Incidence of Venous Thromboembolism After Arthroscopic Anterior Cruciate Ligament Reconstruction

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I have no financial conflicts to disclose
Introduction

Arthroscopically assisted anterior cruciate ligament reconstruction (ACLR) is commonly performed for the treatment of anterior cruciate ligament (ACL) injury. Deep venous thrombosis (DVT) and pulmonary embolism (PE) are potentially life-threatening complications following ACLR. However, the incidence of the DVT and PE, and the risk factors for DVT remain unclear.

Purpose

The objective of this study was to investigate the incidence of DVT and PE after ACLR using ultrasonography (US) and contrast enhanced computed tomography (CT), and to identify the risk factors for DVT.
Materials and methods

Patients

Between April 2017 and September 2018, consecutive 56 ACLRs of 56 patients, including 10 revision surgeries, were performed at our hospital. All of them except for one patient who had a history of PE were enrolled in this study.

Operative procedure

All of the ACLRs were performed by the same surgeon, under general anesthesia with femoral and sciatic nerve blocks, and tourniquet use. ACLs were reconstructed using single bundle hamstring autograft. In revision ACLR, hamstring autograft was harvested from contralateral side. If meniscus tears exist and are repairable, we repaired them with FAST-FIX360 (Smith & Nephew, Andover, MA, USA).

Postoperatively, knee immobilization was used for one day, and on the seventh postoperative day, full weight bearing was permitted.
Thromboprophylaxis

Although none received pharmacological prophylaxis, intermittent pneumatic compression was used for one day and compression stockings were used for seven days after ACLR.

Examination of DVT and PE

US of the leg veins was performed preoperatively and on the seventh postoperative day to detect DVT. If the patient was diagnosed with having DVT on the seventh postoperative day, contrast enhanced CT was conducted to detect PE. US was performed by the vascular surgeon with experience of over 20 years.
Analysis of risk factors for DVT

Clinical factors

Pre-operative condition
• Age
• Body mass index (BMI)
• Pre-operative Lysholm score
• Time interval from injury to ACLR (< 3M or ≥3M)

Surgical procedure
• Primary or revision
• Operative time
• Tourniquet time
• Meniscus repair

The patients were divided into two groups, DVT(-) and DVT(+). Clinical factors were compared between the two groups by use of the Student $t$ test, Mann-Whitney $U$ test, and $\chi^2$ test.
Results

Clinical factors of all the patients

There were 28 female and 27 male, and the mean age was $30.5 \pm 15.0$ years (range, 12 to 63 years). The mean BMI and Pre-operative Lysholm score were $22.6 \pm 2.5$ kg/m$^2$ and $71.5 \pm 14.0$, respectively. Twenty-two patients were performed ACLR less than 3 months after the injury. The mean operative time and tourniquet time were $80.8 \pm 18.5$ minutes and $68.5 \pm 14.7$ minutes, respectively. Meniscus repair was performed in 20 patients.

Incidence of DVT and PE

No DVT was detected before the ACLR. After the ACLR, distal DVT was detected in 9 patients, although all of them were asymptomatic. Of the 9 patients, contrast enhanced CT revealed 4 patients had PE. The incidence of DVT and PE were 16.4% and 7.3%.
## Comparison of clinical factors between DVT (-) and DVT (+)

<table>
<thead>
<tr>
<th>Clinical factor</th>
<th>DVT (-)</th>
<th>DVT (+)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>28.2 ± 14.2</td>
<td>41.9 ± 15.7</td>
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<tr>
<td>BMI</td>
<td>22.3 ± 2.3</td>
<td>23.8 ± 3.1</td>
<td>0.102</td>
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<tr>
<td>Pre-ope Lysholm score</td>
<td>71.7 ± 14.2</td>
<td>70.4 ± 14.3</td>
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<tr>
<td>Time interval</td>
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<td></td>
<td></td>
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<tr>
<td>&lt; 3M</td>
<td>19</td>
<td>3</td>
<td>0.655</td>
</tr>
<tr>
<td>≥ 3M</td>
<td>27</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>ACLR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>38</td>
<td>7</td>
<td>0.731</td>
</tr>
<tr>
<td>Revision</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Operative time</td>
<td>80.4 ± 19.0</td>
<td>83.1 ± 17.7</td>
<td>0.691</td>
</tr>
<tr>
<td>Tourniquet time</td>
<td>67.8 ± 14.6</td>
<td>71.9 ± 16.2</td>
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</tr>
<tr>
<td>Meniscus repair</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(-)</td>
<td>27</td>
<td>8</td>
<td>0.085</td>
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<tr>
<td>(+)</td>
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<td>1</td>
<td></td>
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</tbody>
</table>

The mean age was significantly higher in the DVT (+) group compared to DVT (-) group.
Discussion

The present study revealed that the incidence of asymptomatic DVT and PE were 16.4% and 7.3%, and age was the risk factor for DVT after ACLR. The incidence rate of DVT after ACLR has been reported to be 9% to 14% in previous surveys using venography or US [1-3], which are almost the same as our results. The symptomatic PE was reported to be 0.18% to 0.21% from the large data base [4,5], but the investigation on asymptomatic PE was little conducted.

In this present study, the incidence of asymptomatic PE was unexpectedly high, and there are reports of the cases with fatal PE after arthroscopic surgery [6,7]. Thus, the prevention of DVT and PE after ACLR should be considered as an urgent issue.
Pharmacological prophylaxis such as low-molecular-weight heparin (LMWH) is effective for reducing DVT after knee arthroscopy [8]. However, it remains controversial whether the benefits of LMWH outweigh the risks and costs [9]. In fact, there is no consensus regarding the indication for LMWH use after ACLR.

In this study, the age was identified as a risk factor for DVT after ACLR. Similarly, Ye et al. used venography to examine DVT and reported the age older than 35 years was the risk factor [1], and Struijk-Mulder et al. used US to examine DVT and reported the advanced age was the risk factor [2]. Jameson et al. and Gaskill et al. evaluate the incidence of DVT based on large data base and reported the risk factor was the age older than 35 years and 40 years, respectively [4,5].

Our findings show that the patients with advanced age should be considered for pharmacological prophylaxis after ACLR.
Conclusion

➢ We investigated the incidence of DVT and PE after ACLR using US and contrast enhanced CT.

➢ The incidence of asymptomatic DVT and PE were 16.4% and 7.3%, and advanced age was the risk factor for DVT after ACLR.

➢ The patients with advanced age should be considered for pharmacological prophylaxis after ACLR.
Reference


