臺北市立萬芳醫院 - 委託臺北醫學大學辦理
Taipei Municipal Wanfang Hospital (Managed by Taipei Medical University)

CT Meeting : DVT

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Diagnostic Performance of Dual-Layer Computed Tomography for Deep Vein Thrombosis in Indirect Computed Tomography Venography

Circulation Journal Circ J 2020; 84: 636 – 641 doi: 10.1253/circj.CJ-19-0722

- Venous attenuation ≥80 HU can provide adequate differentiation between the veins and a clot.

- low keV can increase both contrast enhancement and venous attenuation compared with conventional images, but they also markedly increase image noise. So far, there have been no reports on the usefulness of virtual monochromatic images (VMI) at low keV for the detection of DVT.

CT and Contrast Infusion Protocols

- CTV and CTPA with DL-DECT. CTV was acquired in the caudocranial direction from just above the diaphragm to the end of the feet.
- The parameters for CTV were as follows: peak voltage, 120 kVp; detector collimation, 64×0.625 mm; tube rotation time, 500 ms; and helical pitch (beam pitch), 0.703.
- CTPA were as follows: detector colli mation, 64×0.625 mm; tube rotation time, 500 ms; and helical pitch (beam pitch), 1.015.
- CTV and CTPA began 300 s and 30 s after contrast injection, respectively.

- CT Image Reconstruction The spectral-based image data were post-processed at a workstation (Spectral Diagnostic Suite; Philips Healthcare) to generate VMI at 17 different energy levels (40–200 keV) with a spectral level of 3 (as per the vendor’ s recommen dation). DL-DECT uses a model-based iterative recon struction (IR) algorithm with de-noising levels.
- Higher de-noising yields more noise reduction. We used conven tional CT reconstructed with IR (iDose level 3; Philips Healthcare) as a control.
- The CTV and CTPA slice thick ness was 3 mm and 5 mm, respectively.

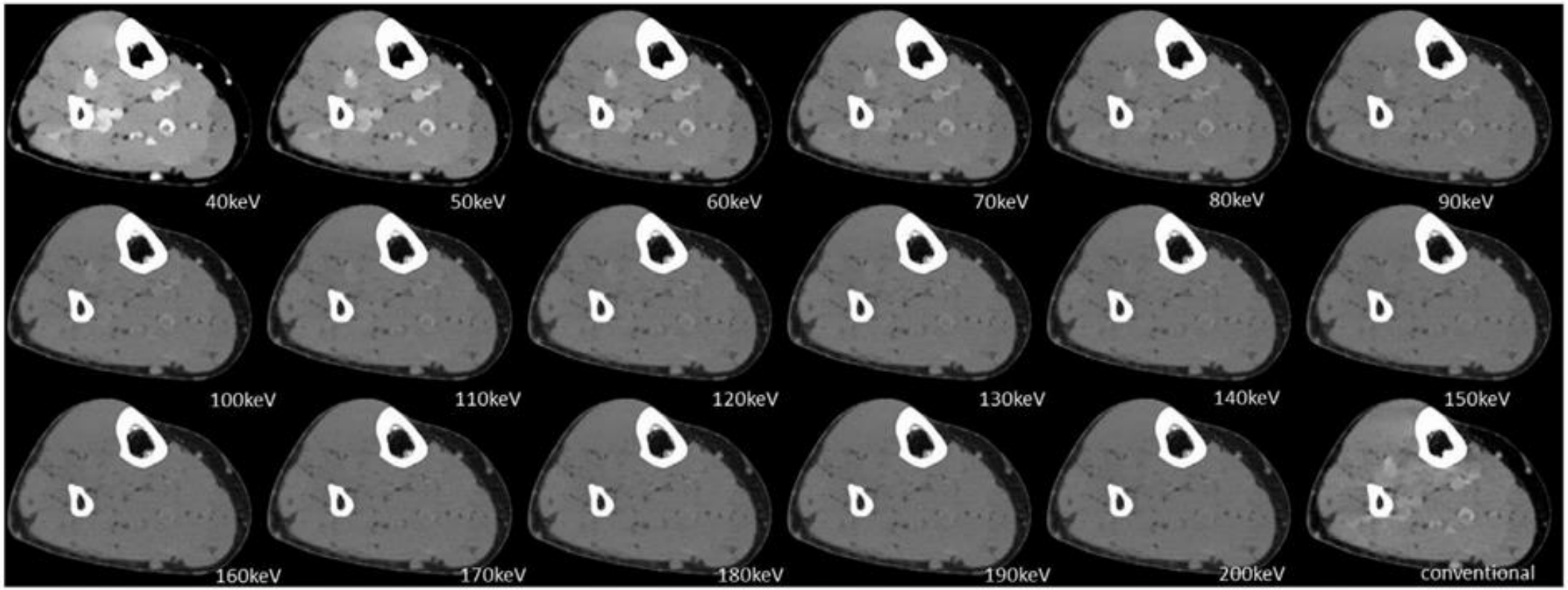

Figure 2. Contrast-to-noise ratio was highest for the 40-keV virtual monochromatic image, compared with conventional computed tomography.

Results

- The CNR of the 40-keV VMI was the highest of all VMI at all energy levels, and we defined 40 keV as the optimal VMI energy level (Figure 2). The contrast and CNR at 40 keV were significantly higher than those of conventional CT ($P<0.01$)

- In conclusion, in indirect CTV, 40-keV VMI obtained with DL-DECT offer better image quality and diagnostic performance for DVT than conventional CT

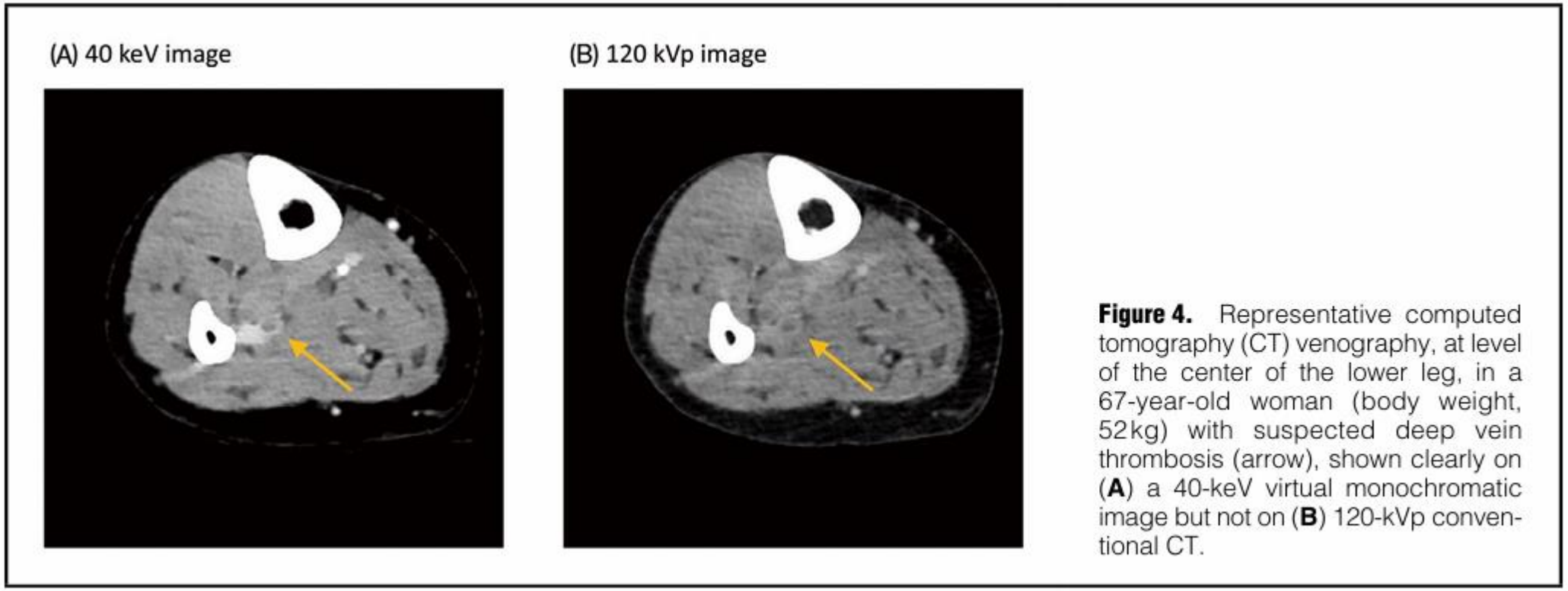

Figure 4. Representative computed tomography (CT) venography, at level of the center of the lower leg, in a 67-year-old woman (body weight, 52 kg) with suspected deep vein thrombosis (arrow), shown clearly on (**A**) a 40-keV virtual monochromatic image but not on (**B**) 120-kVp conventional CT.

Low Tube Voltage Computed Tomography Venography for Patients With Deep Vein Thrombosis of the Lower Extremities

Circulation Journal Circ J 2021; 85: 369 – 376 doi: 10.1253/circj.CJ-20-0416

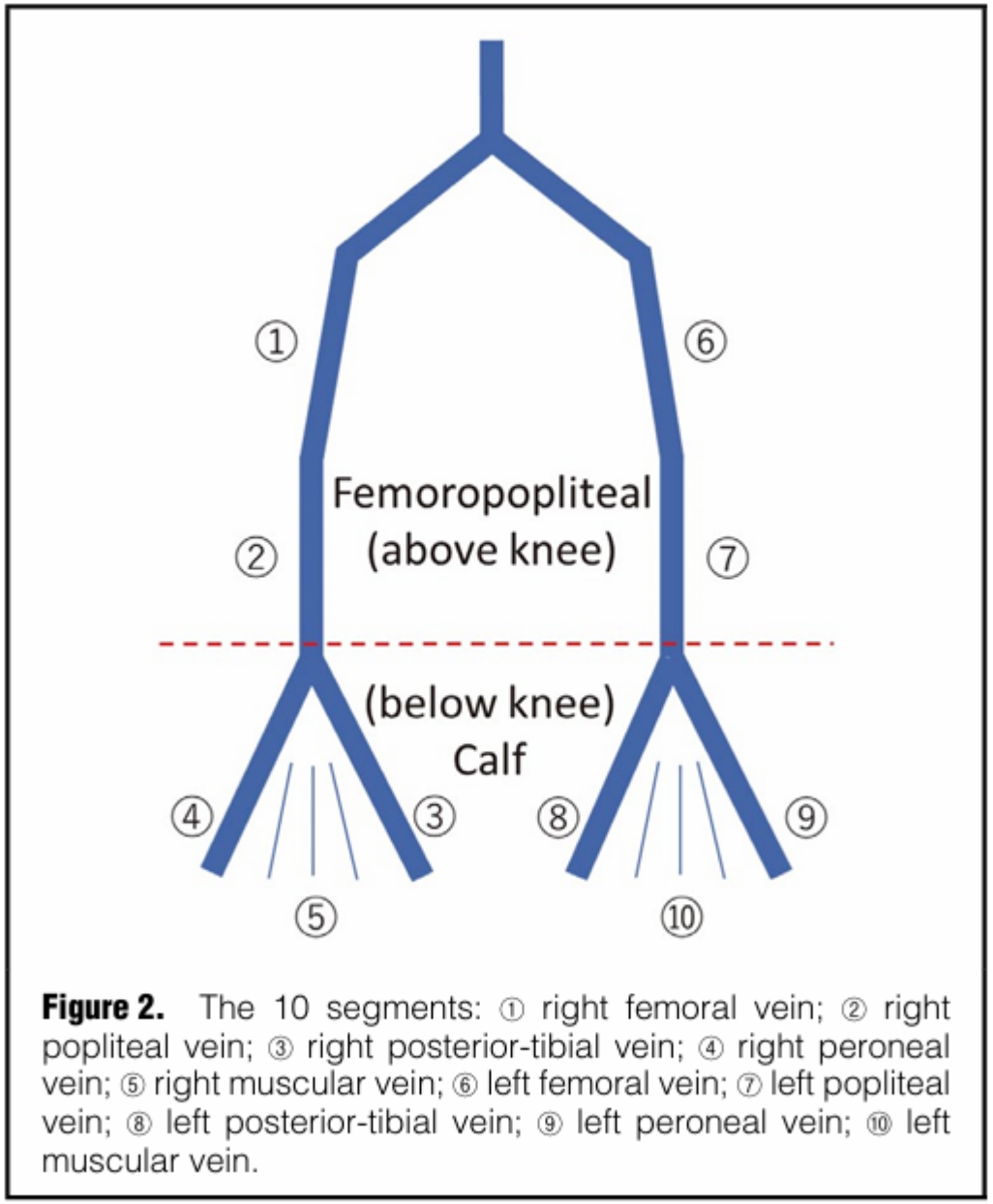

Figure 2. The 10 segments: ① right femoral vein; ② right popliteal vein; ③ right posterior-tibial vein; ④ right peroneal vein; ⑤ right muscular vein; ⑥ left femoral vein; ⑦ left popliteal vein; ⑧ left posterior-tibial vein; ⑨ left peroneal vein; ⑩ left muscular vein.

Three types of deep vein thrombosis

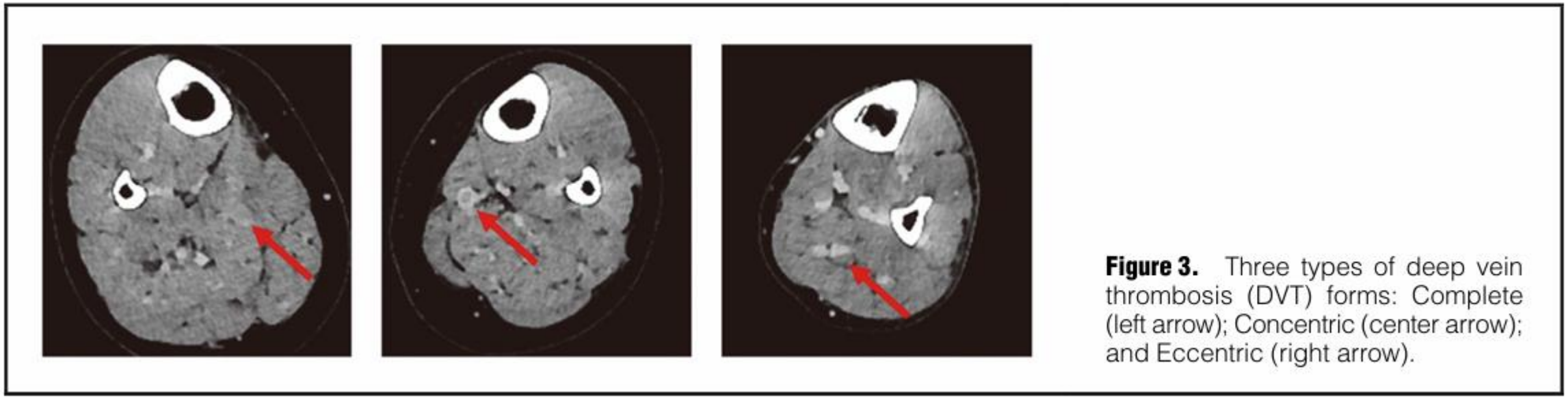

Figure 3. Three types of deep vein thrombosis (DVT) forms: Complete (left arrow); Concentric (center arrow); and Eccentric (right arrow).

Complete Concentric Eccentric

MDCT Imaging Protocol

- CTPA-CTV studies were performed on a 192-slice scanner
- flow rate of 22.2 mgI/kg/s（大約是體重 × 0.06 = 注射流速 (cc/s)）
- threshold of 200 (HU) within the pulmonary trunk was used, and the acqui sition of CTPA started 10 s after the trigger
- CTV started 5 min after the completion of the CTPA
- 80 kVp; collimation, 192×0.6 mm; (CARE Dose4D; Siemens) (CTDIvol) of 3 mGy; section thickness, 2.0 mm; slice interval, 2.0 mm; gantry rotation time, 0.28 s; and pitch, 0.85.
- The IR technique of the Sinogram Affirmed Iterative Reconstruction (SAFIRE; Siemens) was used with the strength level 4.

Conclusions

- The DVT diagnostic ability above the knee was comparable between low tube voltage CTV with IR and conventional CTV,
- eccentric DVT on CTV tend to be a false positive, especially in the calf muscular vein.

敬請指導