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Lavindra Tomar
(1) Department of orthopaedics, Max Super Speciality Hospital, 108 A, I.P. Extension, Patparganj, Delhi, India
(2) MS, MCh(UK), FICS. Director & Unit Head, Department of Orthopaedics Max Super Speciality Hospital, Patparganj, Delhi, India

Pawan Dhawan
(1) Department of orthopaedics, Max Super Speciality Hospital, 108 A, I.P. Extension, Patparganj, Delhi, India
(2) Attending Consultant, Department of Orthopaedics Max Super Speciality Hospital, Patparganj, Delhi, India

Gaurav Govil
(1) Department of orthopaedics, Max Super Speciality Hospital, 108 A, I.P. Extension, Patparganj, Delhi, India
(2) Senior Orthopaedic Consultant, Department of Orthopaedics Max Super Speciality Hospital, Patparganj, Delhi, India

Corresponding Author:
Gaurav Govil
(1) Department of orthopaedics, Max Super Speciality Hospital, 108 A, I.P. Extension, Patparganj, Delhi, India
(2) Senior Orthopaedic Consultant, Department of Orthopaedics Max Super Speciality Hospital, Patparganj, Delhi, India

Symptomatic acute pulmonary embolism despite thromboprophylaxis after simultaneous total knee arthroplasty: Case report in an Indian female

Lavindra Tomar, Pawan Dhawan and Gaurav Govil

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Abstract
Symptomatic acute pulmonary embolism (PE) in a post-operative orthopaedic condition is a medical emergency with grave prognosis if left undetected. Simultaneous total knee arthroplasty (TKA) need prior identification and risk assessment. A prophylactic thromboprophylaxis expectedly reduces the incidence of venous thromboembolism (VTE) including deep vein thrombosis (DVT) and PE.
We report a 52-year old obese Indian female who underwent simultaneous TKA with standard operating protocol. Peri-operative mechanical and chemo-thromboprophylaxis was given with no evidence of DVT. Acute PE presented on 3rd post-operative day with an episode of breathlessness, chest pain and desaturation. A positive computed tomographic pulmonary angiography (CTPA) and high D-dimer levels were conclusive. Management with therapeutic anticoagulant therapy was done. No late mortality occurred. Return to her activities of daily living with improved knee scores was the desired outcome.
Simultaneous TKA in patient with a high body mass index should receive prophylactic thromboprophylaxis. Pre-operative risk stratification in TKA with a high index of suspicion in postoperative period are necessary steps to identify and manage a potentially fatal acute PE.

Keywords: Pulmonary embolism; deep vein thrombosis; thromboprophylaxis; total knee arthroplasty; knee replacement

Introduction
Pulmonary embolism (PE) is an uncommon but disastrous post-operative complication of knee arthroplasty [1, 2]. Clinical relevance of asymptomatic, un-diagnosed or missed PE is less clear.[3] Symptomatic episode is an emergency, necessitating high suspicion and prompt identification for an effective management. The acute PE mortality in immediate one-hour period is 10% and the 30-day post-operative period mortality is also high due to recurrent fatal VTE [4, 5]. It requires care in critical care unit in a tertiary care centre.
Any change in oxygenation in post-operative period should lead us to suspect acute PE even if the patient shows no specific symptoms.[6] The diagnosis of pulmonary embolism can be confirmed by the patient's clinical symptoms combined with CTPA and increased level of D-dimer. A ventilation-perfusion lung scanning has high sensitivity and is a non-invasive method for diagnosis [4, 6].
We report a case of simultaneous TKA in a 52-year old obese female who despite prophylactic thromboprophylaxis presented with breathlessness and chest pain on 3rd post-operative day to necessitate prompt investigations and management in a critical care unit for an eventual favourable outcome.

Case report
A 52-year old female from India, with a body mass index (BMI) of 37 kg/m2 and a history of obstructive sleep apnoea (OSA) syndrome underwent simultaneous TKA for the treatment of osteoarthritis (Figure 1a). Her pre-operative work up included venous doppler study of lower limbs which was negative for DVT. She was assessed as American society of anaesthesiologist (ASA) grade 2. Bilateral TKA under regional anaesthesia with utilization of midline incision and the medial parapatellar approach was done (Figure 1b). We used the standard operating protocol. The bone-cutting necessary was completed using an intramedullary guide in the

femur part, and an extramedullary guide in the tibia part. All prostheses were fixed by a cement technique. Injection enoxaparin were prescribed for thromboprophylaxis in immediate post-operative period. Mechanical prophylaxis with compression pumps was started in immediate postoperative period in prophylactic dosage. The next day of surgery, post-operative rehabilitation protocol initiated and ambulation with walker support done (Figure 1c). Supervised oxygen saturation monitoring continued in ward for OSA. Progression to independent and increased walking distance ensued under assisted physiotherapy guidance.

On the 3rd postoperative day the patient experienced shortness of breath and chest pain, but a review of a radiograph obtained using a plain film showed no specific findings (Figure 2). An episode of desaturation was noted and the patient was transferred to the critical care unit for management. After initial stabilization further evaluation was done. CTPA showed a variable small filling defects in the right descending pulmonary artery and lower lobe segmental arteries especially in the posterior basal and superior segments suggesting of pulmonary embolism (Figure 3a and 3b). Areas of consolidation in both lung lower lobes right more than left with few interspersed small enhancing areas and small pulmonary infarcts in right lung base was also noted (Figure 3c). D-Dimer levels showed increased value of 1896.3 ng/mL (0- 232 ng/mL) and cardiac evaluation by echocardiography showed ectopic activity but no regional wall motion abnormality was noted. No DVT was detected on the repeat ultrasound examination of the lower extremities (Figure 4a, 4b and 4c). Wells score showed likely probability of PE with a score > 4. Treatment with LMWH in therapeutic dosage for next seven days was done. The patient stabilized three days later and was transferred back to the orthopaedic ward for another four days before discharge. Supervised ambulation and assisted physiotherapy done. Oral anticoagulant therapy with Xarelto was initiated at the time of discharge and followed for three months.

At three months follow up, no symptomatic evidence of DVT or PE. At six months follow up pain-free range of movements with improved level of activities of daily living and improved knee scores were noted.

Fig 1: Preoperative anteroposterior radiograph (1a) both knees showed advanced degenerative arthritis with varus angulation and postoperative anteroposterior radiograph (1b) both knees with implanted TKA and clinical photograph (1c) in postoperative period walking with walker support

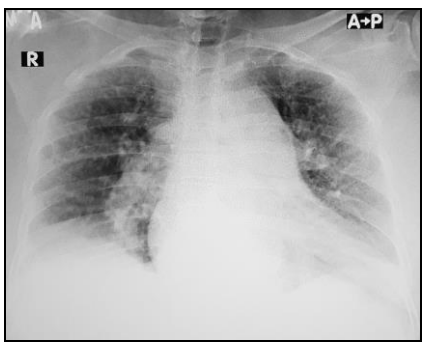

Fig 2: Chest radiograph on day 3 after TKA showed nonspecific infiltrates with right lower base blunting of costophrenic angle.

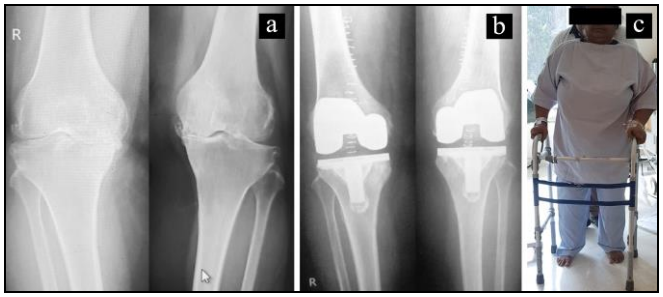

Fig 3: CTPA showed small filling defects in the right descending pulmonary artery (3a) and lower lobe segmental arteries especially in the posterior basal and superior segments (3b) with areas of consolidation in both lung lower lobes right>left (3c) with small pulmonary infarcts in right lung base.

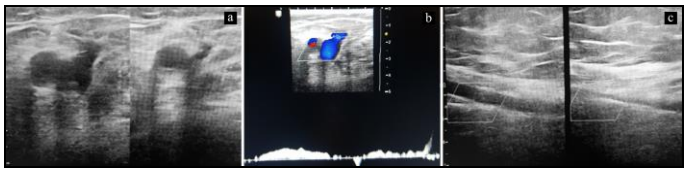

Fig 4: Doppler study showed normal spontaneous unidirectional flow (4a) with phasic variation in the right common femoral vein (4b) and unidirectional flow in popliteal vein (4c) with no thrombus.

Discussion

Estimates of the incidence of symptomatic pulmonary embolism in larger Western populations range from 0.22% to 0.45% [1, 2]. In the absence of thromboprophylaxis, the incidence of venography proven VTE ranges from 40 to 84% after TKA [8, 9]. Rates of symptomatic VTE after prophylaxis were 1 to 4% however, a higher incidence in geriatric group has been reported [8].

Our understanding of symptomatic embolic episodes is based on studies from western population data and we follow their recommendations for management. [5, 10] There are studies which suggest lower incidence of PE in Asian race [1, 6, 9]. Lower prevalence of factor V Leiden and other genetic predisposing factors were probable reasons. [2, 5, 9] The incidence of DVT after TKA in Asian patients in absence of thromboprophylaxis was however equivalent of Western patients in a prospective epidemiological study [11].

Despite using current VTE prophylaxis, approximately 1 in every 100 patients undergoing primary TKA and approximately 1 in every 200 patients undergoing primary total hip arthroplasty (THA) develops symptomatic VTE prior to hospital discharge.[3] A symptomatic DVT may involve distal calf veins or proximal thigh veins. Symptomatic proximal DVT carries a 40 to 50% rate of PE if left untreated [7, 8]. Preventive measures for DVT are important for reducing proximal thrombus propagation and PE.

PE is a potentially life-threatening complication following TKA. It should not be underestimated despite the low incidence [1, 10]. Dyspnoea or deterioration of existing dyspnoea, pleuritic chest pain, and cough including haemoptysis should alert the surgeon [7]. The clinical decision-making tools like Wells criteria should be used to identify risk for DVT and PE [5]. Case fatality depends on the severity of the disease graded as low, intermediate and high risk based on clinical symptoms of shock or hypotension, cardiac troponin testing for myocardial injury and echocardiography or multidetector CT for right ventricular dysfunction [12].

Female gender, obesity, dementia, rheumatoid arthritis and adult respiratory distress syndrome are known risk factors.[2] Imperative to identify patient with increased post-operative

bleeding risk or increased risk of PE. There was an increased risk of post-operative bleeding in patients undergoing revision arthroplasty and those with a history of a bleeding disorder, recent gastrointestinal bleeding, or recent haemorrhagic stroke.[1] There was an increased risk of PE in patients with previous symptomatic pulmonary embolism, inherited thrombophilia, or a hypercoagulable state, and those having difficulties with early mobilization.[1,8]

D-dimer testing has a good negative predictive value, but its positive predictive value and role in patients with a moderate or high probability of PE remain questionable.[12, 13] The cardiac biomarkers, particularly troponins and natriuretic peptides, have been used to detect myocardial dysfunction and injury, respectively, in patients with acute PE and their elevated levels present with worse short-term survival.[4,12]

There is a strong positive association between BMI and the risk of PE.[1,2] Delayed post-operative mobilisation time, improper dosing of anticoagulants, and the ineffectiveness of mechanical compression devices are factors that increase the risk for obese patients to develop PE after TKA.[2,8]

Pulmonary disease had an inconclusive association as risk factor for PE. [2] As compared to renal disease and cerebrovascular disease, the contribution of chronic obstructive pulmonary disease leading to PE decreased with increasing age.[2]

Evidence suggests that venous thrombosis is initiated at the time of surgery, partly due to tourniquet use, as well as trauma to the endothelium of the deep veins of the leg during manipulation and placement of hardware during TKA.[8] The relationship between pulmonary embolism and simultaneous bilateral TKA is still unresolved.[14] Revision THA and primary TKA were associated with a higher overall incidence and odds of in hospital PE as compared to primary THA and revision TKA.[2]

The guidelines developed by the American Academy of Orthopaedic Surgeons are routinely used. They recommend use of regional anaesthesia during surgery and mechanical prophylaxis intraoperatively or immediately postoperatively with continuation until discharge for hip and knee arthroplasty.[8,15] Prophylactic anticoagulation therapy is a strong recommendation after risk stratification.

LMWH are distinct drugs to treat symptomatic thromboembolic episodes.[7] Studies suggest that enoxaparin was more effective than dalteparin in preventing symptomatic VTE.[8] For chemoprophylaxis, aspirin may be an appropriate chemoprophylactic drug in patients with increased risk of bleeding and warfarin is appropriate in patients with increased risk of PE.[1]

Much effort has been spent to decrease the incidence of DVT and PE through the use of pharmacological, mechanical, rehabilitation perioperative interventions.[2] However, the effectiveness of efforts remains controversial with occurrence of PE associated with high mortality even with implementation of recommended measures.

Conclusion

A high index of suspicion when a patient develops symptoms of respiratory difficulty in the postoperative period and low threshold for early investigations like CTPA are necessary for early diagnosis and management to reduce unfavourable outcomes.

Multimodal regimens should be considered to reduce the incidence of a VTE progressing to symptomatic PE in high risk TKA.

Abbreviations

PE: pulmonary embolism
TKA: total knee arthroplasty
VTE: venous thromboembolism
DVT: deep vein thrombosis
CTPA: computed tomographic pulmonary angiography
BMI: body mass index
OSA: obstructive sleep apnoea
ASA: American society of anaesthesiologists
LMWH: low molecular weight heparin
THA: total hip arthroplasty

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