Suspected pulmonary embolism and deep venous thrombosis: A comprehensive MDCT diagnosis in gynecologic patients

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Purpose

Venous thromboembolism (VTE) is a systemic and potentially lethal illness: pulmonary embolism (PE) and deep venous thrombosis (DVT) are two aspects of the same disease. DVT and PE are the most frequent postoperative complications in surgical patients, especially in patients who had gynecological pelvic surgeries, because they often meet the criteria for Virchow's classic triad of venous stasis, hypercoagulability and endothelial injury. Pulmonary embolism is a leading cause of postoperative death in the highest risk patients with uterine, ovarian, or cervical carcinoma. DVT of the lower extremities is believed to be the source of PE in most patients, and the primary risk factor for recurrent PE is the presence of residual proximal venous thrombosis. Therefore, prompt and accurate diagnosis DVT and PE simultaneously is essential for appropriate treatment.

Multi-detector computed tomography (MDCT) has been shown to detect thrombi and emboli in both low limb veins and pulmonary arteries at the same time with thin slice thickness, and it was only minimally invasive and feasible. The objective of this study is to present incidence of deep venous thrombosis and pulmonary embolism undergoing gynecological pelvic surgeries with using multi-detector computed tomography (MDCT) and to investigate relevant risk factors.
Methods and Materials

Between January 2008 and June 2010, this study enrolled 60 consecutive patients (age range, 39-83 years old; mean age, 61 ±13 years old) suspected of having pulmonary embolism after gynecologic surgery at Beijing Chaoyang Hospital Affiliated with Capital University of Medical Science. The underlying disease was endometrial cancer in 9 patients; ovarian cancer in 17 patients; vulvar abscess in 1 patient; cervical cancer in 9 patients; ovarian endometriosis in 2 patients; uterine sarcoma in 1 patient; pelvic synovial sarcoma in 1 patient; uterine prolapse/anterior vaginal wall prolapse in 6 patients; ovarian goiter in 1 patient; ovarian fibroma in 2 patients; adenomyosis in 1 patient; uterine fibroids in 7 patients; ovarian mucinous cystadenoma in 2 patients; theca cell tumor in 1 patient.

Initial enhanced CT of the pulmonary arteries scanning was performed from the lung apices to the base of the diaphragm with the following CT settings: 64 × 0.6mm detector collimation, 0.5 second gantry rotation time, pitch of 0.9, 370-mAs tube current, 120-kVp tube voltage, with a 0.75-mm section thickness and a 0.75-mm section interval, and 5-7-second scanning time. The CT scan was triggered by a bolus-tracking technique, with the region of interest placed in the pulmonary trunk, and image acquisition started 6 seconds after the attenuation reached the predefined threshold of 100 HU. And 3 min after contrast injection, with a 5-mm section thickness and a 5-mm section interval from the base of the diaphragm through the lower extremities, scanning of the lower extremities was performed for DVT. The presence of a pulmonary embolism as interpreted by an attending radiologist defined a positive CTPA result. Deep venous thrombosis (DVT) was diagnosed by CTV.

We then retrospectively reviewed their clinical records for pertinent information including age, body weight and height, indication for surgery, surgical method and duration, interval between surgery and the onset of PTE, therapy for PTE and prognosis.
Results

PE and DVT showed intraluminal filling defect of blood vessels in MDCT. Of the 60 patients, 23 patients (38.3%) had both PE and DVT detected by MDCT, with bilateral lower limb DVT (n = 8) or unilateral (left or right) lower limb DVT (n = 15); 3 patients (5%) had PE only; 27 patients (45%) had only lower limb DVT; There was no obvious PE or DVT findings on MDCT in 7 patients (11.7%) (Fig 1-3). PE and DVT were most often diagnosed on postoperative day 1 or 2; the mean was postoperative day 7.6±5.0.

Locations of the thrombi in patients with DVT and PE are shown in Fig 4. Among 50 patients with DVT, 43 cases (86%) of DVT in the calf veins, and 7 cases (14%) of DVT extended proximally into iliac vein, popliteal vein, femoral vein, or both. Among 23 patients had PE and DVT simultaneously, 18 cases (78.3%) of pulmonary emboli are due to thrombus arising from the calf veins, and 5 cases (21.7%) of pulmonary emboli are due to thrombus arising from the iliac vein, popliteal vein, femoral vein, or both.

Of the patients had both PE and DVT, DVT of right limb (n = 8) was a little more than that in left limb (n = 7), but no statistical difference was existed (P > 0.05).

There was statistical difference in the level of fibrinogen and Platelet count with DVT and those without DVT (P < 0.05), and there was statistical difference in the level of PR and INR with PE and those without PE (P < 0.05), but there was no difference in age, body mass index, levels of D-dimer, APTT, TT between subjects with DVT or PE and those without DVT nor PE (Fig 5).

Of the 26 patients had PE, 16 patients (61.5%) with gynecologic cancer. Of the 50 patients had DVT, 35 patients (70%) with gynecologic cancer (Fig 6).
Fig. 0: Incidence of deep venous thrombosis (DVT) in the lower extremities and pulmonary embolism (PE) among 60 patients who received gynecological pelvic surgeries. DVT were detected in 50 patients (83.3%) by MDCT, PE were detected in 26 patients (43.3%) by MDCT. In 23 patients (38.3%), both DVT and PE were detected.

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Fig. 0: Transverse contrast-enhanced CT image obtained at the level of the left atrium (LA) in a 69-year-old woman 6 days after gynecological pelvic surgeries for ovarian cancer shows a filling defect in the right middle lobe and right basal segmental pulmonary artery.

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**Fig. 0:** Transverse CT venography in the same patient: CT image at the level of the knee shows thrombus in the right popliteal vein.

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<table>
<thead>
<tr>
<th>Location</th>
<th>DVT</th>
<th>PE and DVT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of patients (%)</td>
<td>No. of patients (%)</td>
</tr>
<tr>
<td>Calf veins</td>
<td>43(86)</td>
<td>18(78.3)</td>
</tr>
<tr>
<td>Popliteal and calf veins</td>
<td>4(8)</td>
<td>3(13.1)</td>
</tr>
<tr>
<td>Popliteal vein</td>
<td>1(2)</td>
<td>1(4.3)</td>
</tr>
<tr>
<td>Femoral vein</td>
<td>-{-}</td>
<td>-{-}</td>
</tr>
<tr>
<td>Femoral and calf veins</td>
<td>-{-}</td>
<td>-{-}</td>
</tr>
<tr>
<td>Femoral, popliteal and calf veins</td>
<td>1(2)</td>
<td>-{-}</td>
</tr>
<tr>
<td>Iliac veins, femoral, popliteal and calf veins</td>
<td>1(2)</td>
<td>1(4.3)</td>
</tr>
<tr>
<td>total</td>
<td>50(100)</td>
<td>23(100)</td>
</tr>
</tbody>
</table>

**Fig. 0:** Location of thrombi in 50 patients with DVT and PE after gynecologic surgery.

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<table>
<thead>
<tr>
<th></th>
<th>PE(+)</th>
<th>PE(-)</th>
<th>p</th>
<th>DVT(+)</th>
<th>DVT(-)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>59.5±10.5</td>
<td>62.7±14.9</td>
<td>0.352</td>
<td>61.5±13.6</td>
<td>60.5±12.0</td>
<td>0.829</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>25.9±4.0</td>
<td>24.7±5.0</td>
<td>0.437</td>
<td>24.7±4.4</td>
<td>28.1±5.0</td>
<td>0.091</td>
</tr>
<tr>
<td>Fibrinogen (mg/dL)</td>
<td>391.3±65.3</td>
<td>387.8±101.7</td>
<td>0.883</td>
<td>399.2±85.4</td>
<td>356.5±84.1</td>
<td>0.048</td>
</tr>
<tr>
<td>D-dimer(mg/L)</td>
<td>0.75±0.47</td>
<td>0.44±0.32</td>
<td>0.056</td>
<td>0.58±0.42</td>
<td>0.35±0.12</td>
<td>0.44</td>
</tr>
<tr>
<td>Platelet count (× 10⁹/L)</td>
<td>232.4±84.2</td>
<td>259.5±121.2</td>
<td>0.389</td>
<td>258.7±115.3</td>
<td>202±43.9</td>
<td>0.019</td>
</tr>
<tr>
<td>Prothrombin time(s)(PT)</td>
<td>16.1±8.3</td>
<td>12.9±3.8</td>
<td>0.058</td>
<td>14.5±6.7</td>
<td>13.3±3.5</td>
<td>0.605</td>
</tr>
<tr>
<td>Prothrombin time ratio(s)(PR)</td>
<td>1.4±0.7</td>
<td>1.1±0.3</td>
<td>0.039</td>
<td>1.2±0.6</td>
<td>1.1±0.3</td>
<td>0.502</td>
</tr>
<tr>
<td>International normalized ratio (INR)</td>
<td>1.4±0.7</td>
<td>1.1±0.3</td>
<td>0.042</td>
<td>1.2±0.6</td>
<td>1.1±0.3</td>
<td>0.509</td>
</tr>
<tr>
<td>Activated partial thromboplastin time(s)(APTT)</td>
<td>31.3±6.9</td>
<td>30.6±7.7</td>
<td>0.704</td>
<td>31.2±7.6</td>
<td>28.9±6.0</td>
<td>0.370</td>
</tr>
<tr>
<td>Thrombin time(s)(TT)</td>
<td>16.6±1.2</td>
<td>16.9±1.6</td>
<td>0.432</td>
<td>16.7±1.5</td>
<td>16.7±1.0</td>
<td>0.986</td>
</tr>
</tbody>
</table>

**Fig. 0:** Characteristics of patients evaluated for PE and DVT.

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Fig. 0: The percentage of various disease in patients with PE and DVT. Of the 26 patients had PE, 16 patients (62%) with gynecologic cancer. Of the 50 patients had DVT, 35 patients (70%) with gynecologic cancer.

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Conclusion

The morbidity of postoperative lower extremity deep venous thrombosis and pulmonary embolism in gynecological procedures was high, and gynecologic cancer patients were perceived by respondents to have the highest risk of developing a postoperative PE or DVT. PE and DVT of lower limbs could be detected simultaneously by MDCT.
References


Personal Information

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