

The frequency of CVC with correctly positioned catheter tip raised from 55% in the historical group to 87% in the ultrasound group ( $p < 0.001$ ). In the ultrasound group, the time from end of procedure to line utilization was 2.4 hours, whereas the average time for the ultrasound procedure was 15 minutes” Remerand and Espitalier (2017).

Abstract:

Central venous catheters (CVCs) are routinely inserted in ICU, mainly in the internal jugular vein (IJV) or the subclavian vein (SV). These procedures include three main steps. First, needle, guide wire, and then CVC have to be inserted into the target vein. This was generally performed using landmark technique. Second, IV malposition of the CVC has to be detected, and optimal catheter tip placement in the superior vena cava has to be verified. These situations generally require a chest x-ray (CXR) just after the procedure. Third, potential complication has to be detected (mainly pneumothorax), here again with a postprocedural CXR. CXR seemed therefore as the gold standard for CVC control, despite its ionizing effects, and its delayed availability (from 30 minutes to a couple of hours depending of the studies).

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In the last 15 years, focused bedside ultrasound has deeply improved and secured each of these three steps. First, real-time ultrasound guidance is now recommended for needle insertion, notably for IJV cannulation (1–4). Second, bilateral ultrasound visualization of the IJV and SV allows discarding CVC malposition. An ultrasound view of the right atrium (short- or long-axis subcostal views, and sometimes four-chamber apical view) allows optimizing catheter tip position in the lower superior vena cava. Third, lung ultrasound is more accurate than CXR to exclude a pneumothorax (4, 5). Therefore, can bedside ultrasound become the new gold standard for CVC control, and so replace CXR?

Several studies challenged ultrasound-based protocols to evaluate whether ultrasound could decrease CXR requirements (6–9). In these protocols, bedside ultrasound was inconstantly used to CVC insertion, but it was systematically used to assess the tip position, and to detect CVC malpositions and pneumothorax. In all of these studies, the ultrasound examination was shorter than the time to obtain a CXR, with similar diagnostic accuracy (except if CVC or chest drains were already present [7]). Unfortunately, in these studies, bedside ultrasound was performed just after the procedure. In other words, infra-optimal tip placement or malposition was always identified a posteriori, and so required a new procedure to be corrected. The other common limit of these studies was the absence of control group (each patient had both ultrasound protocol and CXR).

In this issue of Critical Care Medicine, Galante et al (10) performed a controlled study evaluating a protocol that included a real-time ultrasound optimization of catheter tip placement. They hypothesized that this new protocol could decrease infra-optimal catheter tip placement and CVC malposition. In a historical group, 94 CVCs were inserted with landmark techniques. Their placement was verified after the procedure on a CXR. In a prospective group, 68 CVCs were inserted using ultrasound at the three steps (only IJV CVCs were inserted under ultrasound guidance). Their tip position was optimized in real time by detecting the guide wire in the right atrium, while handling a second ultrasound probe covered by sterile drapes. After the procedure, a lung ultrasound excluded pneumothorax, and a CXR was performed in all patients.

The frequency of CVC with correctly positioned catheter tip raised from 55% in the historical group to 87% in the ultrasound group ( $p < 0.001$ ). In the ultrasound group, the time from end of procedure to line utilization was 2.4 hours, whereas the average time for the ultrasound procedure was 15 minutes.

This study has a methodologic limitation. The historical group differed from the prospective group: patient recruitment (Table 2 in [10]) and physicians changed between both periods. Neither the number nor the experience of the physicians in the historical group was described, while three experimented physicians inserted all CVC in the ultrasound group.

Reference:

Remerand, F. and Espitalier, F. (2017) Central Venous Catheter Insertion and Bedside Ultrasound: Building a New Standard of Care? Critical Care Medicine. 45(10), p.1793-1794. DOI: 10.1097/CCM.0000000000002555

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