PATHOPHYSIOLOGY OF DVT

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ABSTRACT

DVT has an incidence of about 200,000 cases per year, and is a major preventable condition. VTE, contributes to 60,000-100,000 deaths annually. Normal blood physiology hinges on a delicate balance between pro- and anti-coagulant factors. Virchow's Triad distills the multitude of risk factors for DVT into three basic elements favoring thrombus formation: venous stasis, vascular injury, and hypercoagulability. Anticoagulation therapy is essential for the treatment of DVT. The standard therapy for DVT has been vitamin K-antagonists such as warfarin with heparin or fractionated heparin bridging. Large-scale clinical trials have validated the use of direct oral anticoagulants (DOACs) in. We summarize the pathogenesis, diagnosis, and medical management of DVT, with particular emphasis on anticoagulation therapy and the role of DOACs in the current treatment algorithm.

METHODS

- We researched the literature and pathophysiology of DVT.
- Virchow's triad (Figure 1) consists of venous stasis, vessel wall damage, and a hypercoagulable state.

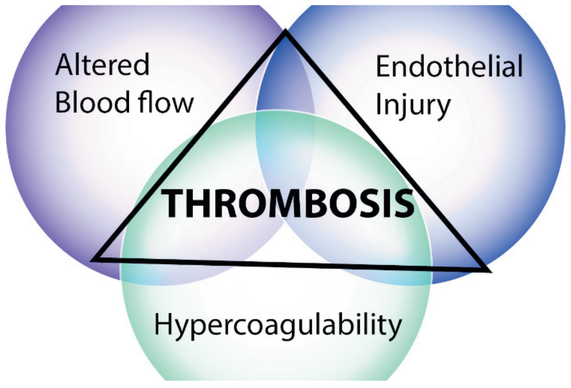

Figure 1: Virchow's Triad

RESULTS

- DVT usually begins in venous valve cusps.
- The thrombus consists of thrombin, fibrin, red blood cells, and platelets.
- Injury to the endothelium results in the formation of a thrombus, resulting in hypoxia, followed by a release of enzymes, and finally symptoms of DVT.
- Without treatment, thrombi may propagate proximally or travel to the lungs.
- Inappropriate thrombus formation is a disruption of homeostasis and may result from an alteration in any of the factors listed below.
- Endothelial injury causes subendothelial collagen exposure and platelet adherence.
- Factors contributing to the injury are hypertension, vasculitis, scarred valves, bacterial endotoxins, and chemicals from cigarette smoke. Stasis can cause endothelial injury, predisposing a patient to thrombosis.
- Hypercoagulability, caused by advancing age, surgery, fractures, burns, myocardial infarction, and cancer can put them at risk for thrombosis.
- Increased hypercoagulability causes an increase in platelet aggregation, which results in a reduction of prostacyclin, a potent vasodilator, and inhibitor of platelet aggregation that is released by the endothelium (Figure 2).
- DVT is a global problem affecting all ages, races, and genders.
- The primary problem with DVT is sluggish circulation, endothelial injury, and the release of enzymes.
- Venous thrombosis tends to occur in areas with decreased or mechanically altered blood flow such as the pockets adjacent to valves in the deep veins of the leg.
- As blood flow slows, oxygen tension declines causing hypoxia with a coincident increase in hematocrit.
- These changes fit perfectly the Virchow's hypothesis.

RESULTS, CONTD.

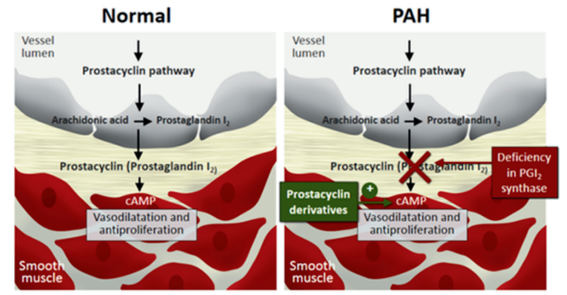

Figure 2: Prostacyclin pathway

- The hypercoagulable micro-environment that ensues may downregulate certain antithrombotic proteins that are preferentially expressed on venous valves including thrombomodulin and endothelial protein C receptor (EPCR).
- Hypoxia drives the expression of certain procoagulants.
- P-selectin, an adhesion molecule attracts immunologic cells containing tissue factors to the endothelium.
- The precise location of tissue factor in this process, whether expressed on the endothelium or by cells within the extravascular tissue is not clear.
- Thrombus formation appears to require both tissue factor and P-selectin.
- A venous thrombus has essentially two components, an inner platelet-rich white thrombus forming the so-called lines of Zahn surrounded by an outer red cell dense fibrin clot.
- As the ratio of procoagulants to anticoagulants increases, so does the risk of thrombus formation.
- The proportion of proteins is in part determined by the ratio of endothelial cell surface to blood volume.
- A decreased cell surface-to-blood volume ratio (i.e., large vessels) favors procoagulants.
- Factor VIII, von Willebrand factor, factor VII, and prothrombin seem to be particularly influential in tipping the scale towards coagulation.

RESULTS, CONTD.

- Prothrombin inhibits the anticoagulant properties of activated protein C, thereby dampening a natural anticoagulant pathway.
- There are three such pathways: the protein C anticoagulant pathway (protein C, protein S, thrombomodulin, and perhaps EPCR), the heparin-antithrombin pathway, and the tissue factor inhibitor pathway.

CONCLUSION

Prevention of DVT is much easier than treating DVT. Virchow's Triad plays a key role in the genesis of DVT.

IMPORTANCE OF OUR RESEARCH

DVT can cause serious complications if thrombi travel to the lungs resulting in PE. DVT and PE have worse outcomes than DVT alone. Prevention of DVT is much easier than treating DVT. Virchow's Triad plays a key role in the genesis of DVT.

ACKNOLEDGEMENT

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