

## Original article

# Is pre-operative assessment of coagulation profile with Thrombelastography (TEG) useful in predicting venous thromboembolism (VTE) following orthopaedic surgery?



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## ABSTRACT

**Introduction:** Epidemiologic data on the incidence of venous thromboembolism (VTE) in Indian population vary widely. Most studies show that the incidence of VTE is lower in Asian patients than in Western population. Screening tools to identify high-risk patients should enable us to reduce this complication. **Methods:** The incidence of VTE in 101 patients who underwent knee or hip arthroplasty, or surgery for hip fractures, without chemoprophylaxis for deep vein thrombosis (DVT) was documented. Diagnosis of DVT was made with Duplex ultrasonography. We also assessed the usefulness of pre-operative assessment of the hypercoagulable status of the patient in predicting the occurrence of VTE, using the Thrombelastography (TEG) test.

**Results:** The incidence of DVT in the study population was 7%. Six of the 7 patients who developed DVT had surgery for hip fractures, while one had knee replacement. The thrombus was above the knee joint level in 6 of the 7 patients. Pre-operative TEG was positive in only one of the 7 patients, but was positive in 37 of the remaining 94 patients.

**Conclusion:** Incidence of DVT in the study population is sufficiently high to recommend some form of prophylaxis to prevent VTE following hip and knee surgery. Pre-operative assessment of the patients' coagulation status with Thrombelastography does not predict the risk of VTE. The use of other lab parameters that could help in selective chemoprophylaxis needs to be explored.

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## 1. Introduction

Epidemiological data on the incidence of venous thromboembolism (VTE) in Asian populations vary significantly.<sup>1–9</sup> While many studies have shown that the incidence of deep vein thrombosis (DVT) is lower in Asian patients than the Western population,<sup>1,3,4,9</sup> some of the recent studies from China and south east Asia have shown significant incidence of DVT in high-risk orthopaedic patients.<sup>2,5–7</sup>

In India, there are conflicting reports on the incidence of VTE.<sup>1–4</sup> While Bagaria<sup>4</sup> and Jain et al.<sup>3</sup> reported a low incidence of DVT, Agarwala et al.<sup>2</sup> and Dhillon<sup>5</sup> showed an incidence of around 60% in patients who did not have prophylaxis peri-operatively. In view of the conflicting data available, we found it necessary to have a

prospective study on the incidence of VTE in high-risk orthopaedic surgery patients who were not on chemoprophylaxis at our institution.

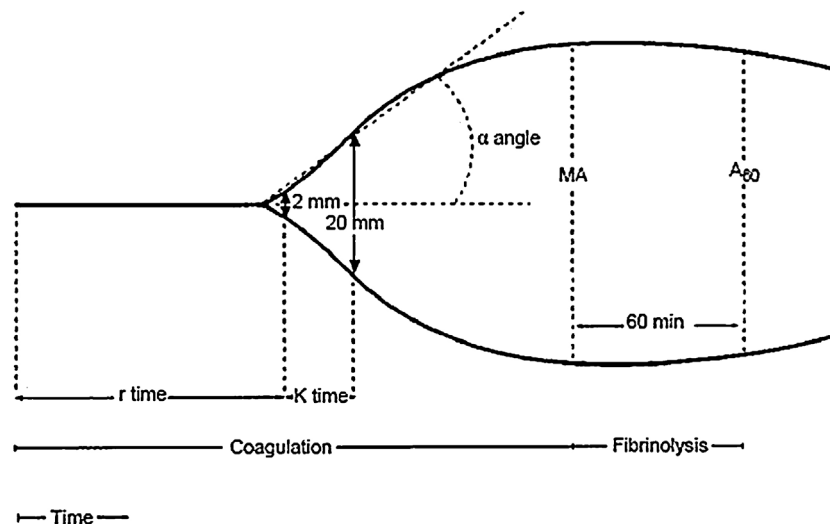
Acknowledging the risks associated with routine anticoagulation, we wanted to explore the use of laboratory tests to aid identify subjects who are at high-risk of developing VTE. Thrombelastography (TEG) is a laboratory test that has been very useful in predicting individuals who are hypercoagulable, and therefore more likely to develop VTE.<sup>10,11</sup> It has also been shown to be useful in predicting which patients would develop DVT despite standard anticoagulation.<sup>11</sup> In this study, we aimed to assess the usefulness of pre-operative TEG in predicting the incidence of DVT in the study population.

## 2. Methods

All consecutive patients who presented with a fracture around the hip or with arthritis, requiring an arthroplasty of the hip or

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**Fig. 1.** Normal TEG curve. *R*, time taken for clot formation to begin; *K*, time period between initiation of clot formation and the time when an amplitude of 20 mm is attained;  $\alpha$  angle, angle subtended on the graph by the tangent drawn to the curve starting from the initiation of coagulation, over the baseline; MA, maximum amplitude (highest amplitude) attained on the curve.

knee were included in the study. At admission, the patients were screened for DVT clinically and a coagulation workup including Prothrombin time (PT), activated partial thromboplastin time (APTT) and platelet count was done. Blood was also collected pre-operatively for the TEG analysis that was done using the Classical Thrombelastography technique (TEG, Haemoscope, Skokie, IL, USA), details of which are described later. While analyzing the TEG results, the *R* and *K* values as well as the alpha angle and maximum amplitude were assessed (Fig. 1). Risk factors for DVT were assessed – history of cancer, inflammatory bowel disease or autoimmune disorders, varicose veins, smoking, use of oral contraceptive pills, or hormone replacement therapy and diabetes. We excluded patients taking anti-platelet agents and oral anticoagulant treatment prior to surgery, patients who had been bedridden prior to admission and those who required ICU treatment post-operatively. All patients included in the study did not receive any form of chemoprophylaxis, which was the standard practice in the unit at the time of the study. All patients were mobilized early and had mechanical prophylaxis in the form of hourly mobilization of the ankle by the patient himself or by his relatives. Patients who requested anticoagulant prophylaxis as part of their treatment when the study proposal was explained to them, were also excluded from the study. The study was cleared by the institutional ethics board.

Post-operatively, all patients were examined clinically for symptoms and signs of VTE on a daily basis and with Duplex ultrasonography of both lower limbs 2 weeks after surgery, or earlier if there was any clinical evidence of DVT. Clinically, DVT was suspected if there was increased pain with leg swelling and a tense, tender calf compartment and a positive Homans' test. The patients were also examined clinically for DVT at 6 months and at 2 years after the surgery. A history of inappropriate leg swelling or pain in the legs was sought at the time of review. Duplex ultrasonography was done in patients suspected to have had DVT at the time of review.

### 3. Results

We studied 101 patients who underwent major orthopaedic surgery – 23 patients had fixation of fractures around the hip, 54 had arthroplasty of the hip for trauma or hip arthritis, and 24 had total knee replacement surgery. Of the 78 patients who underwent arthroplasty, 36 patients had degenerative arthritis,

26 had inflammatory arthritis, and 16 had post-traumatic sequel. The average age of the patients was 53.8 years (range 24–86), with 52 male and 49 female patients. All 101 patients were followed up at 6 months, but the details of only 45 patients were available at 2 years.

Seven patients developed clinical evidence of DVT at a median of 11 days from surgery (range 4–20 days). This was confirmed with Duplex ultrasonography. Six patients had thrombosis above the knee and one had a symptomatic DVT below the knee. None of the other patients developed either clinical or ultrasonographic evidence of DVT or clinical signs of pulmonary embolism. Of the remaining 94 patients, none developed DVT after discharge, though one died of unknown aetiology, a year after the surgery. Of the 7 patients who developed DVT, 2 patients died 18 months after the surgery – one of myocardial infarction and the other following a cerebrovascular event. The patient who had below knee thrombosis was the one who died of the cerebrovascular event.

Six of the 7 patients developed DVT following surgery for fracture of the hip (5 had trochanteric fracture fixation and one had hemiarthroplasty for a fracture neck of femur), and one developed DVT following knee arthroplasty for rheumatoid arthritis. On assessing the risk factors, 47 of the 101 patients had risk factors, but only 4 of the 7 patients who developed DVT had one or more of the risk factors (Table 1).

While there were 4 patients who had a platelet count of more than 450,000 and one patient with an APTT <23 s, none of these patients with abnormal coagulation parameters developed DVT.

**Table 1**  
Risk factors for VTE.

Risk Factors	In the total population (N=101)	In those who developed DVT (N=7)
Smoking	14	2
H/o cancer	3	–
Varicose veins	3	–
H/o hormone replacement therapy (HRT)	1	–
H/o oral contraceptive pills (OCP) intake	2	–
Inflammatory bowel disorder	1	–
Autoimmune disorder	15	1
Diabetes	15	2

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