As anesthesiologists and intensivists, we occasionally encounter a patient with deep vein thrombosis (DVT) and immediately the potentially life-threatening complications of thromboembolism come to mind. It is important to recognize the real risks in a specific patient. This editorial intends to focus on the various imaging modalities available to evaluate the entire spectrum of DVT and to develop an algorithmic approach to treat a patient with DVT. The diagnosis of DVT often leads to delays in associated surgical procedures and may lead to the unnecessary use of therapeutic anticoagulation in every patient with a painful swollen limb.

DVT progresses through stages of acute to chronic thrombus and in some cases leads to sequelae such as the postthrombotic syndrome (PTS). It is the acute stage of DVT, that is fraught with multiple complications, the most feared of which is pulmonary thromboembolism. Previous studies substantiate an estimate of 14 days to be the upper limit on the age of an acute DVT.[1] Once stabilization and maturation of the thrombus occur, it can be considered to be a chronic DVT and these chronic thrombi are usually highly stable and mature; and much less likely to embolize to the pulmonary circulation. It is important to discriminate between an acute and chronic DVT as treatment needs to be individualized, based primarily on the acuteness of the thrombus with acute DVTs requiring low molecular weight or unfractionated heparin therapy, while chronic DVT or PTS may not require anticoagulant therapy unless a new acute thrombus is detected.[2] Chronic DVTs may be relatively innocent and up to one-third of the patients are incidentally found to have asymptomatic DVT of the leg.[3]

As most classical signs and symptoms are poorly predictive of the diagnosis, definitive tests are required to differentiate between an acute and chronic DVT. Orbell et al.[4] evaluated the efficacy of imaging for the qualitative and quantitative estimation of DVT and found that duplex ultrasonography to be the most cost-effective and accurate imaging modality for above-knee DVT. Although computed tomography venography is considered as the gold standard, duplex sonography, which combines compression sonography augmented with color flow Doppler imaging, has a nearly equivalent diagnostic accuracy and may now be considered as the diagnostic test of choice. Despite the high sensitivity and specificity offered by duplex sonography in the diagnosis of DVT, distinction between acute and chronic DVT may be difficult, especially in patients with previously treated DVT who subsequently develop symptoms of a new DVT. The duplex sonographic indices of distinguishing between acute or chronic DVT [Table 1] have a variable efficacy with none found to be the single best. Sonographic elasticity imaging and luminal echogenicity[5] utilize the well-known fact that thrombi harden with age, and these add to the diagnostic value of duplex ultrasonography in this condition. Newer modifications have been introduced into the techniques of elastography such as shear wave induced resonance elastography (SWIRE)[6] and photoacoustic imaging. SWIRE has been found to provide consistent quantitative noninvasive elasticity measurements that are not available with standard compression ultrasound imaging. Acoustic radiation force impulse (ARFI) imaging differs from ultrasonic elasticity imaging method, in that, it does not require compression of the transducer and is a novel addition to this armamentarium,[7] thereby eliminating the operator dependent bias of compression elasticity imaging. Apart from these newer ultrasonographic indices, magnetic resonance imaging may also be used to judge the age of DVT.

Despite the current knowledge of age characterization of a thrombus, the American College of Chest Physicians (ACCP) guidelines suggest initial and long-term anticoagulation for incidental asymptomatic DVT, a therapeutic approach similar to acute DVT. However, no randomized trials have

### Table 1: Duplex ultrasound features of acute and chronic DVT

| Acute DVT | Chronic DVT |
|-----------|-------------|
| Thrombus float in vessel | Thrombus adherent to vessel wall |
| Composed of RBC and fibrin | Composed of fibrin and covered with endothelium |
| Low level echogenicity | Enhanced echogenicity |
| Acoustically homogenous | Acoustically heterogeneous |
| Thrombus expands diameter of veins | Diameter of vein decreases with time |
| Collaterals absent | Collaterals present |
| Vein non-compressible | Partially compressible |
| No evidence of recanalization within vessel | Recanalization within vessel |

DVT=Deep vein thrombosis, RBC=Red blood cell
The presence of a DVT often leads to undue risks of the associated heparin therapy. Current evidence supporting the age discrimination of therapy approach has led to the current extensive use of anticoagulants among in-hospital patients and their associated adverse effects. Reliable age characterization of a thrombus can avoid this “blanket” therapeutic approach. Therefore, novel techniques of ultrasound imaging such as SWIRE and ARFI seem to promising in the aspect of differentiating acute from chronic DVT. In the current scenario, many authors have questioned the widespread in-hospital empirical use of anticoagulants suggesting that the present recommendations by ACCP are made for a group of patients, for whom the benefits outweigh the risks. This epidemiologic perspective may not prove useful in the individual patient perspective, wherein the rampant use of “unnecessary” therapeutic anticoagulants can succumb the patient to adverse effects of these drugs such as heparin-induced thrombocytopenia (up to 30% incidence), bleeding and implications for regional anesthesia in patients who require a surgical procedure. Spinal and epidural anesthesia in combination with anticoagulant therapy is the fifth most common etiological factor for epidural hematoma, whereas spinal and epidural anesthesia alone represent the 10th most common cause of spinal hematoma. The presence of a DVT often leads to undue delays in any required surgical procedures due to dual fear of both perioperative thromboembolic phenomena and the risks of the associated heparin therapy.

Current literature and awareness on this is scarce among anesthesiologists and intensivists. Further randomized control trials are required to assess the utility of these advanced imaging modalities of ultrasonography like SWIRE and ARFI in differentiating acute and chronic DVT. Further studies are also required to confirm and prevent unnecessary aggressive therapeutic anticoagulation in every case of DVT. We propose an algorithmic approach to diagnosis, age characterization, and anticoagulation in DVT [Figure 1].

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How to cite this article: Aggarwal A, Bholaotra AR, Suresh V, Al-Qattan AR. Assessing the age of deep vein thrombus: A need for future perioperative medicine and anesthesia. Anesth Essays Res 2016;10:1-2.