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## CLINICAL INFORMATION

# Ultrasound-guided central venous catheterization – “Syringe-Free” approach

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Ultrasonography;  
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Internal jugular vein  
cannulation;  
Oblique view

### Abstract

**Background and objectives:** Central venous catheterization of the internal jugular vein is a commonly performed invasive procedure associated with a significant morbidity and even mortality. Ultrasound-guided methods have shown to significantly improve the success of the technique and are recommended by various scientific societies, including the American Society of Anesthesiologists. The aim of this report is to describe an innovative ultrasound-guided central line placement of the internal jugular vein.

**Technique:** The authors describe an innovative ultrasound-guided central line placement of the internal jugular vein based on an oblique approach – the “Syringe-Free” approach. This technique allows immediate progression of the guide wire in the venous lumen, while maintaining a real-time continuous ultrasound image.

**Conclusions:** The described method adds to the traditional oblique technique the possibility of achieving a continuous real-time ultrasound-guided venipuncture and a guide wire insertion that does not need removing the probe from the puncture field, while having a single operator performing the whole procedure.

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### PALAVRAS-CHAVE

Ultrassonografia;  
Intervenção;  
Veias jugulares;  
Cateterização;

### Cateterização venosa central guiada por ultrassom – abordagem “Syringe-Free”

### Resumo

**Justificativa e objetivos:** A cateterização venosa central da veia jugular interna é um procedimento invasivo realizado frequentemente e associado a morbidade significativa e até mesmo

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Veia central;  
Canulação da veia  
jugular interna;  
Abordagem oblíqua

mortalidade. Os métodos guiados por ultrassonografia têm demonstrado uma melhora do sucesso deste procedimento e são recomendados por várias sociedades científicas, incluindo a *American Society of Anesthesiologists*. O objetivo deste artigo é descrever uma abordagem inovadora de cateterização venosa central guiada por ultrassonografia ao nível da veia jugular interna.

**Técnica:** Os autores descrevem técnica ecoguiada inovadora de cateterização venosa central da veia jugular interna, baseada numa abordagem oblíqua – a abordagem “*Syringe-Free*”. Esta técnica permite uma progressão imediata do fio-guia ao longo do lúmen venoso, mantendo uma visualização ecográfica em tempo real e contínua.

**Conclusões:** A técnica descrita acrescenta à técnica oblíqua tradicional a possibilidade de, com um único operador, conseguir uma punção venosa central com visualização ecográfica contínua e em tempo real associado à inserção do fio-guia sem necessidade de afastamento do transdutor de ultrassonografia do campo de punção.

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## Introduction

The central venous catheter (CVC) insertion is an invasive procedure commonly performed not only within anesthesiology, but also in multiple specialties ranging from oncology to emergency medicine.<sup>1</sup>

The traditional anatomic landmark technique for placing central venous lines, however valuable, has been linked to a number of procedure-related complications such as arterial puncture or cannulation, venous injury, pneumothorax and hemothorax.<sup>2,3</sup> Comparatively, ultrasound-guided methods have shown some advantages; namely, a decrease in the number of inadvertent arterial puncture or cannulation, less incidence of pneumothorax, higher success rates and favorable cost–benefit ratios.<sup>1,4–6</sup> Its use is therefore recommended by various scientific societies, including the American Society of Anesthesiologists.<sup>6–9</sup>

Among anesthesiologists, the most frequently selected site for central access is the internal jugular vein (IJV). Techniques described include the traditional ultrasound transverse and longitudinal approaches, as well as an alternative oblique view.<sup>10–13</sup> In relation to the latter, different variants have been illustrated; specifically, medial-oblique, lateral-oblique and medial-transversal techniques.<sup>13–15</sup> The referred ultrasound-guided methods share the fact that the operator can confirm the location of the vessel by aspirating blood. However, subsequently, the operator has to disconnect the syringe in order to pass the guide wire through the needle or pass it through a guide wire syringe device. Regardless of which method is used, this requirement increases the possibility of needle dislocation (with all the associated implications, such as arterial puncture, needle tip exteriorization from the venous lumen, and nerve injury). In addition, it requires the presence of a second operator in order to achieve a continuous ultrasound imaging from the skin puncture until the complete guide wire insertion.

This paper describes an innovative ultrasound-guided CVC placement in the IJV that is based on the oblique view, but only requires a single operator and provides real-time continuous ultrasound imaging. This procedure is achievable by using the lateral-medial variant approach with the

guide wire adapted to the needle from the beginning of the procedure.

## Technique

The patient is placed in a 15° Trendelenburg position with a slight head rotation to the side opposite to the operator. The authors recommend placing the ultrasound screen on that side, so that the operator can look up directly at the screen within the same field of vision used to advance the needle. Aseptic technique for preparation is mandatory. Also, the high frequency linear probe and respective cable should be isolated with an appropriate sterile sleeve. The guide wire is adapted to the puncture needle before initiating the procedure (Fig. 1).

As described by Phelan and Hagerty,<sup>13</sup> in order to visualize the carotid artery and the IJV, the probe is placed in a plane transversal to the neck at the level of the sternal and clavicular heads of the sternocleidomastoid (SCM) muscle. When compared to the carotid artery, the IJV generally appears to be non-pulsating, is larger and more superficial, has a thinner vessel wall, and is more easily compressed. It is imperative to correctly position the probe so that the structures on the right side of the ultrasound image correspond to the same side on the patient. Once the described image is obtained, the probe should be rotated 45° clockwise or counterclockwise (whether the target is the right or the left IJV, respectively) to achieve an oblique orientation. The catheterization is performed in this position, in which the vessels emerge as ovoid hyperechoic structures covered by the SCM muscle. The skin is punctured with the needle (adapted to the guide wire) at the lateral cephalic border of the probe, and is advanced in plane toward the IJV. This allows a complete observation of the needle's trajectory. In addition, the cephalic–caudal orientation of the needle will benefit the subsequent progression of the guide wire. As soon as the needle penetrates the vessel lumen, the guide wire is introduced under direct continuous ultrasound visualization (Fig. 2). Once correct introduction and progression of the wire are confirmed, the needle is removed and the procedure is completed in the traditional manner.

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