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IMAGING IN INTENSIVE CARE MEDICINE

Carbon dioxide angiography for detecting minor hemorrhage

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A 78-year-old man was diagnosed to have left emphysematous pyelonephritis with disseminated intravascular coagulopathy. Incisional drainage and a pigtail catheter placement were performed as the initial surgical treatment. Four days after the operation, contrast-enhanced computed tomography revealed a massive hematoma around the left kidney; therefore, urgent angiography was performed.

The trunk of the left renal artery was engaged with a 4 Fr Shepherd's hook catheter. Digital subtraction angiography (DSA) with an iodinated contrast agent demonstrated good anatomical images of renal arteries, but did not reveal hemorrhage. In contrast, CO_2-DSA with a wide imaging range demonstrated the bleeding site, but did not provide good anatomical images (Fig. 1a, b; Movie 1). The sequential use of both contrast agents, thus allowed to exploit the best of both methods: good anatomical images with the iodinated contrast agent and better localization of the bleeding with CO_2-DSA.

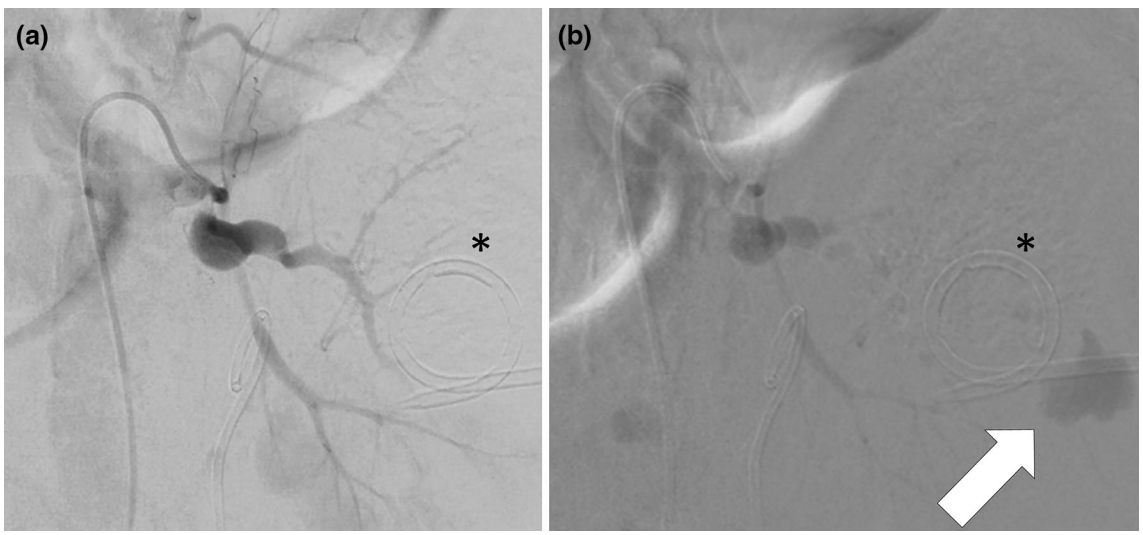

Fig. 1 Angiography images. **a** Angiography with an iodinated contrast agent shows no bleeding. **b** Angiography with CO_2 clearly shows bleeding (arrow) near the location of the pigtail catheter (asterisk)

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In addition to the kidney-friendly nature, the interest in using CO_2 angiography for the detection of minor hemorrhages is due to the low viscosity and high and rapid diffusion. Furthermore, the availability of the high-performance angiography system, which can reduce various artifacts, contributed to the good quality images of CO_2-DSA.

Electronic supplementary material
The online version of this article (https://doi.org/10.1007/s00134-019-05796-7) contains supplementary material, which is available to authorized users.

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Author contributions
TT, SS, HI, and YT contributed substantially to the writing of the manuscript.

Compliance with ethical standards

Conflicts of interest
The authors declare that they have no conflict of interest relevant to this manuscript.

Ethical approval
This study has been approved by the Commission for Medical Ethics of National Defense Medical College.

Informed consent
Written informed consent was obtained from the family of the patients.

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