

# Protection against DVT and PE in Surgical patients

**Done By :**

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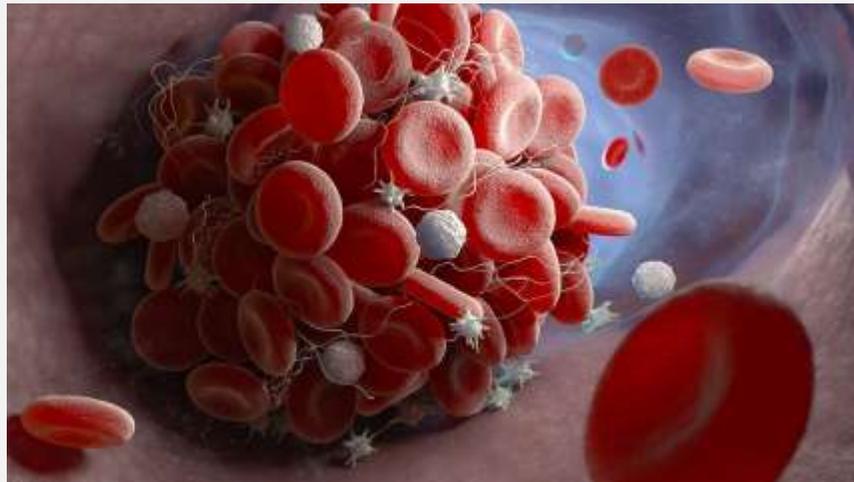
**Baha'a nsirat**

**Roa'a abufaris**

**Lina ma'ani**

**Ali alomari**

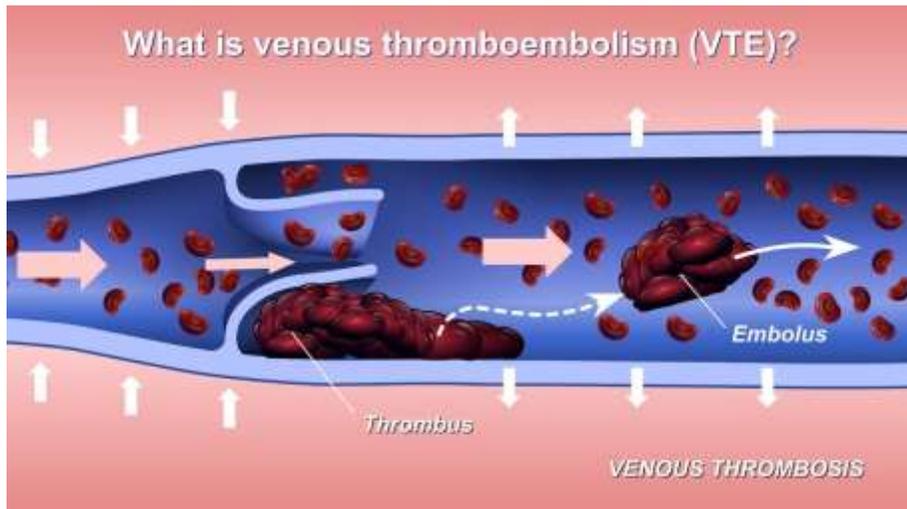
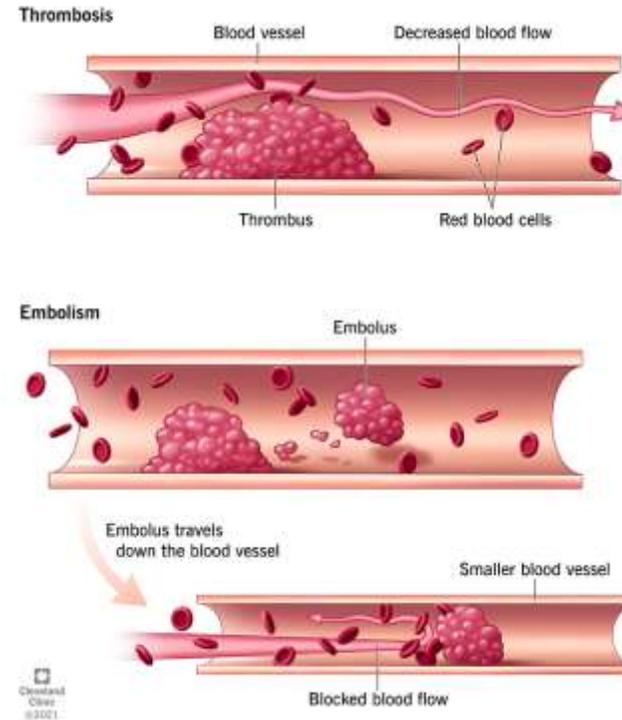
**Ali abuabbas**



- **PE and DVT** considered as a continuum of one clinical entity which is

“ **VENOUS THROMBOEMBOLISM** “

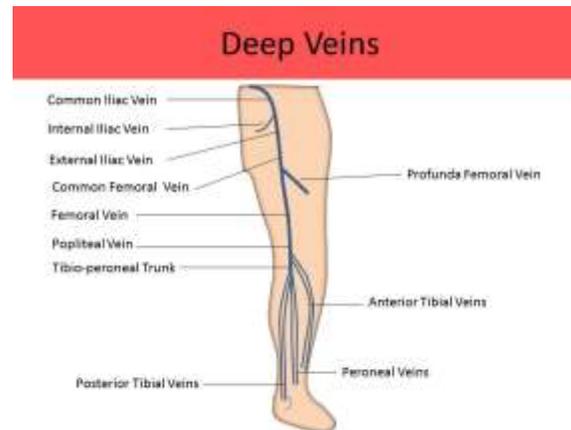
- **VTE** is an important and common complication of general surgery
- it is the most common direct cause of death in surgical patients !



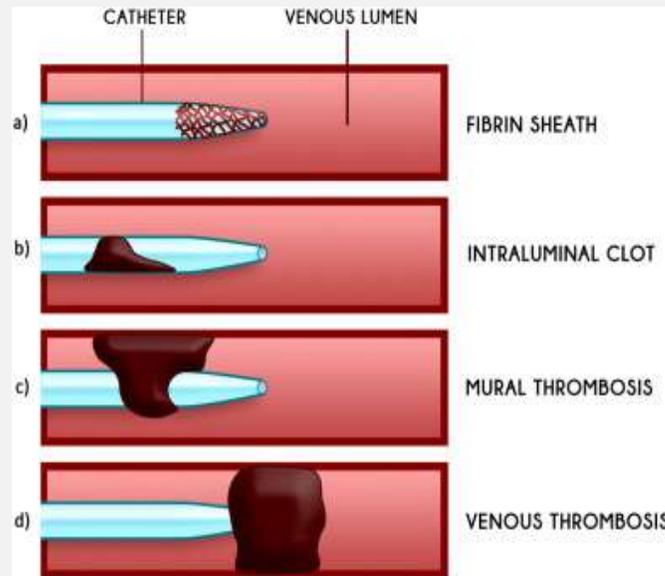
VTE – Refers to a blood clot that starts in veins !

# - INTRODUCTION -

- Venous thrombosis is the formation of a **semisolid coagulum** within the venous system and may occur in the superficial system (**superficial thrombophlebitis**) or the deep system (**DVT**) ,
- A common form of venous thrombosis is deep vein thrombosis when a blood clot forms in the deep veins. If a thrombus breaks off (**embolizes**) and flows towards the lungs, it can become a pulmonary embolism (**PE**), a blood clot in the lungs.
- Usually it affects lower extremities (The **femoral** and **popliteal veins** in the thighs - deep veins in the thigh - and the **posterior tibial** and **peroneal veins** in the calves are most commonly affected) ,

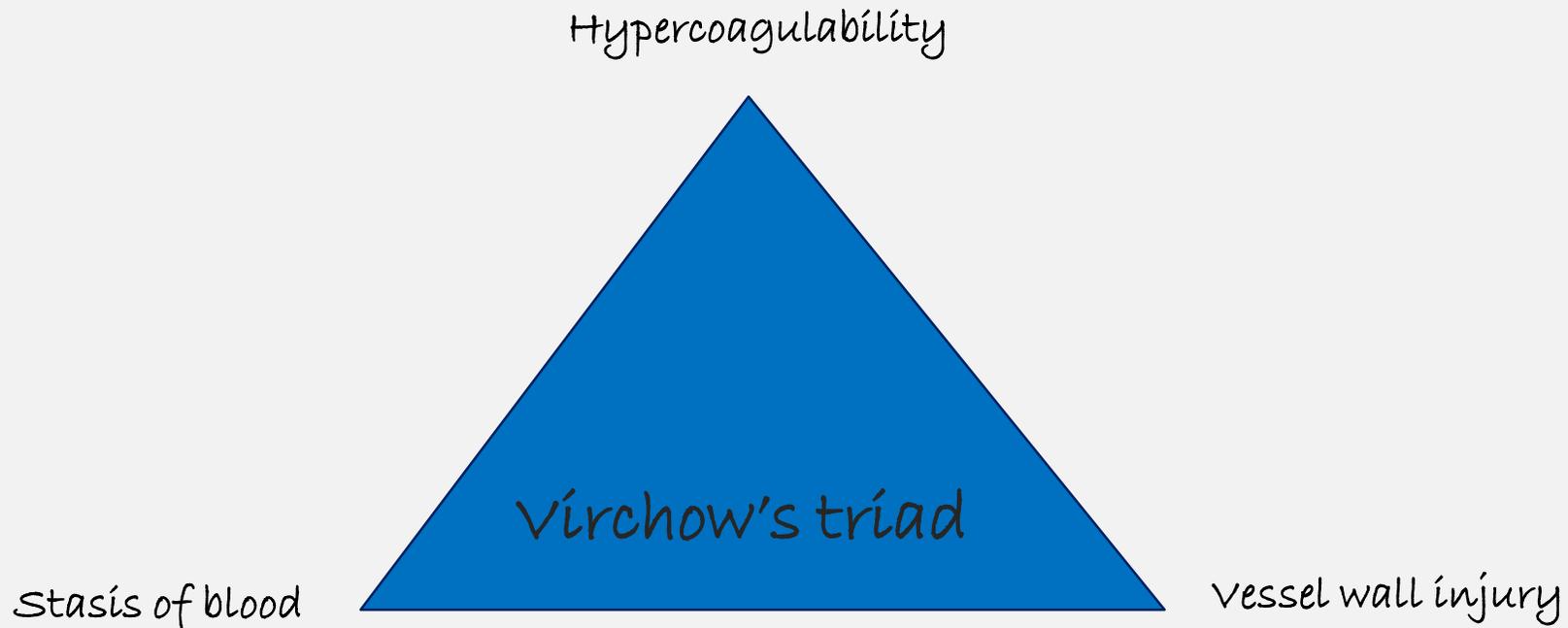


- DVT occurs less frequently in the upper extremities , but the incidence is increasing because of greater utilization of indwelling **central venous catheter**
- **Also , it maybe seen in IV drug abusers !**



- In the operative and postoperative periods, the patient has an increased predisposition to venous thrombosis in the veins of the calf muscles, the main deep venous channels of the leg and pelvic veins.

## - ETIOLOGY -



Usually , venous thrombi formed in the setting of low blood flow  
And low shear stress !  
Mainly consist of Fibrin strands , RBCs and a few platelets

# - Virchow's triad -

## **I- Venous Stasis :**

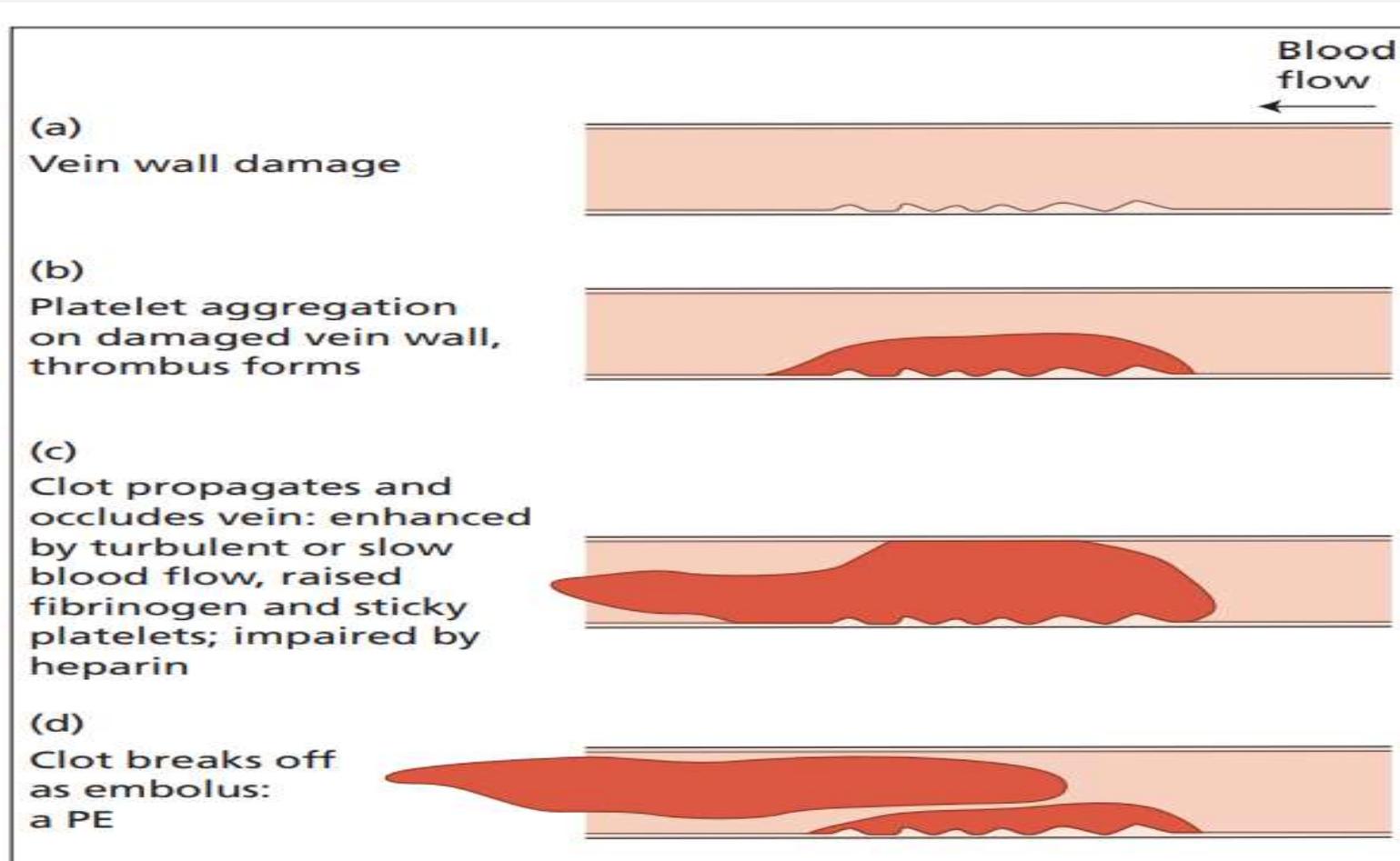
Increased stagnation within the veins occurs as a result of immobilization on the operating table and postoperatively in bed !

## **2- Hypercoagulability :**

Following blood loss and surgical trauma intraoperatively, more platelets are produced, numbers peaking around day 10. The new platelets have an increased tendency to aggregate. Fibrinogen levels also increase, predisposing to clot formation.

### 3- Vessel Wall Injury :

Damage to the vein wall prompts thrombus formation on the damaged endothelium. The damage may be due to an inflammatory process, or may be produced by direct damage at operation (particularly the pelvic veins during pelvic procedures) !



## **Patient Related Factor:**

- 1- Age >40
- 2- Obesity: BMI >30
- 3- Acquired prothrombophilias disorders
- 4- Immobility
- 5- Pregnancy
- 6- Previous DVT or PE
- 7- Thrombophilia
- 8- Cancer

# Diseases or surgical procedure

## Absolute risk of deep vein thrombosis in hospital inpatients

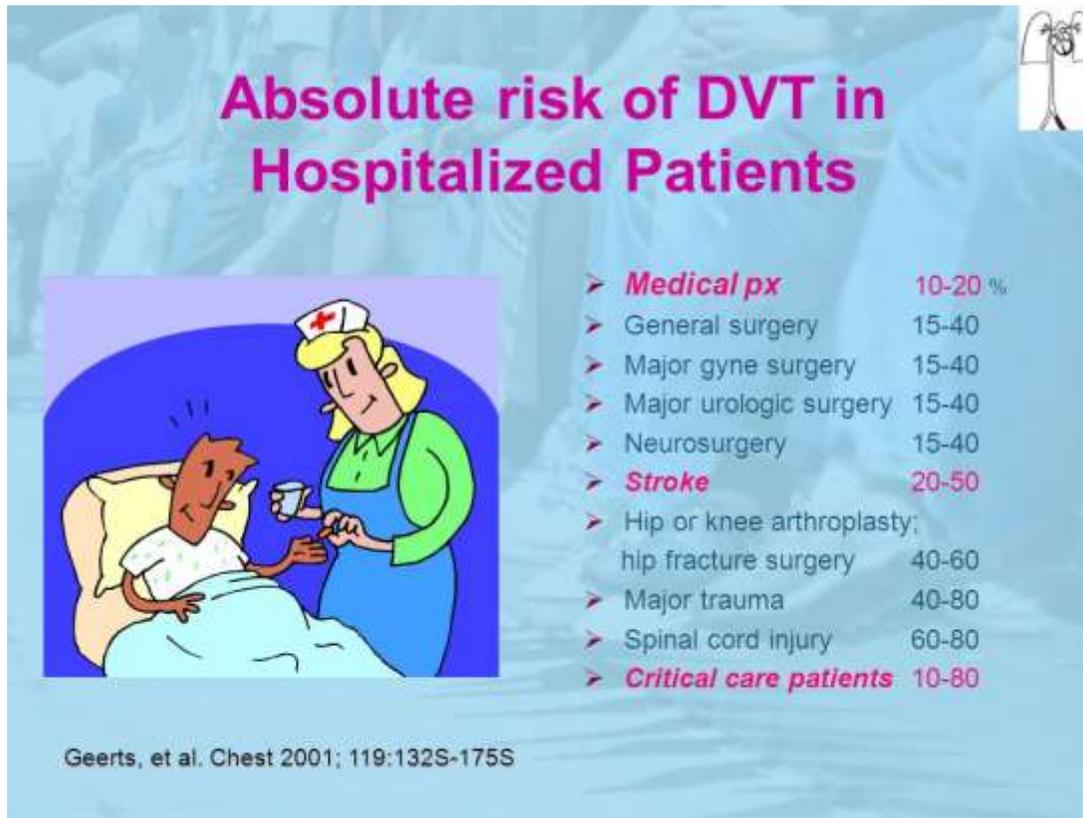


Table 57.2 Abnormalities of thrombosis and fibrinolysis (thrombophilia) that lead to an increased risk of venous thrombosis.

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Congenital	Deficiency of antithrombin III, protein C or protein S Antiphospholipid antibody or lupus anticoagulant Factor V Leiden gene defect or activated protein C resistance Dysfibrinogenaemias
Acquired	Antiphospholipid antibody or lupus anticoagulant

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- The **most important risk factor** is a **hospital admission** for treatment of a medical or surgical condition
- The male-to-female ratio is **1.2:1**, indicating that males have a higher risk of DVT than females.
- Most often , PE is clinically silent ! Recurrences are common
- PE considers the most danderous complication of DVTs !

# Diagnosis

- **History**

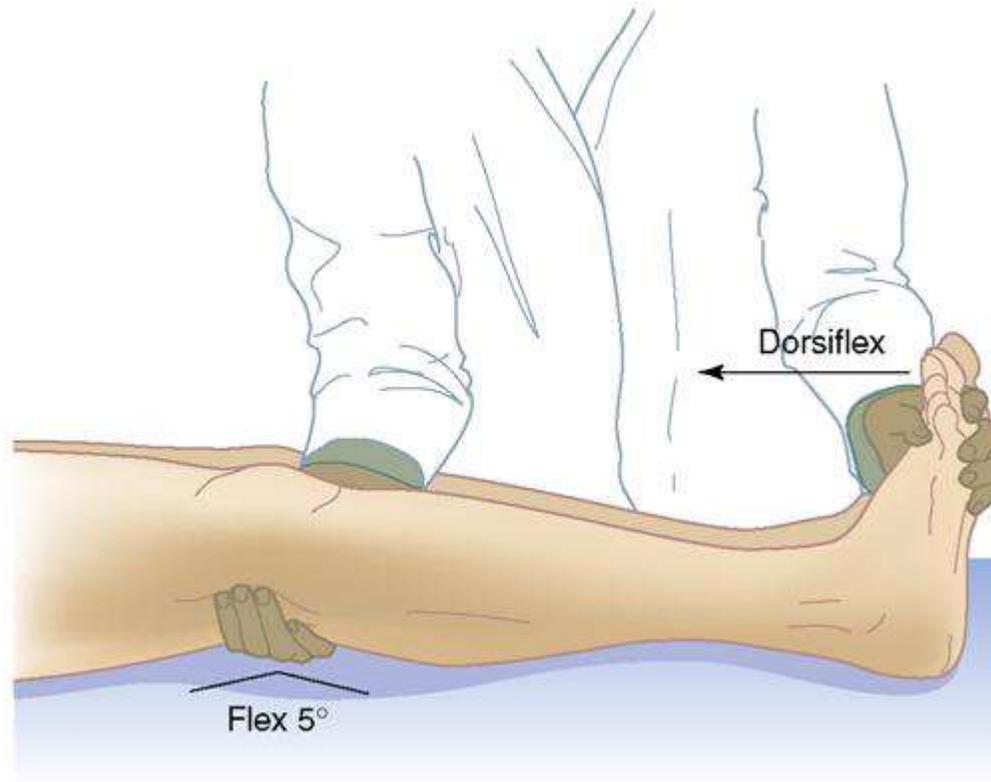
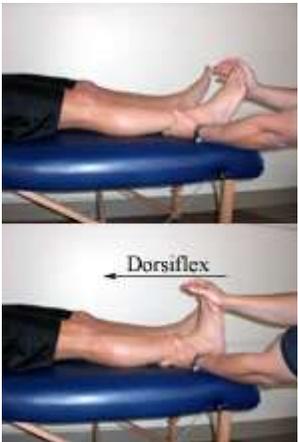
- Most common presentation , unilateral severe sudden leg pain ( especially in the calf ) and swelling.
- Some patients have no symptoms of thrombosis and may first present with signs of a pulmonary embolus, e.g. pleuritic chest pain, hemoptysis and shortness of breath.
- DVT can be silent , but typically the symptoms and signs occur during the 2nd postoperative week, although they may occur earlier or later.
- Bilateral deep vein thromboses are common, occurring in up to 30 per cent.
- When the swelling is bilateral, deep vein thromboses must be differentiated from other causes of systemic oedema, such as hypoproteinaemia, renal failure and heart failure.

# Diagnosis

- **Physical examination**
  - Swelling and mild pitting edema of the ankle
  - Dilated superficial veins
  - A stiff calf and tenderness
  - Pain in the calf
  - Raised skin temperature
  - **Pulmonary Embolism** : cyanosis, dyspnea, raised neck veins, a fixed split second heart sound and a pleural rub.
  - If the pelvic veins or the femoral vein are affected, there is massive swelling of the whole lower limb.

## Homan's sign: a sign of DVT ?

- Homans's sign is often used in the diagnosis of deep venous thrombosis of the leg. A positive Homans's sign (calf pain at dorsiflexion of the foot) is thought to be associated with the presence of thrombosis.
- The Homan's sign is classic yet insensitive test for DVT



# Investigation

The diagnosis of DVT and pulmonary embolus should be established by special investigations as the symptoms and signs are non-specific and may be absent

## Well's criteria

- The model should be **applied only after** a history and physical suggests that venous thromboembolism is a diagnostic possibility.

## Wells criteria and modified Wells criteria: Clinical assessment for pulmonary embolism

▪ Clinical symptoms of DVT (leg swelling, pain with palpation)	3.0
▪ Other diagnosis less likely than pulmonary embolism	3.0
▪ Heart rate >100	1.5
▪ Immobilization ( $\geq 3$ days) or surgery in the previous four weeks	1.5
▪ Previous DVT/PE	1.5
▪ Hemoptysis	1.0
▪ Malignancy	1.0
<b>Probability</b>	<b>Score</b>
<b>Traditional clinical probability assessment (Wells criteria)</b>	
High	>6.0
Moderate	2.0 to 6.0
Low	<2.0
<b>Simplified clinical probability assessment (Modified Wells criteria)</b>	
PE likely	>4.0
PE unlikely	$\leq 4.0$

# D-dimer

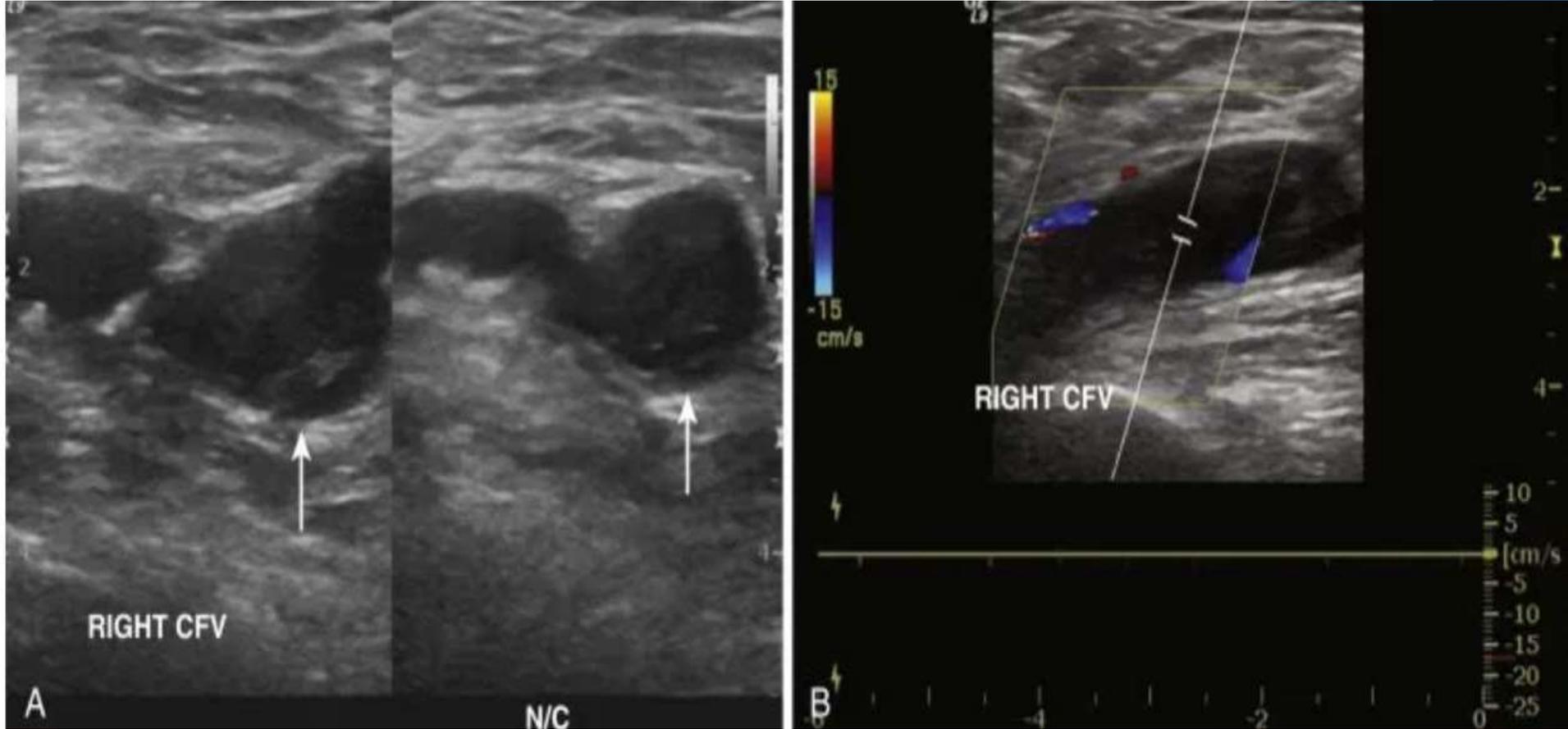
- ▶ Blood work maybe done initially including a test called D-dimer which detects **clotting activity**
- ▶ D-Dimer is used as an initial screening test in the emergency department to diagnose patients who have signs, or symptoms suggestive of venous thromboembolism (VTE). **Sensitive not specific**
- ▶ D-dimer level **>2.0 µg/ml** was found in patients with DVT

# Ultrasonography

- Specificity of **98%** for proximal DVT, and **94%** sensitivity and **75%** specificity for distal venous thrombosis.
- In skilled hands, duplex scanning can detect thrombi in all the major veins at and above the knee, but is less reliable below this. It has the advantage that it is simple and non-invasive.
- Imaging of the **proximal leg veins** with compression ultrasound is preferred over whole-leg ultrasound.

A- Ultrasound examination of the right common femoral vein (CFV) demonstrates an enlarged vein (arrows). The vein is noncompressible (N/C).

B- Corresponding color flow and spectral Doppler image shows an absence of color flow and suggests no flow within the vein



# Ascending Venography

- ▶ Venography (also called phlebography or ascending phlebography) is a procedure in which an x-ray of the veins, a venogram, is taken after a special dye is injected into the bone marrow or veins. The dye has to be injected constantly via a catheter, making it an invasive procedure.
- ▶ It has been replaced by ultrasonography for extremity DVT

Acute  
Thrombus  
is seen as a  
filling  
defect  
within the  
contrast-  
filled  
lumen



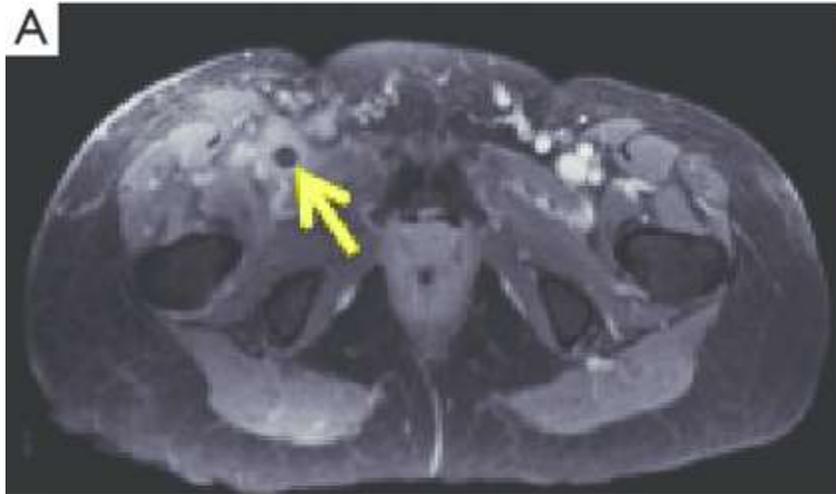
# Computed Tomography Venography

- ▶ allow visualization of central thoracic and abdomino-pelvic veins that are often obscured on ultrasound



# MR venography

- ▶ An MRV uses magnetic resonance technology and intravenous (IV) contrast dye to visualize the veins



# Management

The background features abstract geometric shapes in various shades of blue and green. A prominent dark blue vertical bar is on the right side. The word 'Management' is centered in a bold green font.

**Low Risk Wells ( $\leq 0$ )**

**D-dimer  
(Preferred)**

+

**Ultrasound<sup>†</sup>**

**No Treatment**

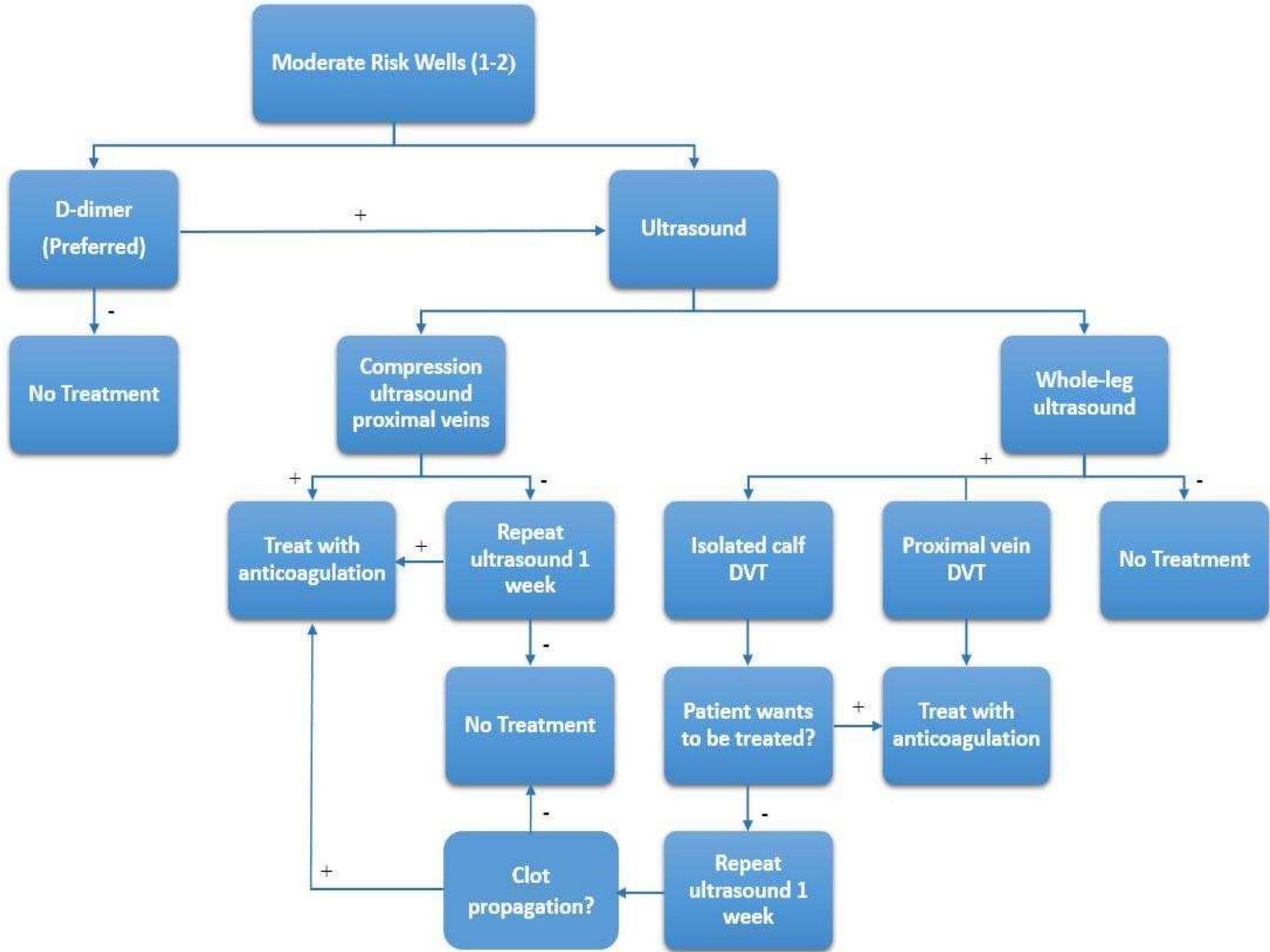
-

**Treat with  
anticoagulation**

+

**No Treatment**

-



High risk Wells (> 2)

Whole-leg  
ultrasound

Compression  
ultrasound  
proximal veins

Treat with  
anticoagulation

No Treatment

Treat with  
anticoagulation

D-dimer

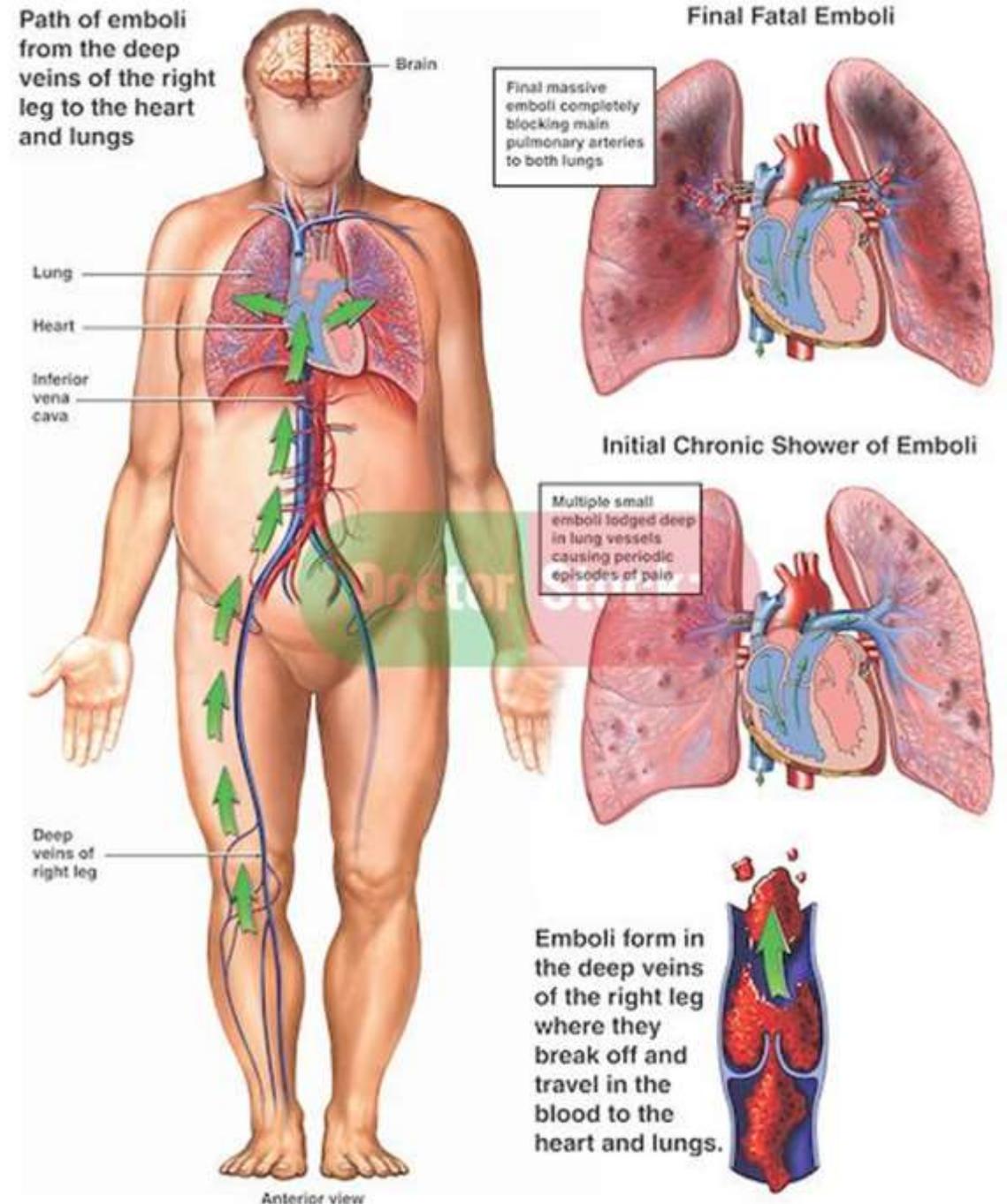
Repeat imaging  
1 week

No Treatment

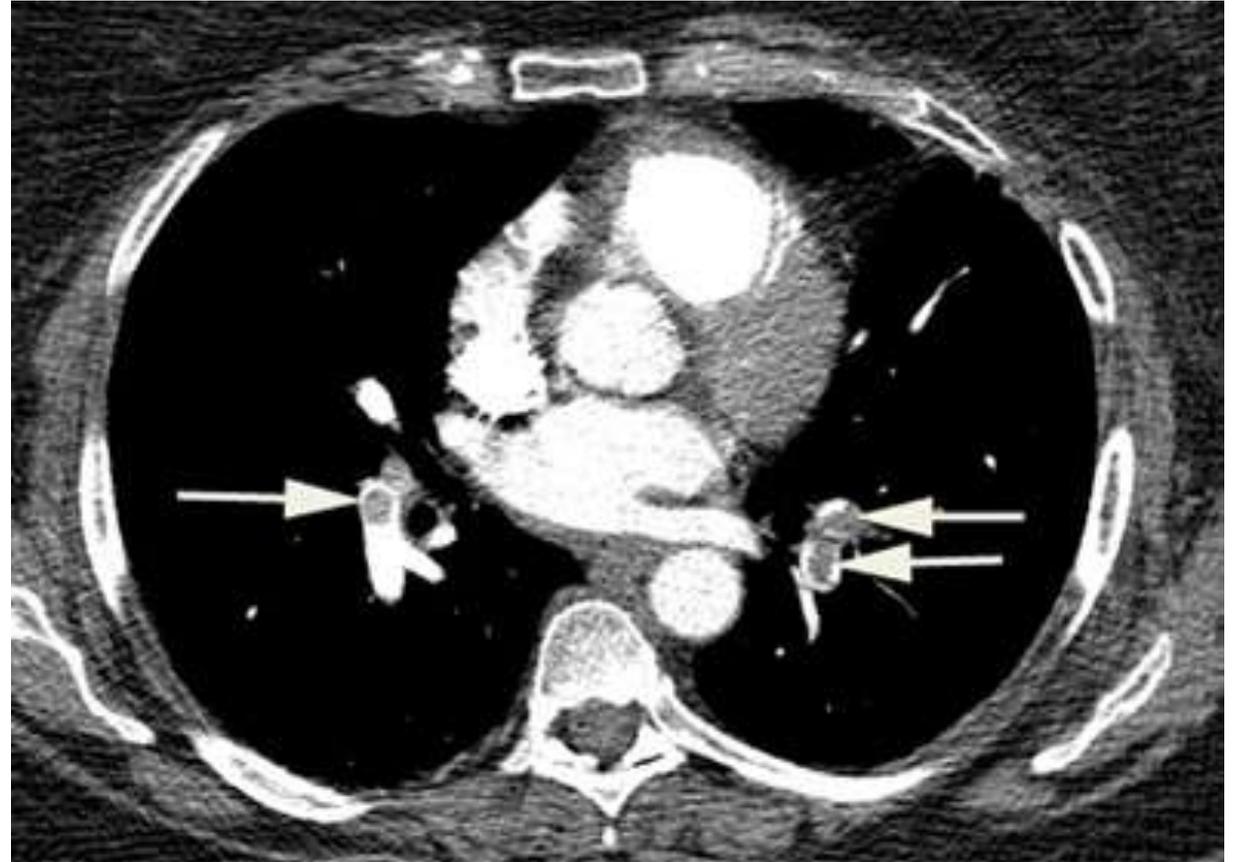
Complication

# PE PULMONARY EMBOLISM

- Symptom :
  - Dyspnea
  - Sudden chest pain ( pleuritic )
  - Cough
  - Haemoptysis
- Signs :
  - Tachycardia
  - Tachypnea
  - If massive may – shock – circulatory collapsed

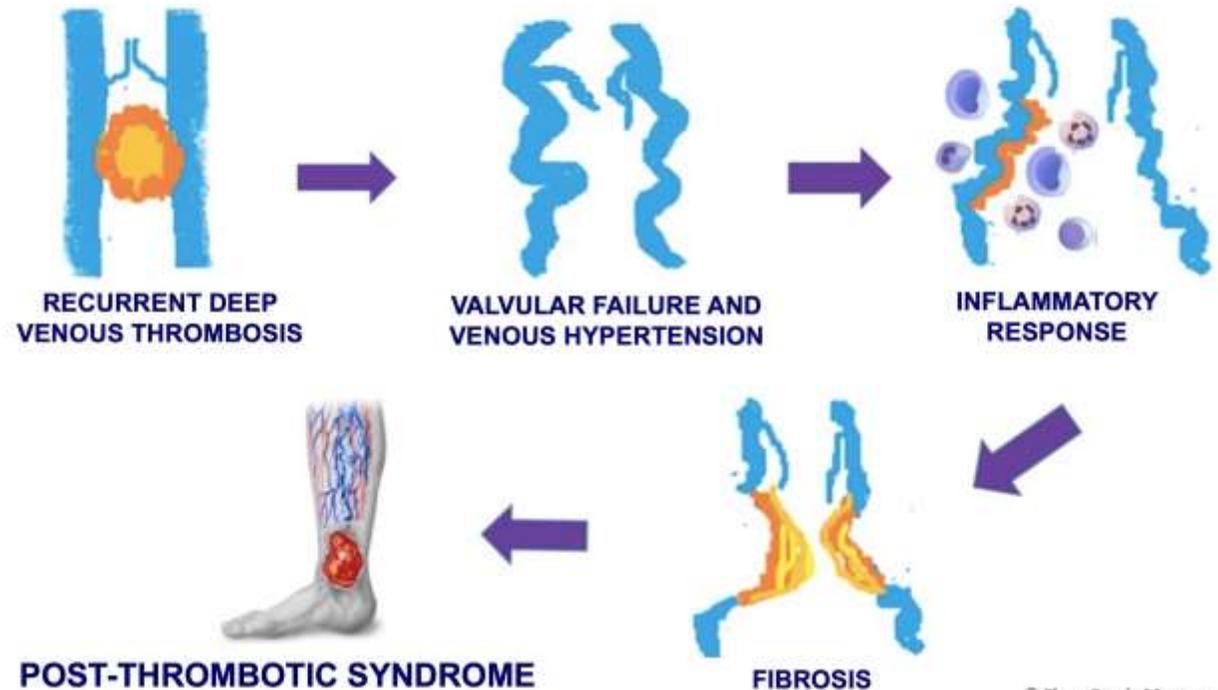


CTA is gold standard for diagnosis



# CVI : chronic venous insufficiency – post thrombotic syndrome – postphlebotic syndrome

- Valve incompetence
- Gravitational pressure of the blood column – transmitted to the ankle .
- Affect superficial-deep venous system .
- Leads to ?

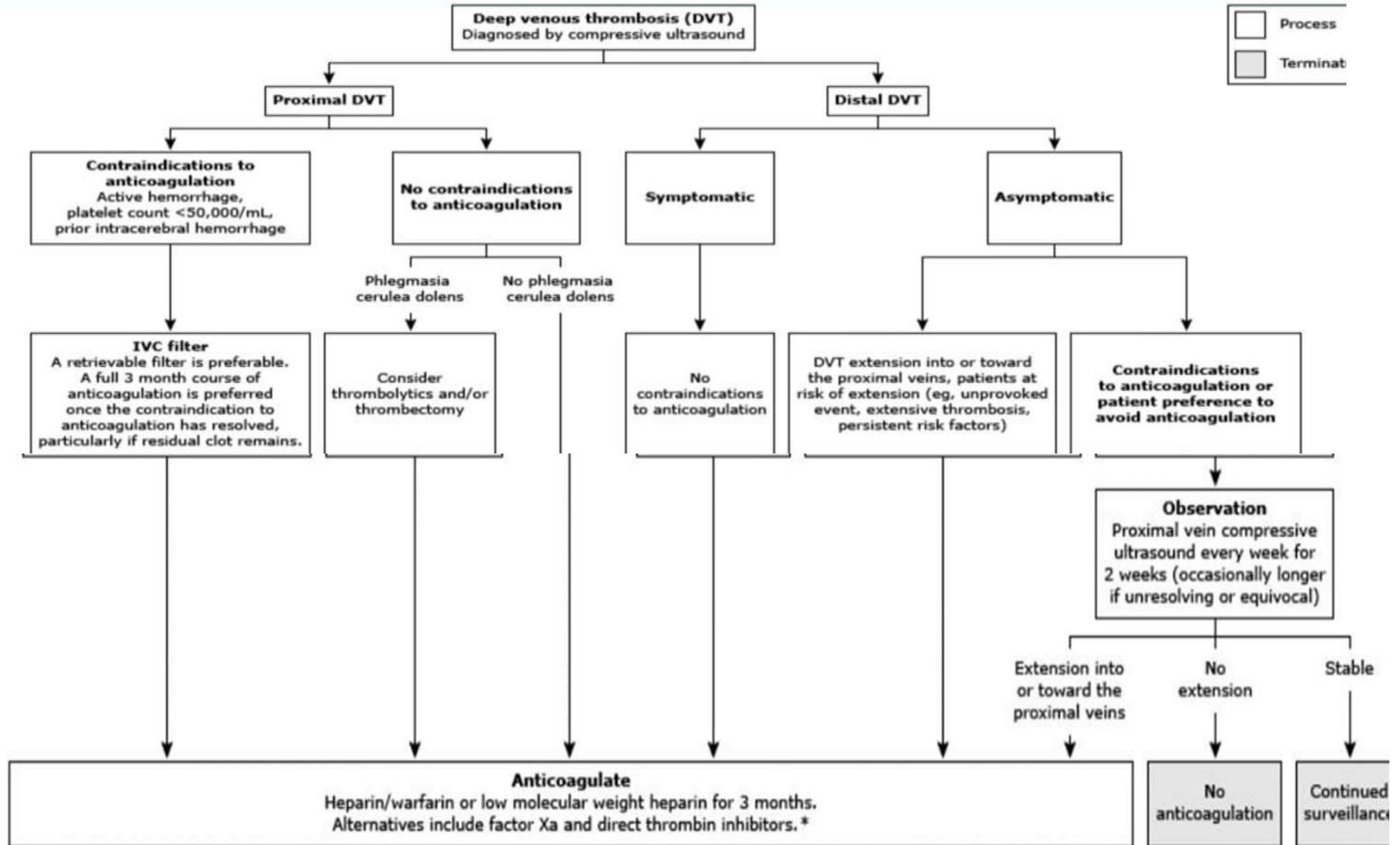


# Venous HTN – low capillary blood flow and hypoxia

pt come with : leg swelling – pain – ulcers – discoloration



# Algorithm for the treatment of lower extremity deep venous thrombosis (DVT)



# PROPHYLAXIS

Patients who are being admitted for surgery can be graded as

1-low

2- moderate

3- high risk

<u>Each risk factor = 1 point</u>	<u>Each risk factor = 2 points</u>	<u>Each risk factor = 3 points</u>	
<ul style="list-style-type: none"> <li>• Age 40-59 years</li> <li>• Minor surgery planned</li> <li>• BMI <math>\geq 30\text{kg/m}^2</math></li> <li>• History of prior major surgery (&lt;1 month)</li> <li>• Swollen legs (current)</li> <li>• Varicose veins</li> <li>• Sepsis (&lt;1 month)</li> <li>• Abnormal pulmonary function (COPD)</li> <li>• Acute myocardial infarction (&lt;1 month)</li> <li>• Congestive heart failure (&lt;1 month)</li> <li>• History of IBD</li> <li>• Medical patient currently at bed rest</li> </ul>	<ul style="list-style-type: none"> <li>• Age 60 – 74 years</li> <li>• Arthroscopic surgery</li> <li>• Major open surgery (&gt; 45 minutes)</li> <li>• Laparoscopic surgery (&gt; 45 minutes)</li> <li>• Prior cancer (except non-melanoma skin cancer)</li> <li>• Present cancer (except breast and thyroid)</li> <li>• Confined to bed (&gt;72 hours)</li> <li>• Immobilizing plaster cast</li> <li>• Central venous access</li> </ul>	<ul style="list-style-type: none"> <li>• Age <math>\geq 75</math> years</li> <li>• History of VTE</li> <li>• Family history of VTE</li> <li>• Present chemotherapy</li> <li>• Positive Factor V Leiden</li> <li>• Positive Prothrombin 20210A</li> <li>• Positive Lupus anticoagulant</li> <li>• Elevated anticardiolipin antibodies</li> <li>• Elevated serum homocysteine</li> <li>• Heparin-induced thrombocytopenia (HIT)</li> <li>• Other congenital or acquired thrombophilias</li> </ul>	
<u>For women only (1 point each)</u> <ul style="list-style-type: none"> <li>• Pregnant or post-partum</li> <li>• History of unexplained or recurrent spontaneous abortion</li> <li>• Oral contraceptives or hormone replacement therapy</li> </ul>	<b>Caprini risk category based on total risk score</b>		<u>Each risk factor = 5 points</u> <ul style="list-style-type: none"> <li>• Major surgery lasting &gt; 6 hours</li> <li>• Stroke (&lt;1 month)</li> <li>• Elective major lower extremity arthroplasty</li> <li>• Hip, pelvis, leg fracture (&lt; 1 month)</li> <li>• Acute spinal cord fracture or paralysis (&lt; 1 month)</li> <li>• Multiple traumas (&lt; 1 month)</li> </ul>
	Total score	Category	
	0 - 4	Low	
	5 - 8	Moderate	
$\geq 9$	High		

## Caprini score vs Wells score

**caprini score:** a risk assessment tool for the occurrence of venous thromboembolism among surgical patients

**wells score:** a number that reflects your risk of developing deep vein thrombosis (DVT)

- Patients on Low risk only ambulation recommendation
- Patients in the medium or high risk groups should be considered for anticoagulation prophylaxis.

☐ Prophylactic methods : ambulation, mechanical and pharmacological.

Age group	No. of patients
<40 years	33 %
41-60 years	36 %
61-74 years	22 %
>74 years	9 %

**TABLE 1: Age wise distribution of patients**

Type of SURGERY	No. of patients
General Surgical procedures	29%
Laparoscopy	7%
Ortho-including hip and knee surgeries	22%
Malignancy-breast, stomach, colon & rectum	8%
Gynaecological procedures	17%
Plastic & reconstructive surgeries	9%
Urological procedures	8%

**TABLE 2: Distribution of patients according to the type of surgery**

Level of risk According to caprini's model	Suggested prophylaxis according to guidelines	No. of patients	Prophylaxis given
Very low Score 0-1	No specific measures; early ambulation	31	No measures-19 Early ambulation-12
Low Score 2	ES, IPC, LDUH (5000U BID), OR LMWH (<3400 u)	16	Es-3, Early ambulation-5
Moderate Score 3-4	IPC, LDUH (5000U TID), OR LMWH (>3400u)	24	Es-8, ipc-2, lmwh-5, Early ambulation-4
High Score: 5 or More	LDUH, LMWH (>3400 U), warfarin, Or FXA i alone or in Combination with ES or IPC	29	LMWH -7 LMWH + ES -6 LMWH + IPC-4 LDUH-1 FXA I-1 ES-4

**Table 3: distribution according to caprini's VTE risk assessment and prophylaxis given**

# Ambulation

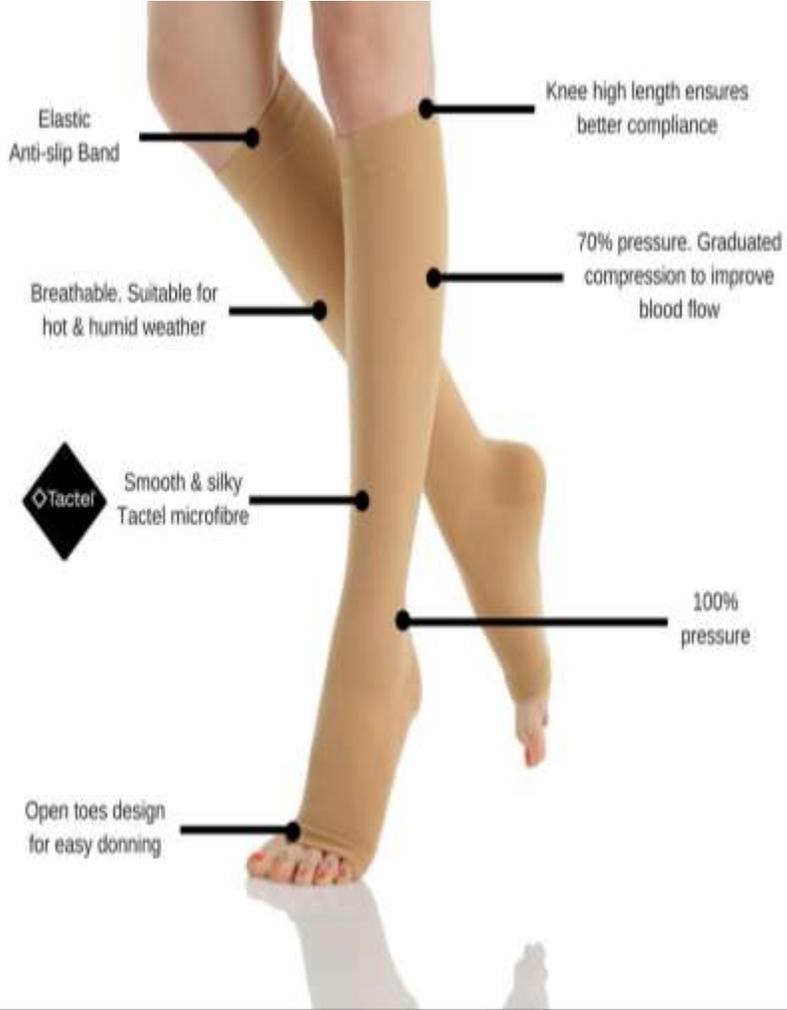
Main goal is to avoid Prolonged bed rest which is one of the DVT major risk factors



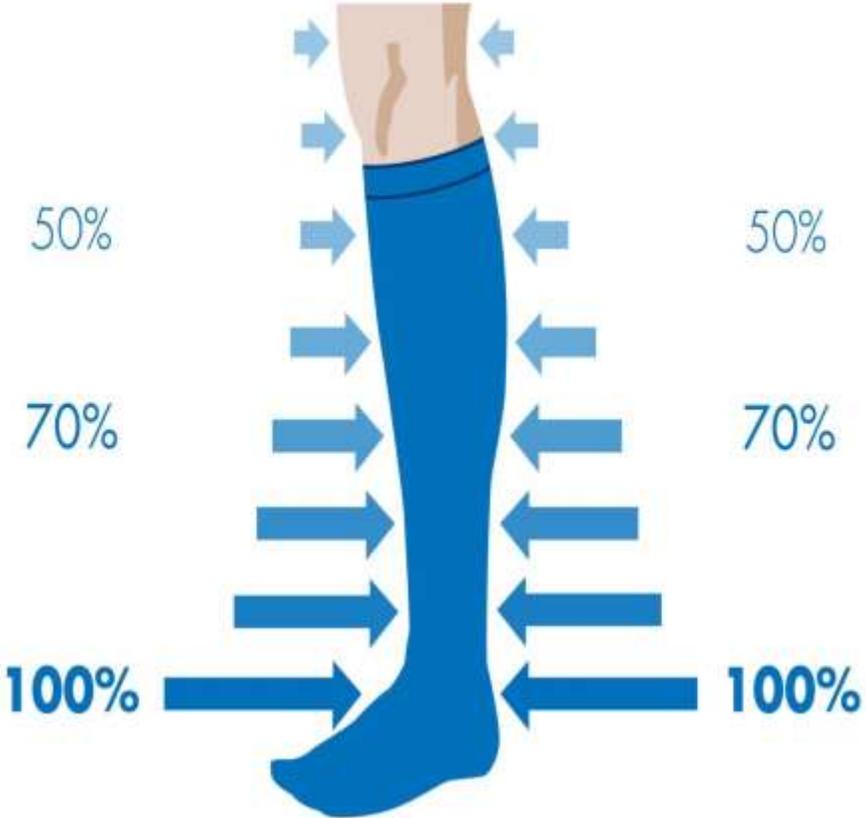
## Mechanical

- prophylaxis involves the use of **graduated compression stockings (GCS)**, **intermittent pneumatic compression (IPC)** and **venous foot pumps** to improve blood flow in the deep veins of the leg & reduce stasis within leg veins

# graduated compression stockings (GCS)



Percentage of Graduated Compression



# intermittent pneumatic compression





venous foot pumps



Impulse wave from  
intermittent  
pneumatic compression

Venous foot  
plexus

# Summary

Risk group	Procedures	Thromboprophylaxis
Low	Major surgery in age <40 yr, Minor surgery in age <60 yr	Early ambulation
Moderate	Major surgery in age >40 yr or with risk factor, Non-major surgery in age >60 yr or with risk factor	GCS, IPC, LMWH, LDUH, or Fondaparinux
High	Major cancer surgery with additional risk factor, Major surgery in patients with previous VTE or thrombophilia	LMWH, Warfarin, or Fondaparinux; IPC*

\*Recommended in patients with a risk of bleeding; consider switching to anticoagulants when the bleeding risk abates.

VTE, venous thromboembolism; GCS, graduated compression stockings; IPC, intermittent pneumatic compression; LMWH, low-molecular-weight heparin; LDUH, low-dose unfractionated heparin; VTE, venous thromboembolism.