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Internal jugular vein valves complicating central venous catheter placement: a case report

S. Pissens (*), M. Peetermans (**), A. Wilmer (**)

Abstract: Placement of central venous catheters in the internal jugular vein is a frequently performed procedure. We present the case of a patient with venous valves causing an unexpected anatomic hindrance in the placement of a central venous catheter in the internal jugular vein. Venous valves are common in the internal jugular vein and can hinder cannulation. Ultrasound can be of use in the proper placement of a central venous line in a patient where cannulation is complicated by venous valves.

Keywords: Central venous catheter; ultrasound; venous valve.

Introduction

Central venous catheters are frequently placed when treating patients in the critical care department, operating theatre and emergency department.

For cannulation of the internal jugular vein, the real-time use of ultrasound is recommended as it increases the success rate of cannulation and reduces the risk of arterial puncture and formation of hematoma (1).

We present the case of a patient with venous valves causing an unexpected anatomic hindrance in the placement of a central venous catheter in the internal jugular vein. A comprehensive review of misplacement of central venous catheters does not mention venous valves as a possible factor complicating placement (2). Therefore, we would like to highlight the possibility of venous valves complicating central venous catheter placement and the role of ultrasound in both diagnosis and management hereof.

Case report

Written informed consent was obtained from the patient. A 45-year-old male was admitted to our medical intensive care unit with acute on chronic liver failure. Central venous access was necessary for infusion of vasopressors. Due to coagulopathy, the internal jugular vein was chosen. Ultrasound guided (General Electric LOGIQ e) placement of a central venous catheter (Arrow Multi-Lumen central venous catheter) in the left internal jugular vein was attempted. Needle insertion in the internal jugular vein was uneventful and venous blood was easily aspirated. Advancing the guidewire was however impossible due to unexpected resistance at approximately 6 centimeter out of the introducer needle. A second attempt was performed in the right internal jugular vein with again uneventful puncture of the vein and backflow of blood, but with unexpected resistance on advancing the guidewire

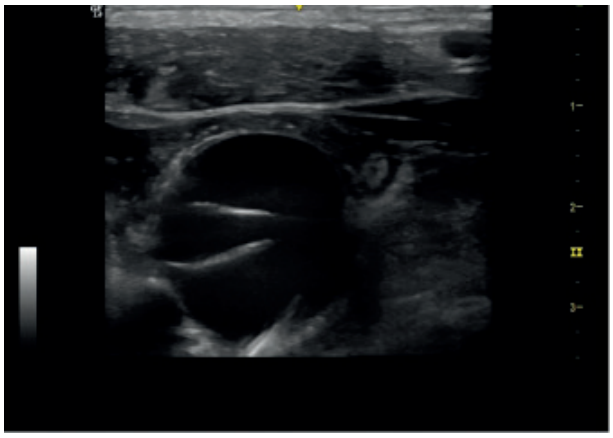

Figure 1. — Short axis view of the bicuspid valve in the right internal jugular vein. The left side is the medial side. The depth in centimeters is noted on the right side in yellow.

Simon Pissens, MD; Marijke. Peetermans, MD PhD; Alexandre Wilmer, MD PhD

(*) Department of Anesthesiology, University Hospitals Leuven, B-Leuven

(**) Medical Intensive Care Unit, University Hospitals Leuven, B-Leuven

Corresponding author: Simon Pissens, Department of Anesthesiology ,University Hospitals Leuven. Herestraat 49, 3000 Leuven. Belgium. Phone: +32497741475

Email: simon.pissens@uzleuven.be

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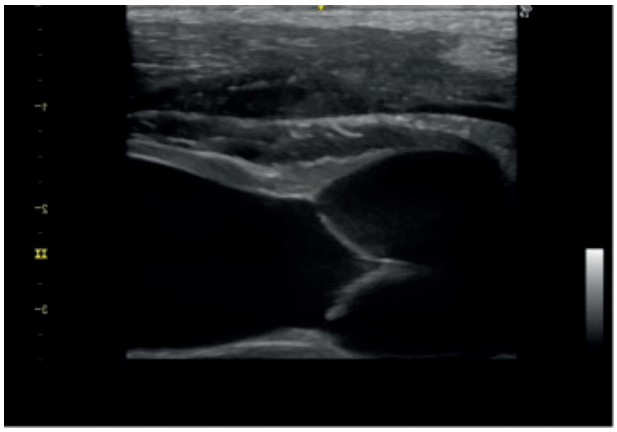
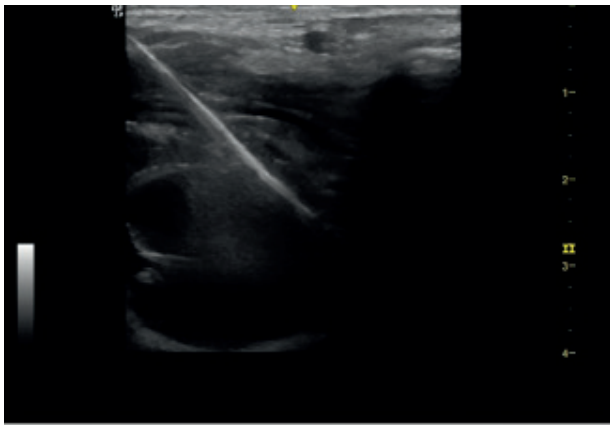
Conflict of interest: None.



Supplemental figure 1. — Long axis view with complete coaptation of the two leaflets (mirrored to match orientation of supplemental figure 2) of the right internal jugular vein. The left side is the cranial side.



Supplemental figure 2. — Guidewire placed distal to the valve resulting in successful cannulation of the right internal jugular vein. The left side is the cranial side.

beyond 3 centimeter out of the introducer needle. Due to concerns about the nature of this resistance (e.g. thrombosis or stenosis), we performed a detailed assessment of the area with ultrasound. A bicuspid venous valve was found (Fig. 1). The guidewire could not be passed despite repositioning of the needle as well as the guidewire including using the reverse end of the guidewire. Changing the positioning of the patient from Trendelenburg position to neutral position did not result in less resistance, reverse Trendelenburg positioning was not tried due to concerns of aggravating existing hypotension. A long axis view showed complete coaptation of the two leaflets with intermittent opening (supplemental fig. 1). A similar valve was found on the left side. A new cannulation of the right internal jugular vein was attempted distal to the valve (using an in-plane technique) and was uneventful (supplemental fig. 2). Chest radiography confirmed correct position of the catheter.

Discussion

Valves in the internal jugular vein are present in approximately 90-95 percent of subjects in autopsy studies (3, 4). The venous valves in the internal jugular and subclavian veins might play an important role in preventing backwards venous flow in conditions of sudden elevated intrathoracic pressure such as coughing or cardiopulmonary resuscitation (5). A cadaveric study by Furukawa et al (3). showed bicuspid valves to be the most common type in about 70%, unicuspid valves are present in about 25% and tricuspid valves in about 2% of cases. Similar findings were seen in another autopsy study (4) and in an ultrasound study in a pediatric population (6).

In about half of the cases these valves are at the level of the clavicle (3). This makes them harder to visualize with echography and other case reports have been made where the valves were initially missed even though the placement was echo-guided (7, 8). A thorough preprocedural assessment of the internal jugular vein, including the most caudal regions, is thus warranted.

Although jugular vein valves are observed in a large proportion of the population (3, 4, 6), clinical problems are rarely encountered as the relatively few case reports for a frequently preformed procedure suggest (7, 9-13). The high prevalence (up to 90%) of incompetent valves (14) could be a reason why resistance during cannulation appears to be rarely encountered.

Apart from failure to insert a catheter (7, 9-12), venous valves can also result in a 180-degree malposition, redirecting the catheter tip cranially (15). Cannulation of the internal jugular vein may cause persistent incompetence of the valve, suggesting these venous valves are prone to injury by cannulation (16). This is supported by cadaveric findings showing possible thrombosis, fibrosis and perforation of the valve cusps by venous cannulation (4).

Whether damage caused by cannulation has any clinical implications is unknown.

When cannulation proves impossible in the right internal jugular vein due to a venous valve, reports have been made of successful cannulation of the left internal jugular vein (9, 12). However in our case, we had resistance in both internal jugular

veins but we were able to overcome this problem by ultrasound-guided cannulation distal to the valve. If the valve is retroclavicular, ultrasound-guided distal cannulation will most likely be very challenging and another large vein should be chosen for cannulation.

Conclusion

Venous valves are common in the internal jugular vein. In a minority of cases these valves do hinder cannulation. An unexpected resistance during guidewire insertion should raise suspicion of possible obstruction by venous valves among other possibilities such as thrombosis or stenosis. Due to possible trauma to the valve, force shouldn't be used to advance the guidewire past the valve. Venous valves are not routinely visualized when placing a central venous catheter under ultrasound guidance due to their typical retroclavicular position, although a complete preprocedural assessment of the vein might reveal their presence.

When the internal jugular vein valves are located at the cervical level, an echography guided cannulation distal to the valve might be an option when these valves do pose a problem in placing a central venous line and other insertion sites are contraindicated.

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