Utility of Non-invasive Endothelial Function Test for Prediction of Deep Vein Thrombosis After Total Hip Arthroplasty

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Introduction: Venous thromboembolism (VTE) is a common and sometimes lethal postoperative complication occurring after arthroplasty. The incidence of VTE is particularly high after orthopedic surgery. Despite the use of prophylaxis in the current clinical setting, subclinical venous thrombosis develops after surgery in 15% to 20% of patients who undergo total hip arthroplasty (THA) and in 40% to 60% of those who undergo total knee arthroplasty (TKA). Orthopedic surgeons are properly concerned about the potential hemorrhagic effect of pharmacological prophylaxis, which could be the cause of prolonged recovery, wound failure, and even peri-prosthetic infection. The benefit of using anti-coagulants for the prevention of VTE is counterbalanced by the potential risk of bleeding. Accurate risk stratification is warranted to establish new prophylactic strategies and to improve prognosis. Endothelial dysfunction is important in the pathogenesis of thrombus formation. Reactive hyperemia-peripheral arterial tonometry (RH-PAT) can non-invasively evaluate endothelial function. This study sought to investigate the predictive value of RH-PAT for deep vein thrombosis (DVT) after lower extremity arthroplasty.

Methods: This report describes a prospective observational study of 126 osteoarthritic patients who underwent TKA or THA. The RH-PAT index (RHI) was measured on the day before surgery. DVT was checked by ultrasonography or phlebography before and after surgery using a standardized technique. Phlebography was performed pre- and postoperatively in patients whose lower extremities veins could not be visualized enough by preoperative ultrasonography. Qhrombosis risk score is a clinical risk prediction algorithm to estimate the individual risk of VTE, and was calculated in each patient.

Results: Following arthroplasty, DVT was diagnosed in 51 patients (40.5%). RHI levels in the DVT group (0.58±0.25) were significantly lower than the non-DVT group (0.71±0.25, P=0.004). Multivariate logistic regression analysis identified low RHI as an independent and significant risk factor for postoperative DVT (odds ratio per 0.1, 0.75: 95% confidence interval 0.63-0.91: P=0.003). Receiver operating characteristics analysis demonstrated that RHI was a significant predictor of DVT after surgery (area under the curve 0.65- 95% confidence interval 0.56-0.75, P=0.004). Using a cutoff value of RHI of <0.76, the sensitivity and specificity for prediction of DVT after arthroplasty were 80% and 45%, with positive predictive value and negative predictive value of 50% and 77%, respectively.
respectively. RHI was a significant and independent predictor of postoperative DVT in multivariate logistic regression analyses and improved a net reclassification index (23.8%, $P=0.022$). Subgroup analyses according to operation site with adjustment for Qthrombosis score demonstrated that RHI significantly predicted postoperative DVT in THA group (odds ratio per 0.1, 0.77; 95% confidence interval 0.60-0.98; $P=0.03$), but did not reach statistical significance in TKA group.

**Discussion:** Traditionally, the pathogenesis of VTE is considered to be different from that of atherosclerotic cardiovascular disease. However, recent epidemiological studies have demonstrated an overlap of many risk factors for atherosclerotic diseases with venous thrombosis. The endothelium is responsible for the fine tuning of vascular homeostasis and mirrors current vascular function through its control of coagulation, fibrinolysis, and platelet activation. The vascular endothelium regulates the functional capabilities of the entire circulatory system: in patients with endothelial dysfunction of the peripheral arteries, the venous functional status may have deteriorated, as well. In patients with TKA, RHI didn’t reach statistical significance, but tended to have influence on postoperative DVT. The use of tourniquet might cause local soft-tissue exposure, deep vein injury, and local circulatory disorder in patients with TKA, whereas tourniquet was not used in patients with THA. These local factors caused by the tourniquet might account for the relatively low predictive value of RHI in patients with TKA. In conclusion low RHI was significantly associated with DVT after lower extremity arthroplasty. Endothelial dysfunction, as assessed by RH-PAT, is potentially useful for identifying patients at high-risk for VTE especially after THA.

**Keywords:** Venous thromboembolism; endothelial function; surgery
論文目録

Ⅰ 主論文
Utility of Non-invasive Endothelial Function Test for Prediction of Deep Vein Thrombosis After Total Hip Arthroplasty
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Ⅱ 副論文
なし

Ⅲ 参考論文
なし