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Ultrasound guided vascular catheterization in non-pulsatile continuous circulation conditions in critical patients with VA ECMO or ventricular assist devices

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Introduction : central venous and arterial catheterisations are very common procedures performed by intensivists and anaesthetists. Traditionally, the technique of locating surface landmarks and palpation was used in catheterization. Vascular access can be challenging in patients with obesity, impalpable pulses, with haemodynamic instability, thrombocytopenia and coagulopathy.

Objectives: to study the clinical effectiveness of vascular ultrasound in arterial and venous catheterization in critical patients with nonpulsatile circulation admitted at cardiac critical care units and to compare with landmark techniques.

Methods: This retrospective study included patients from January 2015 to November 2018 who were admitted to adult cardiac critical care unit with left ventricular assist device (LVAD) or veno-arterial extracorporeal membrane oxygenation (VA ECMO) and required arterial or venous vascular access. Demographic, clinical and laboratory data of patients were collected. The number of attempts for vascular lines insertion, first attempt and procedural success and complications were collected.

Results: 292 vascular catheters were inserted in 152 critical patients. The first attempt success was achieved in (77.9% vs 34.6%, p=0.001) and the procedural success was (100% vs 67.5%, p=0.001) in the ultrasound and landmark groups respectively. The number of attempts was (1.7 ± 0.6 vs 1.2 ± 0.4, p=0.001) and the complications occurred in (2.5% vs 21.2%, p=0.001) in the ultrasound and landmark groups respectively. Jugular catheterization was done in (42.9% vs 19.3%, p=0.001) while subclavian cannulation was done in (5% vs 42.3%, p=0.001) in the ultrasound and landmark groups respectively. Iatrogenic pneumothorax was happened in (0 vs 3.1%, p=0.001) and accidental puncture of adjacent artery was happened in (0 vs 14.7%, p=0.001) and haematoma formation was happened in (3% vs 9%, p=0.03) in the ultrasound and landmark groups respectively.

Conclusion: arterial and venous catheterization guided by ultrasound in critical patients with nonpulsatile circulation and unstable haemodynamics was associated with higher procedural and first attempt success and less complications compared to landmark technique.