized studies, then comes the meta-analysis

1A is the most strongly recommended.
3 are NOT to be performed.



Stable ischemic heart disease

Revascularization to Improve Survival in SIHD Compared With Medical Therapy

Recommendations for Revascularization to Improve Survival in SIHD Compared With Medical Therapy

Referenced studies that support the recommendations are summarized in Online Data Supplement 10.

COR	LOE	Recommendations
		In the case of **Left ventricular dysfunction and multivessel CAD** Coronary artery disease
1	B-R	1. In patients with SIHD and multivessel CAD appropriate for CABG with severe left ventricular systolic dysfunction (left ventricular ejection fraction <35%), CABG is recommended to improve survival.
2a	B-NR	2. In selected patients with SIHD and multivessel CAD appropriate for CABG and mild-to-moderate left ventricular systolic dysfunction (ejection fraction 35%–50%), CABG (to include a left internal mammary artery [LIMA] graft to the LAD) is reasonable to improve survival.

Here, it is to tell you that if the patient has a weak heart (low ejection fraction), surgery (CABG) would be better than stents

Revascularization to Improve Survival in SIHD Compared With Medical Therapy (con't.)

Remember that 1 is better than 2A but here we are looking at the patient's situation and what would be the best in his case

		In the case of **Left main CAD**
1	B-R	3. In patients with SIHD and significant left main stenosis, CABG is recommended to improve survival.
2a	B-NR	4. In selected patients with SIHD and significant left main stenosis for whom PCI can provide equivalent revascularization to that possible with CABG, PCI is reasonable to improve survival. If the patient is not suitable for surgery, then perform PCI

Revascularization to Improve Survival in SIHD Compared With Medical Therapy (con't.)

Because its 2B, surgery is not usually performed and a stent is preferred.

		In the case of Multivessel CAD
2b	B-R	5. In patients with SIHD, normal ejection fraction, significant stenosis in 3 major coronary arteries (with or without proximal LAD), and anatomy suitable for CABG, CABG may be reasonable to improve survival.
2b	B-R	6. In patients with SIHD, normal ejection fraction, significant stenosis in 3 major coronary arteries (with or without proximal LAD), and anatomy suitable for PCI, the usefulness of PCI to improve survival is uncertain.

Revascularization to Improve Survival in SIHD Compared With Medical Therapy (con't.)

		Stenosis in the proximal LAD artery
2b	B-R	7. In patients with SIHD, normal left ventricular ejection fraction, and significant stenosis in the proximal LAD, the usefulness of coronary revascularization to improve survival is uncertain.
		Single- or double-vessel disease not involving the proximal LAD
3: No Benefit	B-R	8. In patients with SIHD, normal left ventricular ejection fraction, and 1- or 2-vessel CAD not involving the proximal LAD, coronary revascularization is not recommended to improve survival.

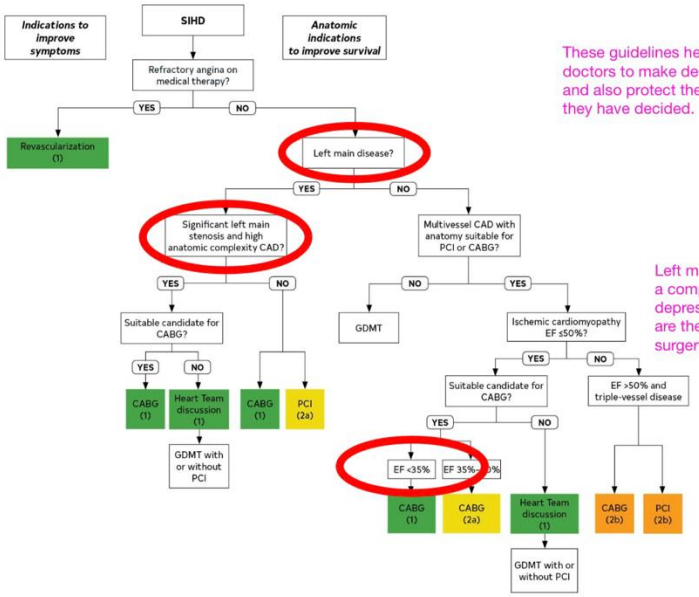
Notice the surgery here is contraindicated (number 3)

In this case, the patient has good cardiac output (normal ejection fraction and no proximal lesions, there is NO benefit from surgery, stents are used instead.

Figure 6. Revascularization in patients with SIHD.

Colors correspond to Table 2.

CABG indicates coronary artery bypass graft; CAD, coronary artery disease; EF, ejection fraction; PCI, percutaneous coronary intervention; SIHD, stable ischemic heart disease; and GDMT, guideline-directed medical therapy.



These guidelines help doctors to make decisions and also protect them after they have decided.

Left main artery disease with a complex lesion and a depressed ejection fraction are the main indications for surgery.

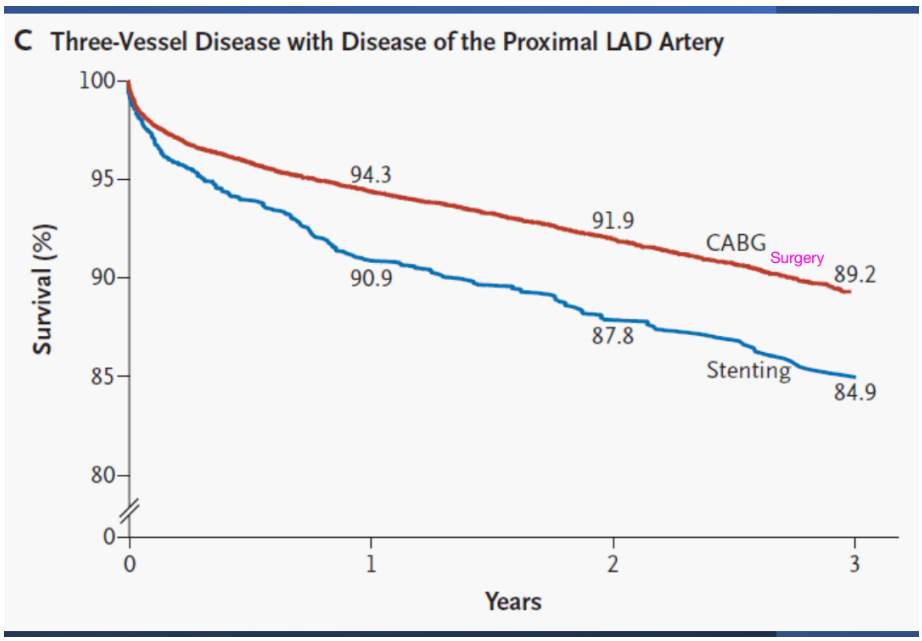
Patients With Complex Disease

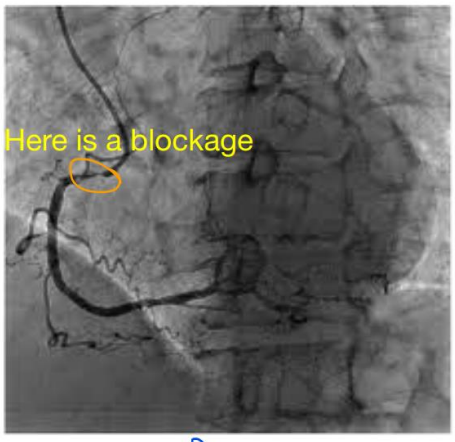
Recommendations for Patients With Complex Disease Referenced studies that support the recommendations are summarized in Online Data Supplement 13.		
COR	**LOE**	**Recommendations**
1	B-R	1. In patients who require revascularization for significant left main CAD with high-complexity CAD, it is recommended to choose CABG over PCI to improve survival.
2a	B-R	2. In patients who require revascularization for multivessel CAD with complex or diffuse CAD (e.g., SYNTAX score >33), it is reasonable to choose CABG over PCI to confer a survival advantage.

Patients With Diabetes

Diabetics usually benefit more from surgery than PCI

Recommendations for Patients With Diabetes Referenced studies that support the recommendations are summarized in Online Data Supplement 14.		
COR	**LOE**	**Recommendations**
1	A	1. In patients with diabetes and multivessel CAD with the involvement of the LAD, who are appropriate candidates for CABG, CABG (with a LIMA to the LAD) is recommended in preference to PCI to reduce mortality and repeat revascularizations.
2a	B-NR	2. In patients with diabetes who have multivessel CAD amenable to PCI and an indication for revascularization and are poor candidates for surgery, PCI can be useful to reduce long-term ischemic outcomes.
2b	B-R	3. In patients with diabetes who have left main stenosis and low- or intermediate-complexity CAD in the rest of the coronary anatomy, PCI may be considered an alternative to CABG to reduce major adverse cardiovascular outcomes.





A

B

12/4/2023 Fourth Year Cardiovascular System Lectures

A shows complicated lesions

B shows complete obstruction

- **A 50-year-old male patient**
- **Diabetic on OHA (Metformin)**
- **Hypertensive on BB and CCB**
- **Dyslipidemia on Statin and aspirin**
- **Presented to the ER with ACS(acute coronary syndrome) (Unstable Angina)**

• He was started on Clopidogrel(antiplatelet drug,also known as plavix) and admitted for further evaluation

-Aspirin/PLAVIX DUAL ANTIPLATELT THERAPY(DAPT)

After angiography was performed to diagnose:

Cath showed

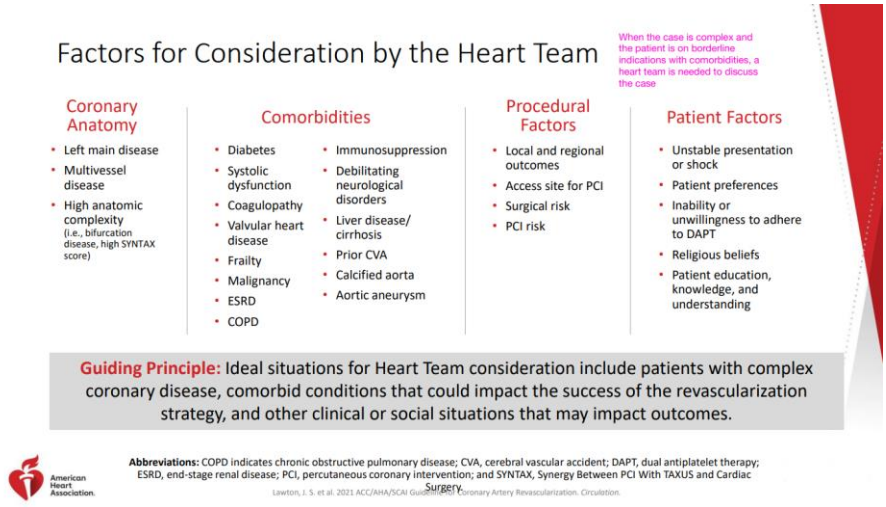
• Distal Left Main Stenosis

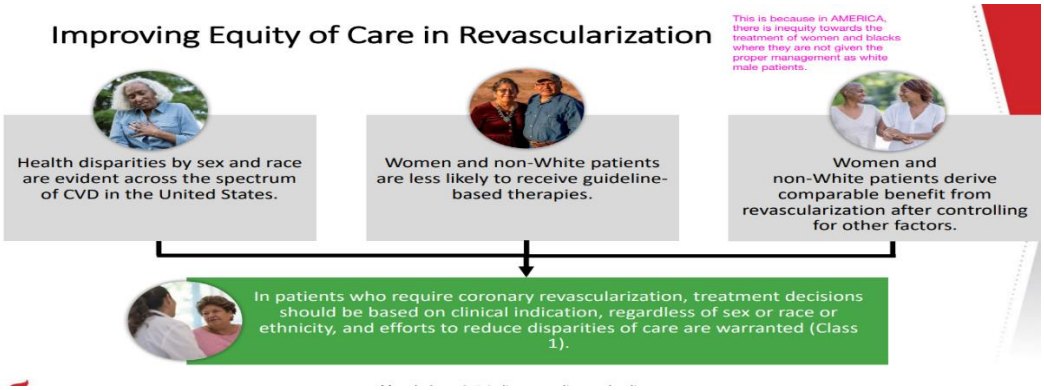
• RCA stenosis

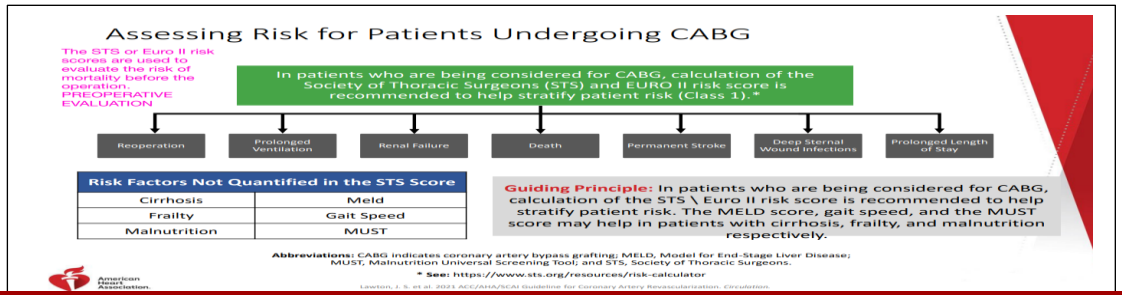
The surgery will be performed on this patient because of

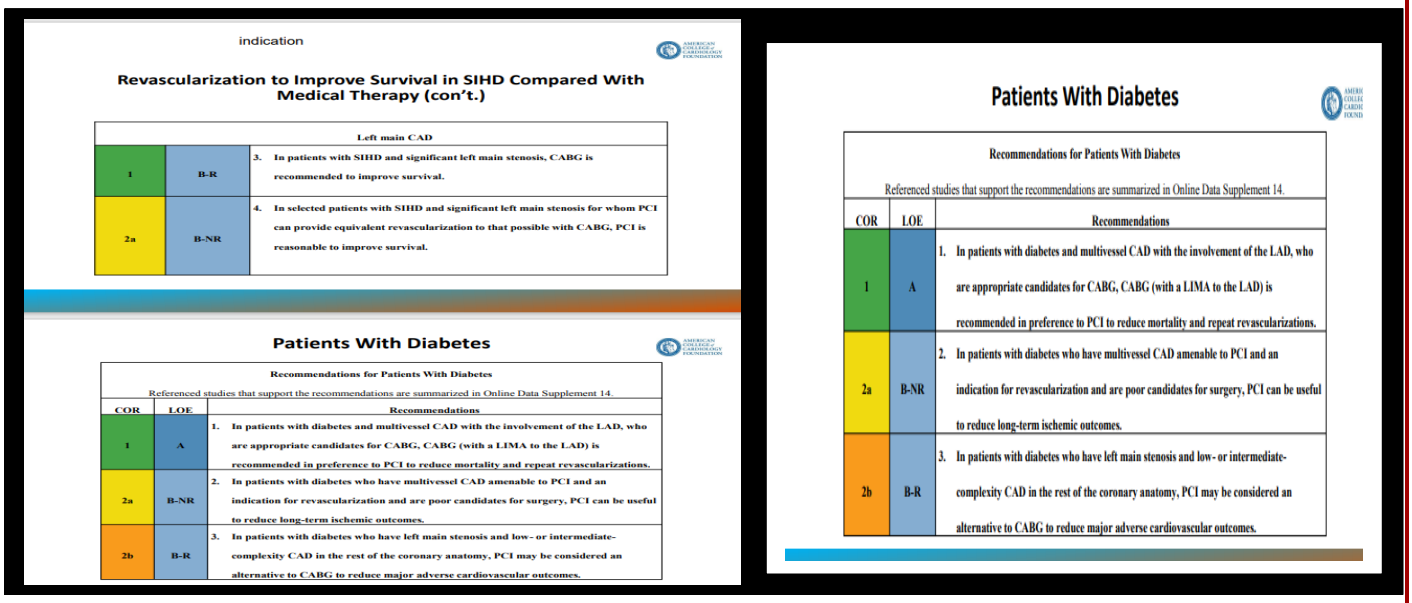
3 vessel disease and the patient is diabetic

https://youtu.be/PHb5NUMDe7U?si=9HXfoyWXmUIASNKk









indication

Revascularization to Improve Survival in SIHD Compared With Medical Therapy (con't.)

Left main CAD		
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Patients With Diabetes

Recommendations for Patients With Diabetes

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Preoperative Evaluation

The patient will undergo a massive surgery (get on the heart-lung machine, fluid disturbances would occur, systemic inflammatory response) so we have to look at multiple things before the operation —> Pre OPERATIVE EVALUATION

-Respiratory Evaluation

• Renal Evaluation

- Infection Evaluation

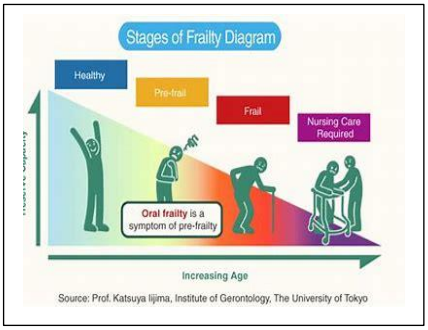
- therefore, if the patient has UTI or pneumonia or ANY OTHER INFECTION ANYWHERE IN THE BODY we cannot perform the surgery.

• Carotids

-We have 3 vascular beds in the body; cerebral, coronaries, peripherals. Ensure that ALL are healthy before the operation(check for bruit auscultation and perform duplex ultrasound)

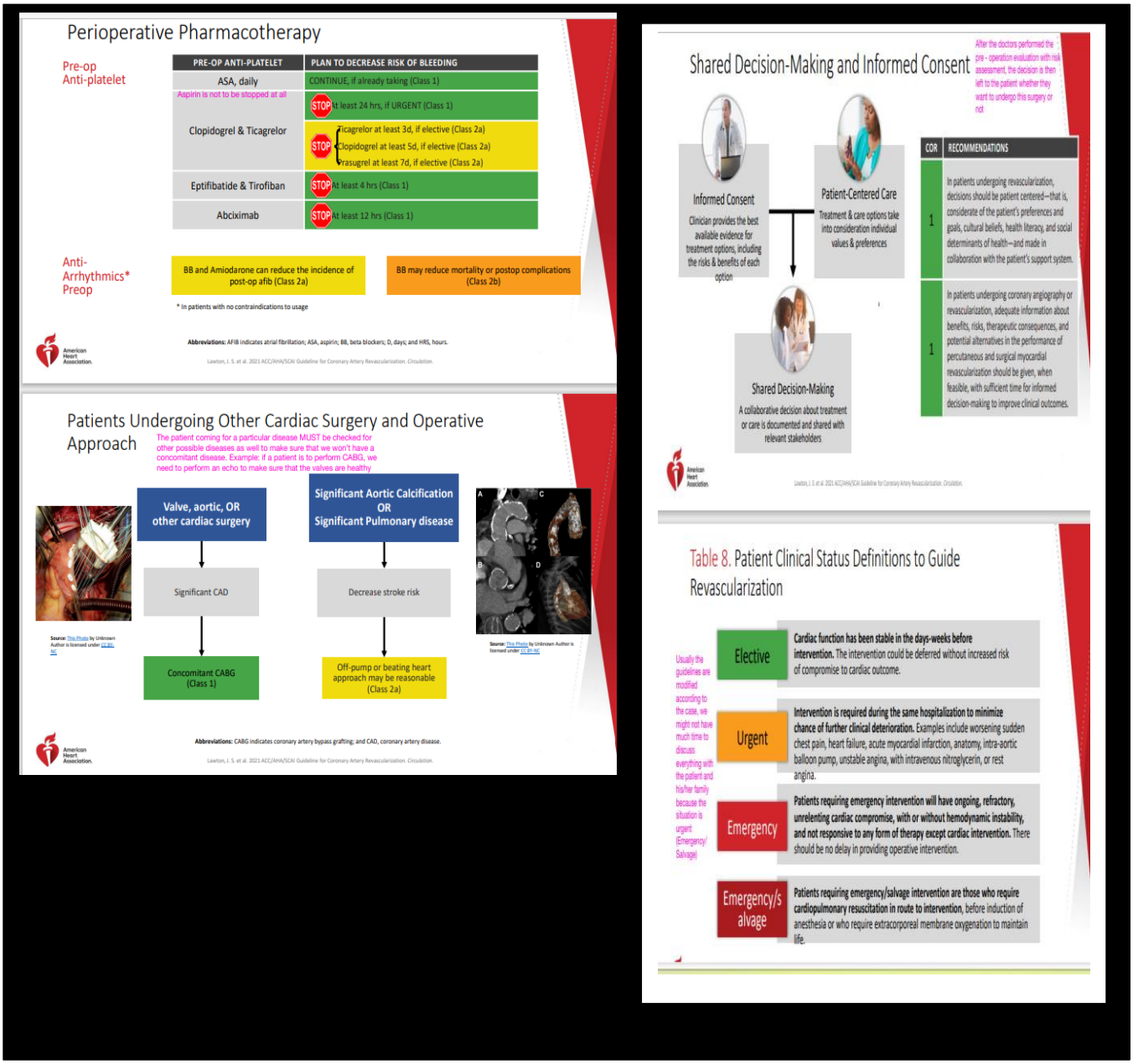
- The bruit may be heard ("auscultated") by securely placing the head of a stethoscope to the skin over the turbulent flow, and listening. Most bruits occur only in systole , so the bruit is intermittent and its frequency dependent on the heart rate

- **Frailty** الهشاشة
- **Risk Assessment**
- **Liver**
- **Thyroid**



-liver and thyroid are Affected by the heart-lung machine

- **Medications**
- **Coagulopathy**

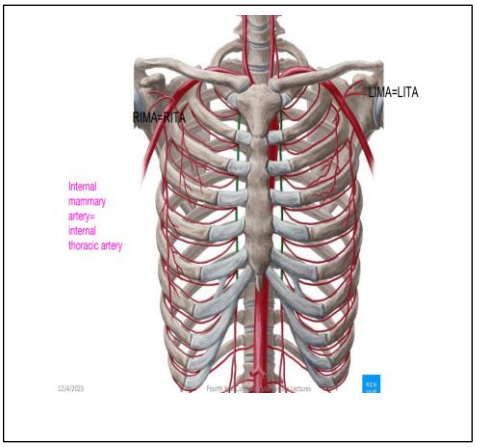


General Procedural Issues for CABG Conduits decision

- Choosing the graft to be used for the bypass

Conduites

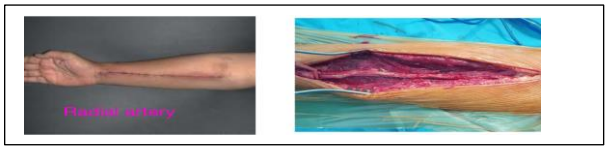
- Arterial:

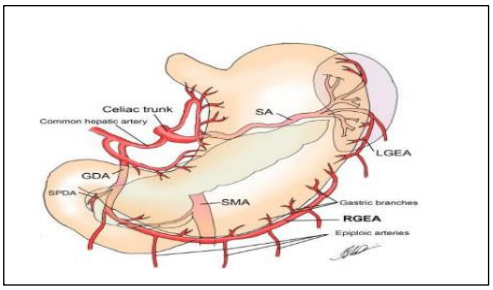


• LIMA Left internal mammary (Mostly used)

• RIMA Right internal mammary

• RA Radial artery





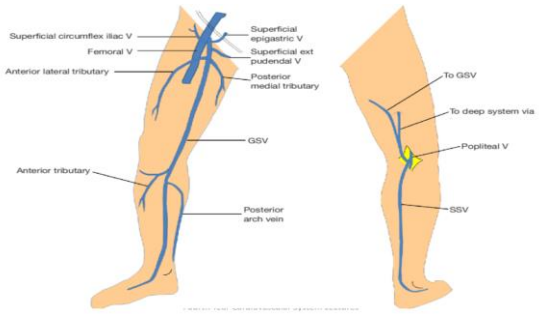
• GEA gastroepiploic

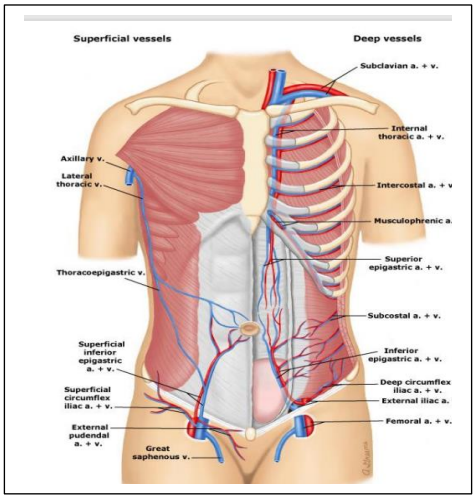
The use of gastroepiploic artery has decreased significantly over the years

• IEA inferior epigastric : less frequent to use

-Venous:

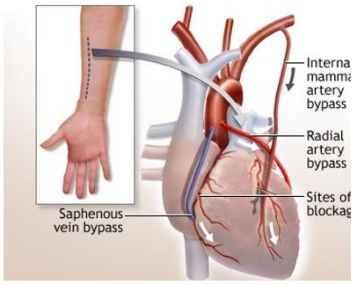
• GSV:great saphenous:2nd common use: Great Saphenous vein- easy to extract, cheap (MENS low complications- wound dehiscence in the leg is not as terrible as wound dehiscence in the chest as when LIMA is used)

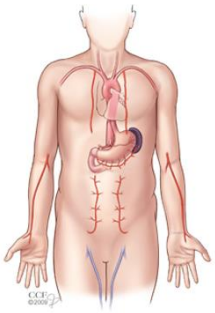




- **SSV:short saphenous**
- **Arm Veins**

Arterial vs Venous conduits

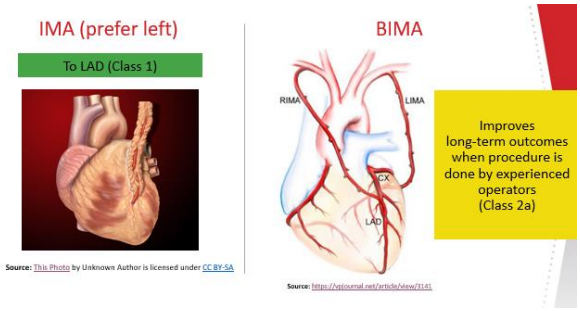




arterial conduits are always better, overdriven by LIMA, however, the risk of infection arises from 2% to 4% especially in obese, diabetics, and smokers.

Bypass Conduits in Patients Undergoing CABG

1st choice:

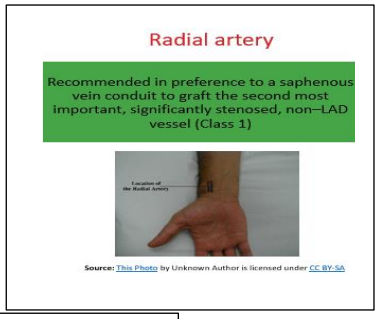


LIMA-LAD anastomosis in CABG is a must!the risk of the open heart surgery may outweigh benefits if this procedure isn't taken.

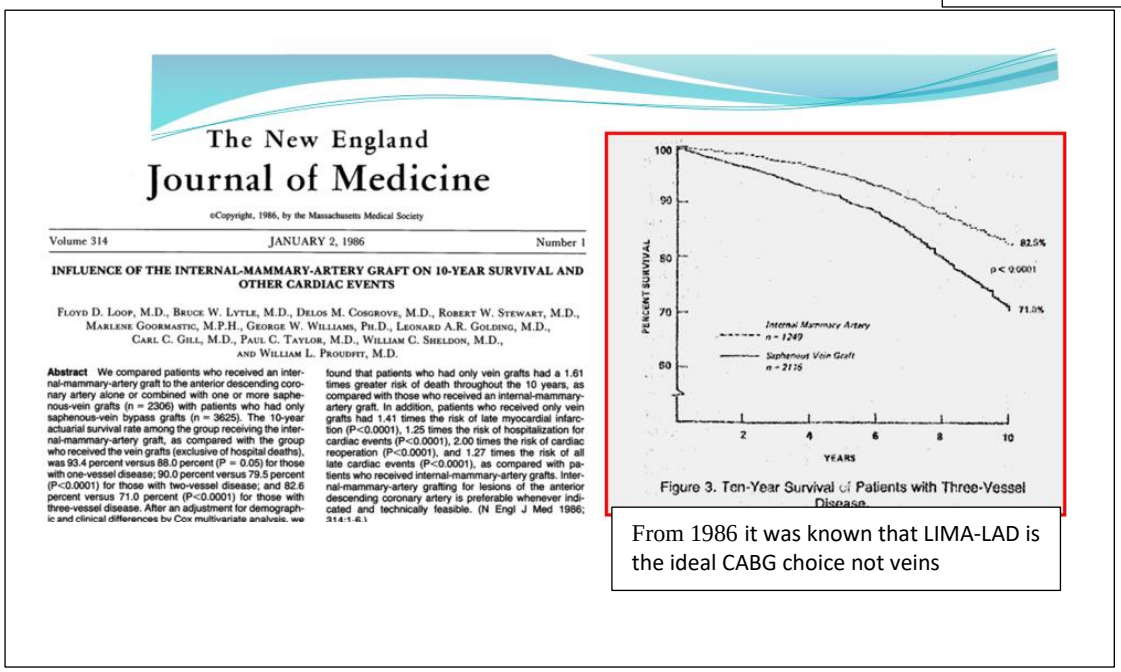
IMA indicates that a single branch is used(either the right or the left),However, LIMA is much better than RIMA to use according to post-operative outcomes. In BIMA(bilateral IMA) both RIMA and LIMA are used, in the figure above: in situ grafting between the right internal mammary artery (RIMA) to the left anterior descending (LAD) artery,and the left internal mammary artery (LIMA) to circumflex (Cx) marginal branches.

-also it is known that BIMA is better than SIMA(single IMA) in survival rates and re-operational free survival rates(re-operational survival rate:a measure of the time a patient remains free from the need for a repeat surgical procedure, reflecting the durability or effectiveness of the initial intervention)

-The 2nd choice is grafting the radial artery with a non-lad artery If more anastomosis is needed, radial-circumflex for example



-these articles prove what was mentioned:


The New England Journal of Medicine

Volume 314 JANUARY 2, 1986 Number 1

INFLUENCE OF THE INTERNAL-MAMMARY-ARTERY GRAFT ON 10-YEAR SURVIVAL AND OTHER CARDIAC EVENTS

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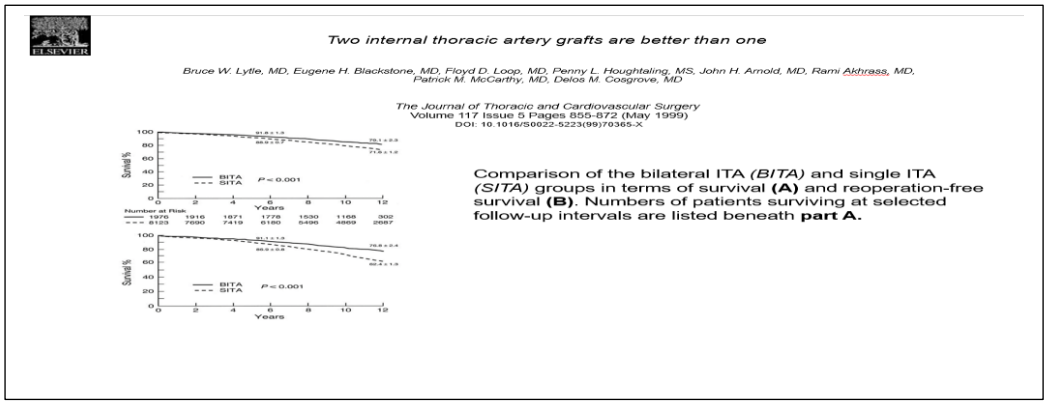
Abstract We compared patients who received an internal-mammary-artery graft to the anterior descending coronary artery alone or combined with one or more saphenous-vein grafts (n = 2306) with patients who had only saphenous-vein bypass grafts (n = 3625). The 10-year actuarial survival rate among the group receiving the internal-mammary-artery graft, as compared with the group who received the vein grafts (exclusive of hospital deaths), was 93.4 percent versus 88.0 percent (P = 0.05) for those with one-vessel disease; 90.0 percent versus 79.5 percent (P<0.0001) for those with two-vessel disease; and 82.6 percent versus 71.0 percent (P<0.0001) for those with three-vessel disease. After an adjustment for demographic and clinical differences by Cox multivariate analysis, we found that patients who had only vein grafts had a 1.61 times greater risk of death throughout the 10 years, as compared with those who received an internal-mammary-artery graft. In addition, patients who received only vein grafts had 1.41 times the risk of late myocardial infarction (P<0.0001), 1.25 times the risk of hospitalization for cardiac events (P<0.0001), 2.00 times the risk of cardiac reoperation (P<0.0001), and 1.27 times the risk of all late cardiac events (P<0.0001), as compared with patients who received internal-mammary-artery grafts. Internal-mammary-artery grafting for lesions of the anterior descending coronary artery is preferable whenever indicated and technically feasible. (N Engl J Med 1986; 314:1-6.)

Figure 3. Ten-Year Survival of Patients with Three-Vessel Disease.

From 1986 it was known that LIMA-LAD is the ideal CABG choice not veins

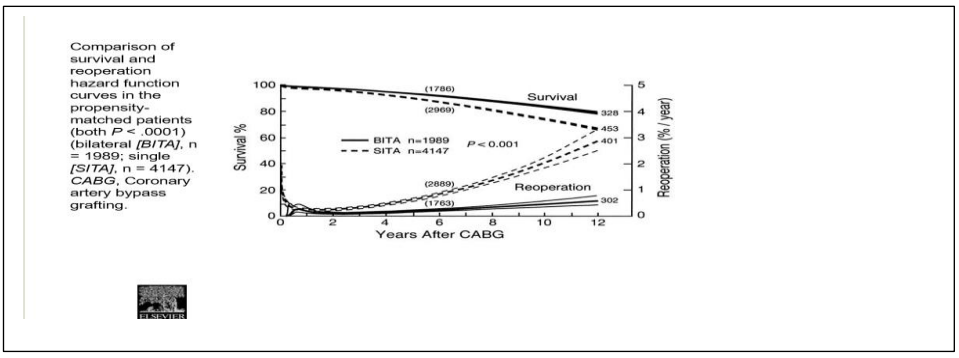


Two internal thoracic artery grafts are better than one

Bruce W. Lytle, MD, Eugene H. Blackstone, MD, Floyd D. Loop, MD, Penny L. Houghtaling, MS, John H. Arnold, MD, Rami Akhrass, MD, Patrick M. McCarthy, MD, Delos M. Cosgrove, MD

The Journal of Thoracic and Cardiovascular Surgery
Volume 117 Issue 5 Pages 855-872 (May 1999)
DOI: 10.1016/S0022-5223(99)70365-X

Comparison of the bilateral ITA *(BITA)* and single ITA *(SITA)* groups in terms of survival **(A)** and reoperation-free survival **(B)**. Numbers of patients surviving at selected follow-up intervals are listed beneath **part A.**



Comparison of survival and reoperation hazard function curves in the propensity-matched patients (both $P < .0001$) (bilateral *(BITA)*, n = 1989; single *(SITA)*, n = 4147). *CABG*, Coronary artery bypass grafting.

Arterial conduits used for coronary artery bypass grafting

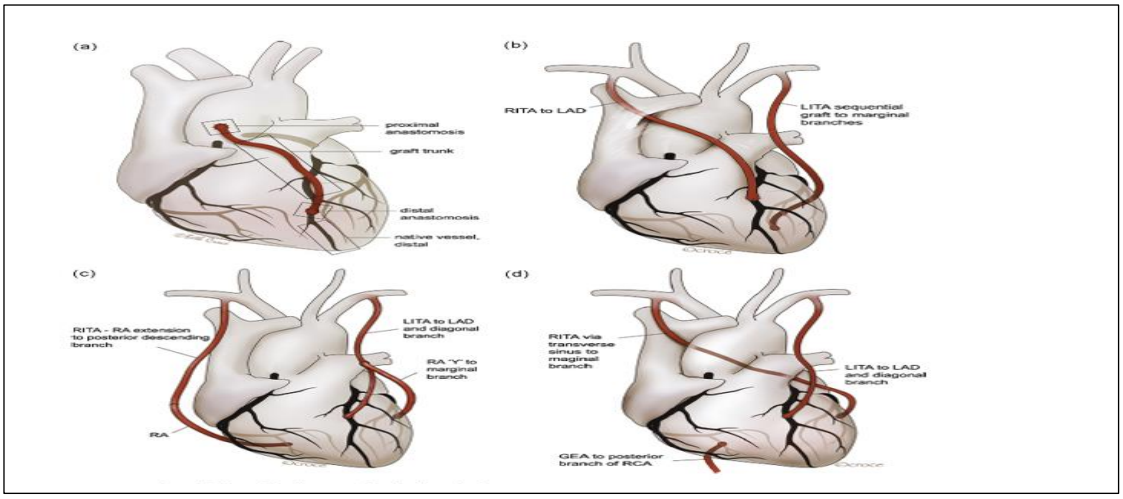
-Internal Thoracic Artery(BIMA is better but LIMA is what used in real world)

- Radial Artery

- Right Gastroepiploic Artery

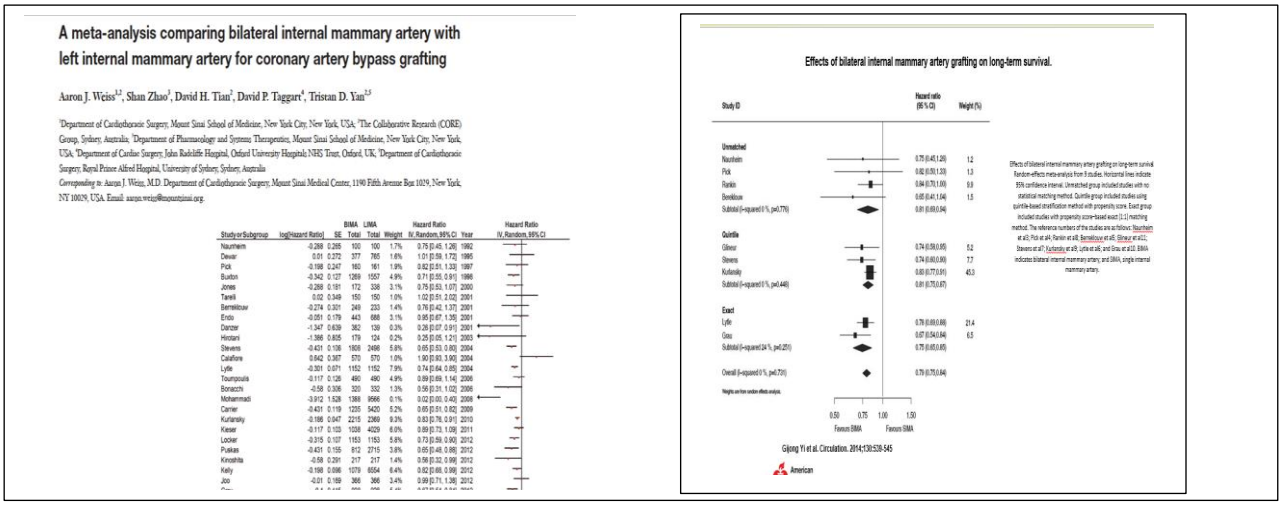
- Inferior Epigastric Artery

-Others



a)Free Grafting: The ITA is harvested as a free graft, meaning it is completely disconnected from its origin and then used to bypass a coronary artery

B) In Situ Grafting: The ITA is left attached to its origin, and it is used to bypass the coronary artery **so a pedicled** left internal mammary artery is dissected off the chest wall and divided distally after systemic heparinisation. It is left attached to the subclavian artery proximally.



A meta-analysis comparing bilateral internal mammary artery with left internal mammary artery for coronary artery bypass grafting

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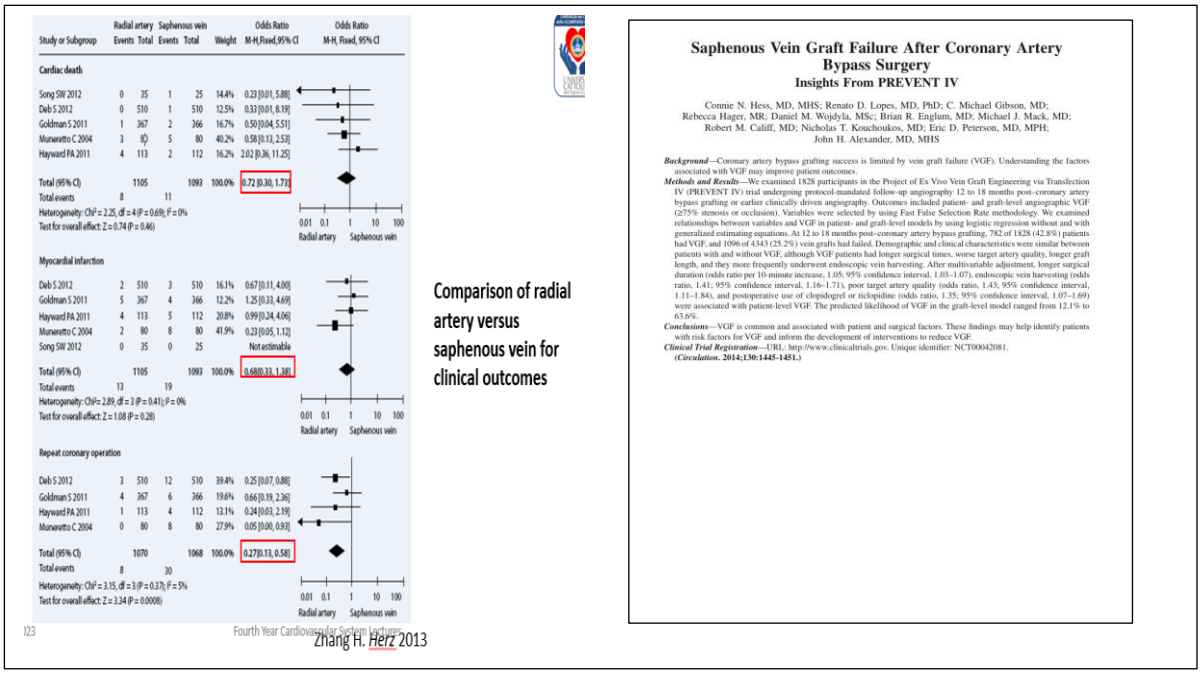
Effects of bilateral internal mammary artery grafting on long-term survival.

Gijong Yi et al. Circulation. 2014;130:539-545



Comparison of radial artery versus saphenous vein for clinical outcomes

Zhang H. Herz 2013

Fourth Year Cardiovascular System Lectures

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Saphenous Vein Graft Failure After Coronary Artery Bypass Surgery

Insights From PREVENT IV

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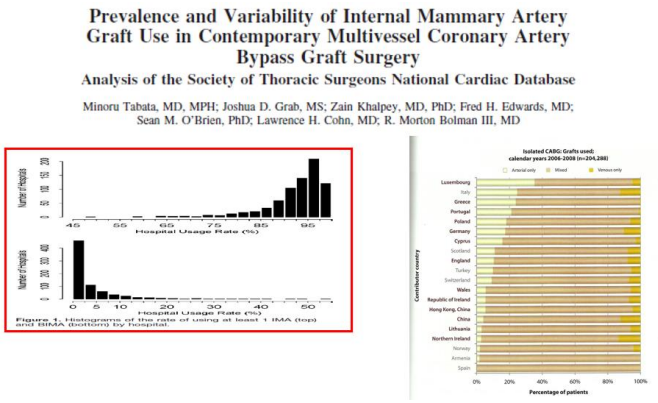
Background—Coronary artery bypass grafting success is limited by vein graft failure (VGF). Understanding the factors associated with VGF may improve patient outcomes.

Methods and Results—We examined 1828 participants in the Project of Ex Vivo Vein Graft Engineering via Transfection IV (PREVENT IV) trial undergoing protocol-mandated follow-up angiography 12 to 18 months post–coronary artery bypass grafting or earlier clinically driven angiography. Outcomes included patient- and graft-level angiographic VGF (≥75% stenosis or occlusion). Variables were selected by using Fast False Selection Rate methodology. We examined relationships between variables and VGF in patient- and graft-level models by using logistic regression without and with generalized estimating equations. At 12 to 18 months post–coronary artery bypass grafting, 782 of 1828 (42.8%) patients had VGF, and 1096 of 4343 (25.2%) vein grafts had failed. Demographic and clinical characteristics were similar between patients with and without VGF, although VGF patients had longer surgical times, worse target artery quality, longer graft length, and they more frequently underwent endoscopic vein harvesting. After multivariable adjustment, longer surgical duration (odds ratio per 10-minute increase, 1.05; 95% confidence interval, 1.03–1.07), endoscopic vein harvesting (odds ratio, 1.41; 95% confidence interval, 1.16–1.71), poor target artery quality (odds ratio, 1.43; 95% confidence interval, 1.11–1.84), and postoperative use of clopidogrel or ticlopidine (odds ratio, 1.35; 95% confidence interval, 1.07–1.69) were associated with patient-level VGF. The predicted likelihood of VGF in the graft-level model ranged from 12.1% to 63.6%.

Conclusions—VGF is common and associated with patient and surgical factors. These findings may help identify patients with risk factors for VGF and inform the development of interventions to reduce VGF.

Clinical Trial Registration—URL: http://www.clinicaltrials.gov. Unique identifier: NCT00042081.

(*Circulation*. 2014;130:1445-1451.)



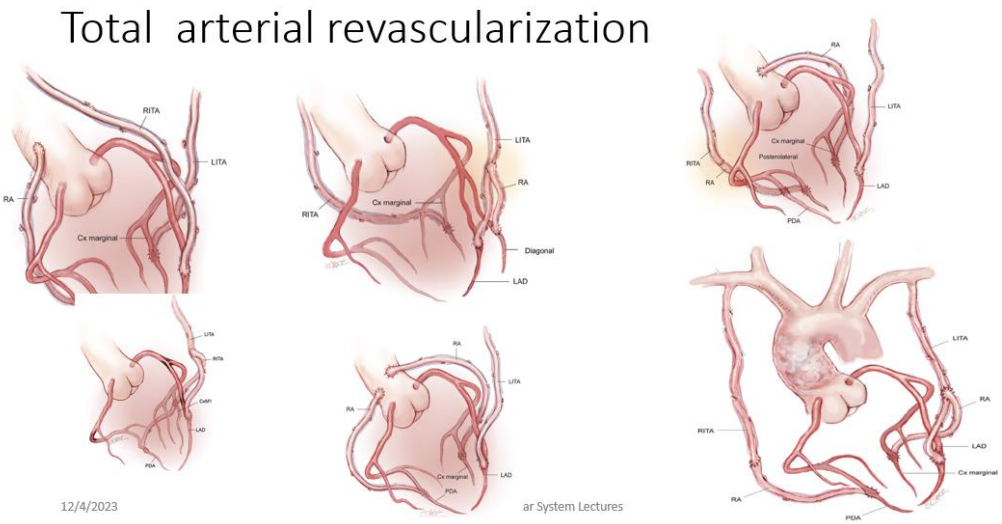
-left internal mammary artery (LIMA), has become the conduit of choice for the LAD. Since the mid-1980s, long-term patency rates of >98% (doctor mentioned 90-98)have been reported, with improved long-term survival and fewer reoperations vs limited long-term patency rate for long saphenous vein grafts (50–60% at 10 years)(up to 65 as the doctor mentioned)and also 10% of vein grafting fails before the discharge of the patient. However, concerns about additional operative time, enhanced technical complexity, graft spasm with hypoperfusion, competitive flow, increased risk of bleeding, deep sternal wound infection, and most importantly lack of randomized trial data have prevented the universal adoption of total arterial coronary grafting making the real world opposite than the ideal practice by tending to use 2 venous grafts and 1 IMA graft(mix).

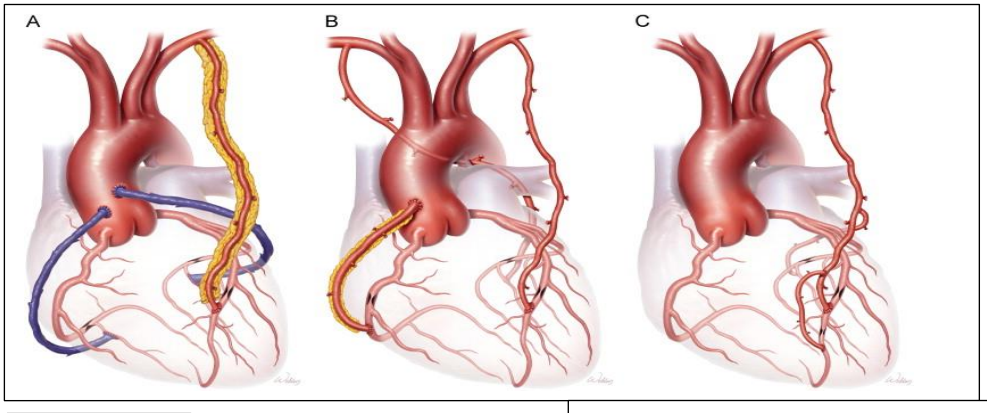
-- The patency rate refers to the degree or extent of openness or unobstructed flow within a vessel or conduit, typically a blood vessel or a graft used in surgical procedures. The term is commonly used in the context of vascular and cardiac procedures, where the goal is to establish or maintain unimpeded blood flow.In the medical field, the patency rate is often expressed as a percentage and is used to assess how well a vessel or graft is functioning. Specifically:A high patency rate indicates that the vessel or graft remains open and allows blood to flow through without significant obstruction.A low patency rate suggests that there is a degree of blockage or narrowing that is impeding the normal flow of blood.

Operation Decision

-Planning for the Surgery by the team is so important to prevent missing time that increases the risk of complications. **Conduits combination: arterial vs venous**, BIMA vs SIMA,…)

-for example, for a 52-year-old patient 3 arterial grafts(BIMA and RA)are better than lima and 2 veins to avoid re-operation.





real

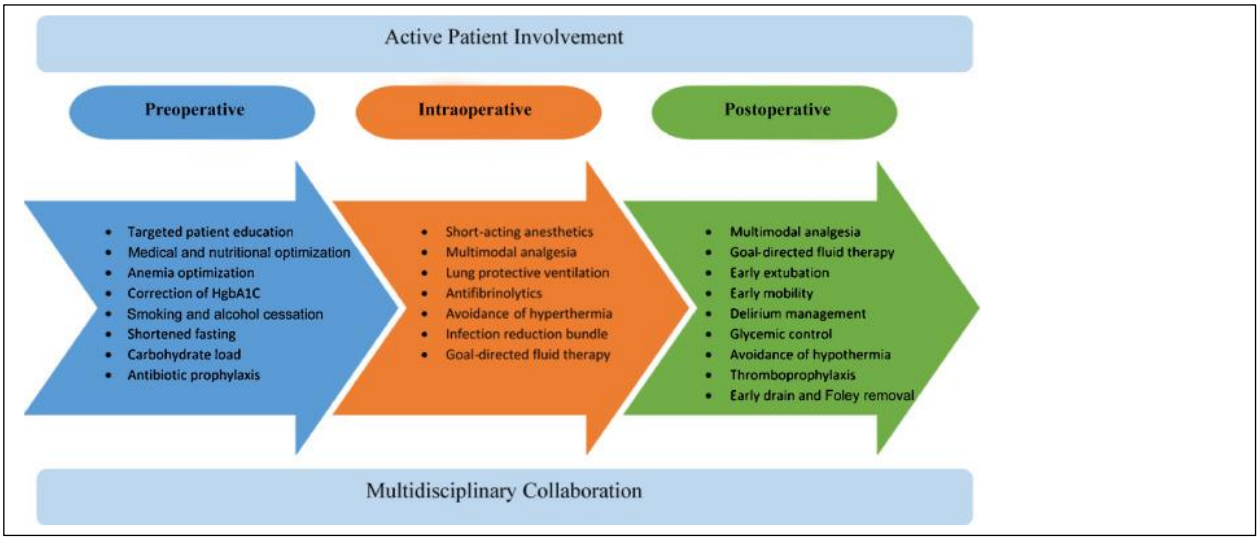
ideal

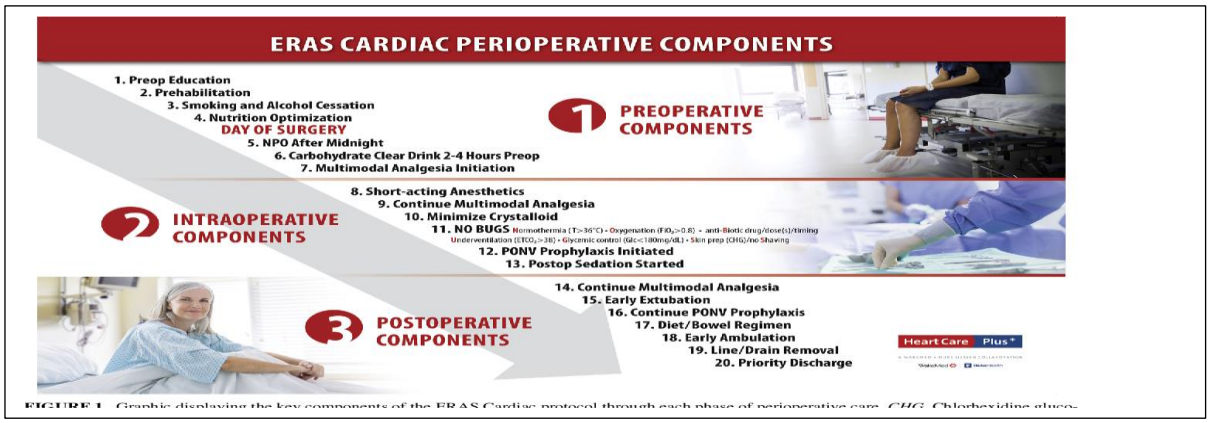
C) Composite Y or T graft with free right internal mammary artery (RIMA) connected proximally to the left internal mammary artery (LIMA) with LIMA anastomosed to the left anterior descending (LAD) artery and RIMA anastomosed to the circumflex (Cx) marginal branches

ERAS

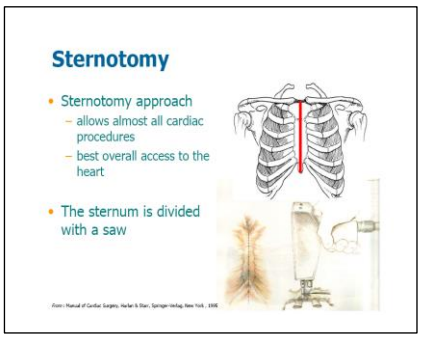
Or ERAX as cardio surgery calls(Early recovery after surgery)

-it aims not to leave patients in hospital more than necessary as the hospital is considered a risk factor, (the more the patient stays in the hospital, the more risk predisposition).





SURGICAL TECHNIQUES



- The heart is approached mainly by a median sternotomy(major trauma). An incision is made from the suprasternal notch to the lower end of the xiphisternum. The sternum is divided and retracted to expose the thymus superiorly and the pericardium inferiorly. The thymus, although atrophic in adults, often remains relatively vascular.

The thymus and pleurae are dissected from the pericardium and the pericardium is opened. Before cannulation for CPB(cardiopolmunary bypass), the patient is fully heparinized.

- After disinfection and sterilizing

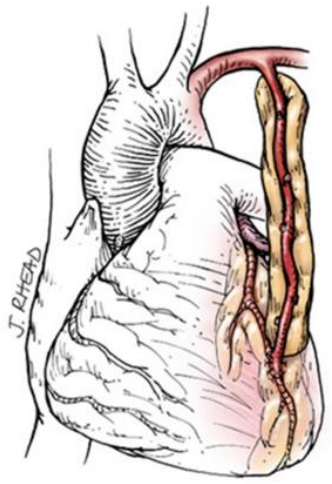
procedures, the skin will be incised,

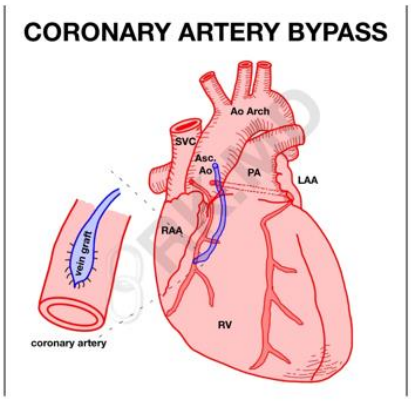
facing subcutaneous tissue→

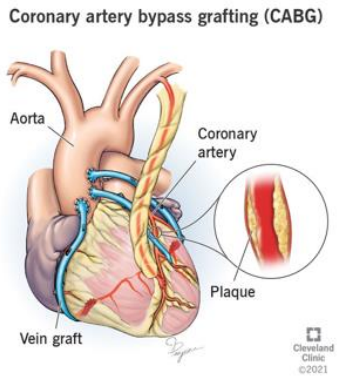
pectoralis major and minor→sternum→

thymus(thymectomy)→

pericardium →abundant yellow fat→then the surgeon either harvests or dissects LIMA keeping it in its origin→grafting it with LAD distal to stenotic part of coronary(bypassing)→finally CABG is done:0







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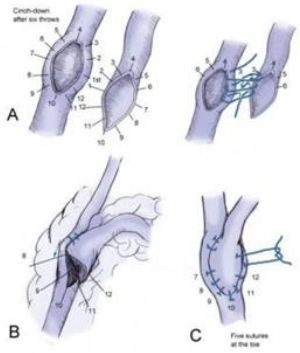
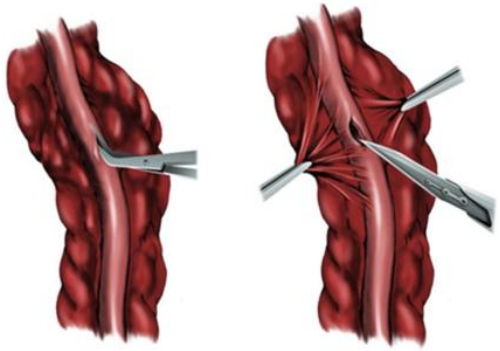
- Coronary is cut and widened to 3-4 mm then connecting it with the conduit and the sutures must be symmetric to prevent bleeding





Heart Lung Machine

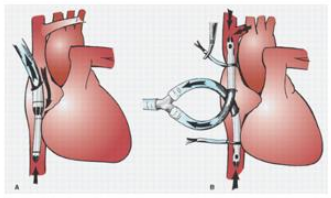
-cardiopulmonary bypass(CBP)

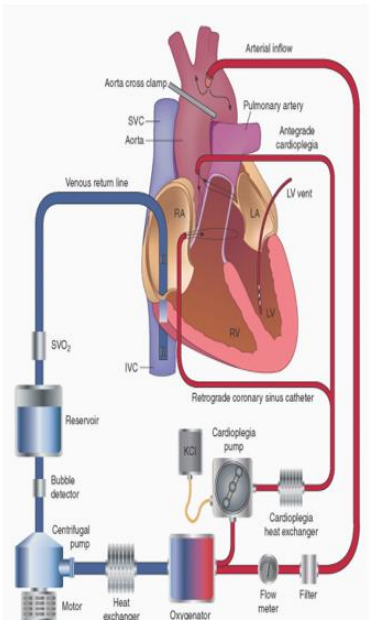
-AFTER CLAMPING THE ARCH OF AORTA , cardiopulmonary bypass is initiated. Arterial cannulation conventionally, the great vessels are exposed and an aortic perfusion cannula is inserted into the ascending aorta, held in place by the purse-string suture. Air is excluded and the cannula connected to the bypass circuit. VENOUS CANULATION:A purse-string suture is placed around the right atrial appendage and a single ‘two-stage’ venous cannula is placed to establish venous drainage. The venous pipe has end holes that sit in the inferior vena cava and side holes that sit in the right atrium (to take drainage from the superior vena cava)

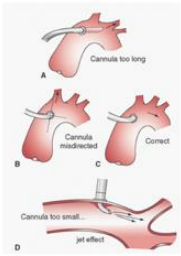
Once the circuit is connected the CPB machine (the ‘pump’) gradually takes over the processes of circulation. Once full flow is established (the required cardiac output depends on the body surface area of the patient), the heart can be isolated from the rest of the circulation(ARRESTED HEART). Blood is drained from the heart to the venous reservoir and oxygenated using an

oxygenator that allows gas exchange across its membrane. Blood is then pumped to the body by the bypass machine via the aortic cannula.

-THE HEART IS ARRESTED BY cardioplegia WHICH is a technique used in cardiac surgery to induce temporary cardiac arrest, allowing surgeons to operate on a still heart. During certain heart procedures, it's necessary to stop the heart temporarily to facilitate a bloodless and motionless surgical field. Cardioplegia involves delivering a specialized solution to the heart to achieve this temporary arrest. This solution usually contains a combination of electrolytes, potassium, and sometimes other substances to arrest the heart muscle's activity.SO A FLAT ECG IS SEEN.







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Off-Pump Coronary Artery Bypass (OPCAB)

NO CARDIOPLEGIA

Surgery (CABG) without the use of CPB is a well-established and increasingly popular method that may be combined with a minimally invasive approach or carried out through a conventional sternotomy. It offers the advantages that it avoids the physiological stress associated with CPB and, to some extent, the aortic manipulation that can lead to neurological injury through atherosclerotic embolisation. Since the introduction of cardiac stabilizing devices such as the Octopus), off-pump coronary artery bypass (OPCAB) grafting has become widespread. One of the concerns, however, is related to the quality of anastomosis carried out on a beating heart and bloody field that can limit the surgeon's vision. THE DECISION MUST BE TAKEN PRE-OPERATION.

Use of Cardiopulmonary Bypass in Patients Undergoing CABG

Recommendations for Use of Cardiopulmonary Bypass in Patients Undergoing CABG Referenced studies that support the recommendations are summarized in Online Data Supplement 40.		
COR	**LOE**	**Recommendations**
2a	B-R	1. In patients with significant calcification of the aorta, the use of techniques to avoid aortic manipulation (off-pump techniques or beating heart) is reasonable to decrease the incidence of perioperative stroke when performed by experienced surgeons.
2b	B-R	2. In patients with significant pulmonary disease, off-pump surgery may be reasonable to reduce perioperative risk when performed by experienced surgeons.

Procedure:

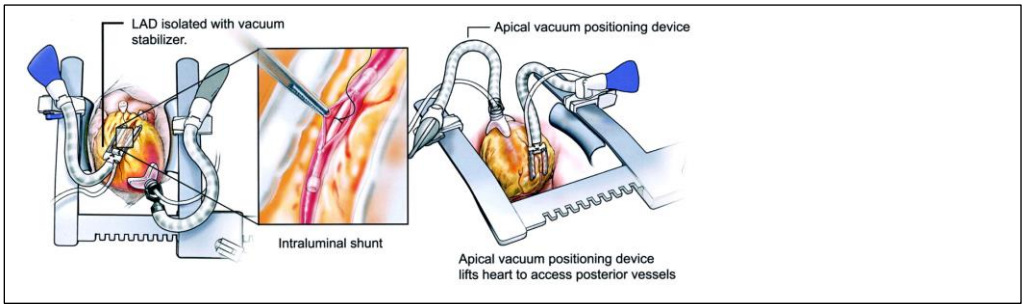
-Median sternotomy of varying sizes.

-Depending on the physiology of the patient, the smallest incision will be made.

-Arteries or veins can be harvested from the patients chest wall, arm, and or leg.

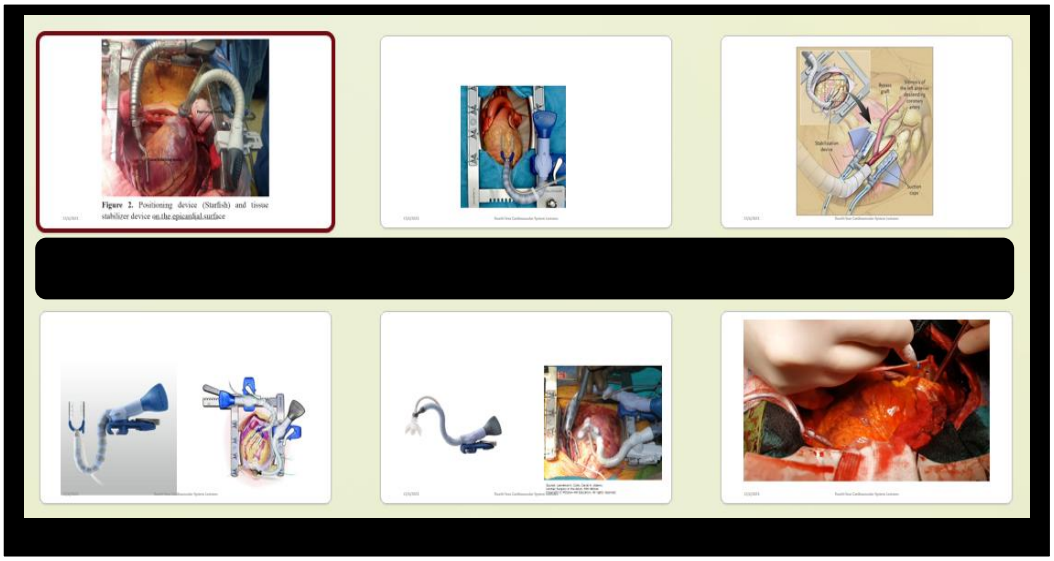
-Betablockers are used to slow the heart rate.

-Deep pericardial sutures and the use of specialized instruments to prop the heart in a position that will allow the surgeon to access occluded arteries

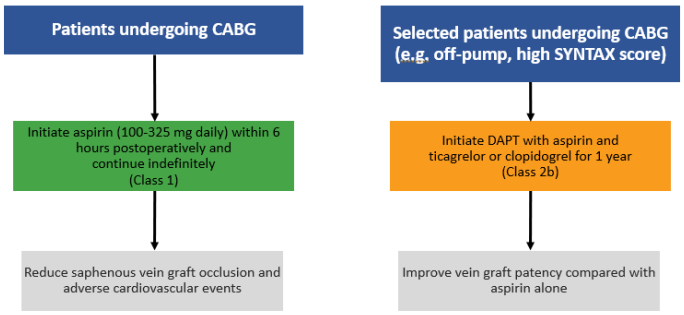


Instrumentation

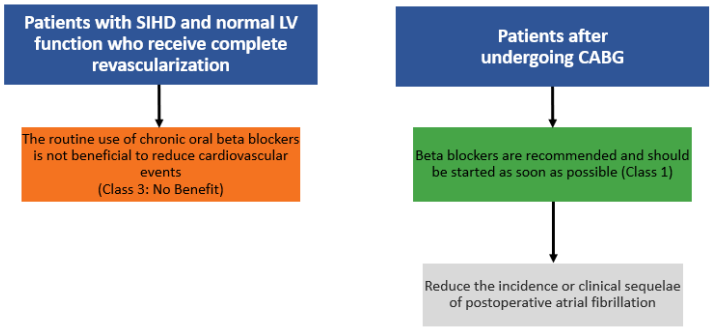
Octopus Device  	**Has multiple small suction cups that are applied to the heart surface.** **When suction is turned on, the cups stick to the surface, and hold the heart steady, with movement being less than 1 mm.**	It is fixed around coronay so the 2 fingers of the device will limit the motion of that part
Star fish Device  	**When suction is turned on, the cups stick to the surface, and hold the heart steady**	It is put on the apex and be moved to the point of surgical intervention

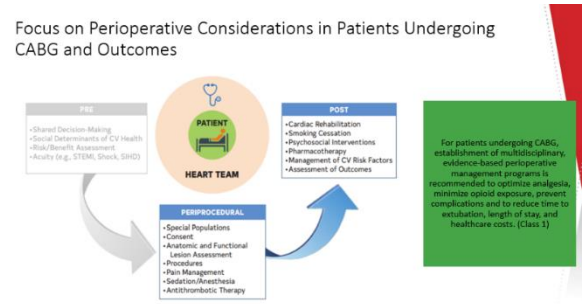


Antiplatelet Therapy in Patients After CABG



Beta Blockers in Patients After Revascularization





Take-Home Messages

2021 Guideline for Coronary Artery Revascularizatio

- Treatment decisions with regard to coronary revascularization in patients with coronary artery disease should be based on clinical indications, REGARDLESS OF SEX, RACE, OR ETHNICITY, because there is no evidence that some patients benefit less than others, and efforts to reduce disparities of care are warranted

- In patients being considered for coronary revascularization for whom the optimal treatment strategy is unclear, a multidisciplinary HEART TEAM approach is recommended. Treatment decisions should be patient centered, incorporate patient preferences and goals, and include shared decision-making

- Patients with significant LEFT MAIN DISEASE, SURGICAL REVASCULARIZATION is indicated to improve survival relative to that likely to be achieved with medical therapy. Percutaneous revascularization is a reasonable option to improve survival,

compared with medical therapy, in selected patients with low to medium anatomic complexity of coronary artery disease and left main disease that is equally suitable for surgical or percutaneous revascularization.

- Updated evidence from contemporary trials supplement older evidence with regard to mortality benefit of revascularization in patients with stable ischemic heart disease, normal left ventricular ejection fraction, and triple-vessel coronary artery disease. Surgical revascularization may be reasonable to improve survival. A survival benefit with percutaneous revascularization is uncertain. Revascularization decisions are based on consideration of disease complexity, technical feasibility of treatment, and a Heart Team discussion

- The use of a RADIAL ARTERY as a surgical revascularization conduit is preferred to the use of a saphenous vein conduit to bypass the second most important target vessel with significant stenosis after the left anterior descending coronary artery. Benefits include superior patency, reduced adverse cardiac events, and improved survival

- Revascularization decisions in patients with diabetes and multivessel coronary artery disease are optimized by the use of a Heart Team approach. Patients with DIABETES WHO HAVE TRIPLE-VESSEL DISEASE SHOULD UNDERGO SURGICAL REVASCULARIZATION; percutaneous coronary intervention may be considered if they are poor candidates for surgery

The end

Indication for CABG:

a) Single artery disease without distal main left coronary
b) Double artery diseases without distal left coronary
c) Triple arteries disease without distal left coronary
d) Triple arteries diseases with distal main left coronary

Best conduit for coronary aortic bypass:

a) Radial artery
b) Left internal thoracic artery

Additional:CABG:

What is it?Coronary Artery Bypass Grafting

What are the indications?Left main disease≥2-vessel disease (especially diabetics)Unstable or disabling angina unresponsive to medical therapy/PTCAPostinfarct anginaCoronary artery rupture, dissection, thrombosis after PTCA

CABG vs. PTCA ± stents?CABG = Survival improvement for diabetics and ≥2-vessel disease, ↑ short-term morbidityPTCA = ↓ short-term morbidity, ↓ cost, ↓ hospital stay, ↑ reintervention, ↑postprocedure angina

What procedures are most often used in the treatment?Coronary arteries grafted (usually 3 to 6): internal mammary pedicle graft andsaphenous vein free graft are most often used (IMA 95% 10-year patency vs.50% with saphenous)

What medications should almost every patient be given afterCABG?Aspirin, β-blocker Can a CABG be performed off cardiopulmonary bypass?Yes, today they are performed with or without bypass

V2:check the highlighted