Future directions of research in Venous Thromboembolism and Pulmonary Embolism

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Objectives

Future directions of research in :

- The role of dyslipidemia and statins in venous thromboembolism.
- Effectiveness of Intermittent Pneumatic Compression Devices for Venous Thromboembolism prophylaxis in high-risk surgical & medical patients
- IVC Filters: Challenges and Future Directions

The role of dyslipidemia and statins in venous thromboembolism

- Concentrations of total serum cholesterol and Lp(a) may be important risk factors for VTE.
- Specimen collection remote from the initial VTE event may be important, since lipids are known to decline in the presence of acute vascular events, such as VTE or myocardial infarction.
- Future studies could help to clarify whether dyslipidemia is a causal risk factor for VTE and, if so, which lipid molecule is most thrombogenic.

The role of dyslipidemia and statins in venous thromboembolism

- Recent studies suggest that statins may alter elements within the vascular endothelium and coagulation cascade in a manner consistent with an antithrombotic effect.
- One hypothesis to explain these effects is that these agents inhibit platelet-derived protease-activated receptor-1 (PAR-1) and tissue factor upregulation, leading to thrombin generation.
- Others have demonstrated a reduction in concentrations of soluble thrombomodulin with statin use. There may also be a rapid biological effect of statins on endothelial barrier permeability and nitric oxide production.

The role of dyslipidemia and statins in venous thromboembolism

- **Why might lipids induce venous thrombosis?**

Before the routine use of acetylsalicylic acid (ASA) and heparin, patients with acute myocardial infarction previously experienced high rates of VTE, often independent of their degree of immobilization during the recovery period.

- Dyslipidemia was also found to be a major prognostic risk factor for saphenous vein graft disease in the Post-coronary Artery Bypass Graft (Post-CABG).

The role of dyslipidemia and statins in venous thromboembolism

- **Why might statins reduce the risk of venous thrombosis?**

Because these agents are also effective in individuals with 'normal' baseline lipid measurements, it has been suggested that they also possess antithrombotic and anti-inflammatory properties.

Effectiveness of Intermittent Pneumatic Compression Devices for Venous Thromboembolism prophylaxis

- **Intermittent pneumatic compression** is a therapeutic technique used in medical devices that include an air pump and inflatable auxiliary sleeves, gloves or boots in a system designed to improve venous circulation in the limbs of patients who suffer the risk of (DVT) or (PE).
- In use, an inflatable jacket (sleeve, glove or boot) encloses the limb requiring treatment, and pressure lines are connected between the jacket and the air pump. When activated, the pump fills the air chambers of the jacket in order to pressurize the tissues in the limb, thereby forcing blood and lymph, out of the pressurized area. A short time later, the pressure is reduced, allowing increased blood flow back into the limb.
- The primary functional aim of the device is to ensure the movement of venous blood.

Effectiveness of Intermittent Pneumatic Compression Devices for Venous Thromboembolism prophylaxis

- There are a wide variety of IPCDs available, but it is uncertain if they vary in effectiveness or ease of use.

- Different types of intermittent pneumatic compression (IPC) devices have been used for thrombosis prophylaxis in patients following THR.
- Available devices differ in compression garments, location of air bladders, patterns of pump pressure cycles, compression profiles, cycle length, duration of inflation time and deflation time, or cycling mode such as automatic or constant cycling devices.

Effectiveness of Intermittent Pneumatic Compression Devices for Venous Thromboembolism prophylaxis

- Despite the widely accepted use of IPC for the treatment of arterial and venous diseases, the relative effectiveness of different types of IPC systems as prophylaxis against thrombosis after THR is still unclear.

IVC Filters: Challenges and Future Directions

- Since their introduction in 1973, inferior vena cava filters use has expanded due to broader indications for insertion. We will focus on the challenges and future directions of this trend, including a closer look at complications, retrieval rates, and cost-effectiveness.
- IVC filter placement as a mode of PE prevention is well supported by recent guidelines. There are widely accepted indications for IVC filter placement.

IVC Filters: Challenges and Future Directions

- (i)Absolute indications:

  (a)inability to anticoagulate with documented PE, IVC, iliac, femoral, or popliteal DVT

  (b)recurrent PE on therapeutic anticoagulation.

  (c)bleeding complications on anticoagulation for PE/DVT.

- (ii)Relative indications:

  (a)free floating IVC/Iliac thrombus

  (b)septic pulmonary embolism.

  (c)extension of DVT on adequate anticoagulation

  (d)high risk for complications from anticoagulation for DVT/PE

  (e)massive PE or large DVT with limited reserve for further insult

  (f)recurrent PE with IVC filter.

  (g)recent DVT undergoing major surgery or thrombolysis

  (h)pregnancy with proximal DVT.

IVC Filters: Challenges and Future Directions

- However, over the last decade, the ease of use and retrievability of modern IVC filters have had the effect of lowering the threshold for device insertion in many clinical settings.
- Because of this trend, a closer look at complications, retrieval rates, and cost-effectiveness of IVC filter placement has been the focus of the future directions of research.

IVC Filters: Challenges and Future Directions

- Complications of IVC Filter Placement:

Insertion site DVT and rarely bleeding .

Long-term complications(Insertion site thrombosis/DVT .

Filter fracture, embolization from IVC filter thrombi, and migrations have also been reported.

Migrations can occur if a standard 28 mm filter is placed in an IVC of more than 28 mm or during line exchanges. Immediate surgical extraction is necessary if percutaneous retrieval is difficult or dangerous.

IVC Filters: Challenges and Future Directions

- Challenging retrievals are predicted by factors that imply difficult retrieval due to endothelial proliferation or neointimal incorporation into the caval wall . The mechanism behind this response is poorly understood but creates an opportunity to modify current temporary IVC filters to more favorable retrieval attempts. Methods to reduce or document the rate of endothelial proliferation will dramatically impact more successful retrieval attempts.

IVC Filters: Challenges and Future Directions

- In patients with a documented DVT/PE, a retrievable IVC filter should be removed when a therapeutic dose of anticoagulation has been reached . This can be done without cessation of anticoagulation.

- Alternatively, prophylactic IVC filters in patients should be removed whenever the significant risk factors for DVT/PE resolve or patients can safely receive prophylactic anticoagulation.

- Retrieval rates for IVC filters have been generally low.

- Troubleshooting filter retrievals should be approached with caution. Administration of heparin is recommended with difficult retrievals as clot typically builds up around wires. Fracture or entanglement of snares/wires within the IVC filter struts is not uncommon.

IVC Filters: Challenges and Future Directions

- The cost of the procedure and device contribute to the controversy surrounding prophylactic filter use.
- Once the clinical decision has been made to insert an IVC filter, clinicians must decide on a particular filter model and type. Although the clinical scenario will likely determine the filter type (i.e., permanent versus retrievable), no randomized clinic trial between different retrievable filter models has been performed.

IVC Filters: Challenges and Future Directions

- Retrieval rates, despite the integration of institutional specific protocols, are alarmingly low. The clinical benefits of removal have not been fully elucidated, and thus, strict adherence to following these patients must be carried out to maximize retrieval rates.
- In addition, referring clinicians should be educated on the risks, benefits, alternatives, and the need for retrieval, as many are aware of the benefits of caval interruptions but not of the responsibility during and after placement.

Take Home Points

- There is a new body of evidence supporting a possible link between dyslipidemia and the development of VTE, as well as the potential for statins to reduce the risk of VTE.
- IPCDs are appropriate for VTE thromboprophylaxis when used in accordance with current clinical guidelines. The current evidence base to guide selection of a specific device or type of device is limited. When choosing a specific IPCD, focusing on device flexibility, acceptability by nursing staff and patients, and the most frequently studied devices, as well as on cost, can help direct selection of appropriate IPCDs. Comparative effectiveness studies are urgently needed to address current gaps in evidence.

Take Home Points

- The field of caval filtration has rapidly developed by changes to technology and design modification over the past 40 years to include various commercially available permanent and retrievable IVC filters placed percutaneously. Clinical trials will further compare IVC filters

advantages/disadvantages, further define indications, explore maximum patient benefit, and outline cost-effectiveness.

Thank You