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Should all critical care patients with a central venous catheter in situ be screened for central catheter related thrombosis?

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Abstract

There are many studies on central catheter related thrombosis (CCRT), however, there are significantly fewer studies focusing on the incidence and evolution of CCRT in the adult critical care population. This article reviews data collected from observational studies that have performed bedside duplex ultrasound for surveillance of CCRT and discuss if we should routinely screen for CCRT. The reported CCRT incidence is 17–38%, with most thrombus being detectable on ultrasound within seven days of line placement. Nearly all CCRT are designated as asymptomatic (no associated pulmonary embolism (PE) or deep vein thrombosis (DVT)) and no significant changes in mortality rates amongst patients that develop CCRT were reported. Based on the evidence reviewed, we do not recommend screening routinely for CCRT in the adult critical care population.

Key words: Central catheter related thrombosis; Critical care; Duplex ultrasound; Central venous catheters (CVCs)

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Central venous catheters (CVCs) placed in Critical Care Unit (CCU) patients can result in central catheter related thrombosis (CCRT). Should this patient group receive point of care ultrasound to screen for CCRT?

Studies focusing on CCRT surveillance within the CCU setting are limited. A systematic search for 'catheter related thrombosis' was performed using the EBSCO database. Articles relating to oncology patients and those not relating to critical care were excluded.

Routine screening for central catheter related thrombosis is necessary

Bedside duplex ultrasound surveillance of CCRT has the potential to offer CCU patients protection against complications associated with CVCs such as pulmonary embolism (PE), symptomatic deep venous thrombosis (DVT), post thrombotic syndrome and central line associated blood stream infection (CLABSI). Duplex ultrasound is well-established as a safe, sensitive, low cost and convenient method of diagnosing CCRT. Historically contrast venography was considered the gold standard however in comparison to duplex ultrasound it is associated with radiation exposure, contrasts risks and is technically more difficult to perform and thus is now less widely used (Wall et al, 2016).

Nm Bhat M et al (2019) studied intensivist performed CCRT screening using bedside ultrasound after internal jugular vein (IJV) CVC placement (n=50) at 3, 6, 9, 12 and 15 days post insertion. The authors reported a CRRT incidence of 38% (n=19) with thrombus detection at an average of 6.9 days after line placement. Interestingly, the authors also found that all cases of CLABSI (n=5) occurred in patients who also had CCRT detected. Although CCRT has not been shown to increase rates of mortality (Wu C et al, 2023 and Abbruzzese et al, 2023), CLABSI in the CCU setting is a significant source of mortality and healthcare-related costs.

Wu C et al (2023) performed a prospective multicentre study (n=1262) using daily ultrasound scanning to both detect and follow the evolution of CCRT. The authors reported

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an overall CCRT incidence of 16.9% (n=213; by site 23% IJVs, 11.2% femoral veins (FV) and 7.4% subclavian veins (SCV)). Central catheter related thrombosis diameter was >5 mm in 48% of cases. All were classified as asymptomatic (no associated DVT or PE). Notably, 82% of CCRT were detectable within seven days of CVC insertion. The study protocol dictated ongoing surveillance for seven days after CCRT diagnosis regardless of whether the CVC had been removed or not. When the CVC remained in situ, there was no significant change in thrombus diameter during the seven-day surveillance period (p=0.84). Four days after CVC removal, the diameter of the thrombus had significantly decreased ($p \leq 0.001$). CVC removal and use of anticoagulation was variable and at the discretion of the treating physician. Multivariate analysis revealed that both age and IJV insertion site were independent predictors of CCRT occurrence. This study demonstrates the potential benefits of US monitoring of CCRT and could usefully impact on the management of line thrombosis in patients with relative contraindications to anticoagulation.

Routine screening for central catheter related thrombosis is unnecessary

When considering a screening programme, important considerations include the condition's incidence, the treatment options and the mortality benefits of its early identification.

Abbruzzese et al (2023) performed a single-centre prospective observational cohort study; 375 CVCs (302 IJV, 60 FV, 13 SCV) were screened daily for CCRT by duplex ultrasound. The median time interval between catheter placement and CCRT was 5 days and the overall incidence of CCRT was 17.7% (n=52). All CCRTs were asymptomatic. The IJV had a higher incidence rate of CCRT (20.1%) when compared to other sites (5.9%). This finding is supported by Wu C et al (2023) and Hrdy O et al (2017) (p<0.001). Abbruzzese et al (2023) reported no significant difference in mortality (p=0.323) but did report a longer length of CCU to stay in those patients identified to have CRRT ($p \leq 0.001$).

Hrdy O et al (2017) looked for CCRT in CCU patients at the time of CVC removal (n=198). A 24% CCRT incidence (n=47) was reported, of which 68% were categorised as incomplete obstruction of the vessel. Note 70% of the CVCs were sited in the SCV and 95.8% of CCRT were asymptomatic. No mortality difference (p=0.212) was seen between patients with or without CCRT. This is supported by Wu C et al (2023).

Conclusions

The literature does not dispute that bedside ultrasound is a safe, sensitive, and convenient method of diagnosis of CCRT. Patients with *symptoms* associated with CCRT should receive a diagnostic bedside ultrasound.

Surveillance bedside ultrasound has demonstrated that CCRT can occur in association with CVCs in 17–38% of CCU patients within a relatively short time frame (5–7 days). The vast majority of the CCRT identified by bedside surveillance are asymptomatic defined as having no associated DVT or PE.

Asymptomatic CCRT are not associated with an increased mortality and there is no consensus on their appropriate management in the literature. The basic principles of a screening programme are not met.

We currently do not recommend surveillance bedside ultrasound in asymptomatic CCU patients to identify CCRT. Further research is required to study asymptomatic CCRT in more detail. We recommend further studies powered to consider associated mortality and then to help risk stratify potential treatment options.

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Key points

- This article is a review of observational studies that have used bedside Duplex ultrasound to study CCRT.
- The article reviews study reported incidences of CCRT.
- The article reviews the evolution of CCRT by Duplex ultrasound.
- The article reviews findings around length of stay and mortality in relation of CCRT.
- The article draws a conclusion related to the need to routinely screen for CCRT.

Availability of data and materials

All the data supporting the findings of this study are available within the manuscript.

Author contributions

NMS and CC performed the research for this article. CC drafted the manuscript and both authors contributed to editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics approval and consent to participate

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Conflict of interest

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