Complete heart block during ultrasound-guided central venous catheterization

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A 65-year-old woman with dialytic chronic kidney disease was admitted to our unit for treatment of a sepsis of urinary focus. Her medical history included hypertension, type 2 diabetes mellitus and dyslipidemia. Her home medications were furosemide, amlodipine, atenolol, hydralazine, omeprazole, aspirin, losartan, simvastatin and NPH insulin. Electrocardiogram (ECG) at admission showed a sinus rhythm with left bundle branch block. A real-time ultrasound-guided central venous catheter cannulation was attempted through the right internal jugular vein with the patient connected to a monitor that recorded her ECG and blood oxygen saturation. Before performing the cannulation, her heart rate was averaging 70–80 beats per minute. During the process of guidewire insertion, her heart rate suddenly dropped to 35 beats per minute, and the ECG on the monitor displayed a pattern compatible with a complete heart block. A stat ECG was obtained (Fig. 1), which confirmed the complete heart block. She remained unresponsive for 30 s, but her blood pressure was unaltered. Application of external transcutaneous pacing was suggested, but in the meanwhile, over the next 20 min, the patient spontaneously regained her previous baseline rhythm. A panel of cardiac enzymes was performed, and came out normal. The rest of her clinical course included the treatment of infection-related complications, but no further dysrhythmic event was detected during the hospitalization, and an outpatient follow-up after 2 months

revealed no further clinical events, and her ECG was similar to her previous baseline rhythm.

Central venous catheterization is a common procedure in medical practice, performed by a wide array of medical specialties, including emergency physicians, intensive care physicians, nephrologists, surgeons and anesthesiologists. It enables the infusion of drugs, blood products, chemotherapy, or parenteral nutrition, and it also provides access for hemodialysis. Although more than 15% of central venous catheterizations present complications, mainly subcutaneous hematomas, vascular injuries, infections and pneumothorax, cardiac dysrhythmias are rarely reported in this setting [1]. However they are probably being underestimated because only a small percentage of dysrhythmias are symptomatic [2]. Due to the relatively rarity and usually transient nature of dysrhythmias during this procedure, physicians frequently are not aware of such complication, and commonly perform this procedure without continuous electrocardiographic and pulse-oximetry monitoring, which would enable early detection of dysrhythmias during the procedure. Indeed, the occurrence of a complete heart block during central venous catheter cannulation is a rare complication compared with others such as a pulmonary artery puncture on cardiac catheterization, mainly because during this procedure no structure should enter into the heart [3]. However, some points should be considered: the guidewires used to facilitate the central venous catheter insertion through the Seldinger's technique are rigid, so they predispose to a higher risk of cardiac conduction disturbances while on direct trauma to the right bundle branch, which is quite superficially placed anatomically in the right ventricle as compared with the left bundle branch. Of note, the overall incidence of a right bundle branch block during the passage of guidewires or catheters into the heart is as high as 12% [4]. In patients

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Fig. 1 ECG evidencing the complete heart block following the guidewire insertion for RIJV cannulation

with a baseline ECG without any electrical conduction disturbances, a transient right bundle branch block usually does not cause major clinical impacts; however, even a transient one in a patient with a preexisting left bundle branch block may lead to a complete heart block and hemodynamic instability due to a simultaneous bilateral bundle branch block [3].

There are only a few case reports addressing the occurrence of complete heart blocks during central venous cannulation [3, 4], however none of them was performed with a real-time ultrasound guidance. Indeed, many studies are proving the superiority of real-time ultrasound-guided central venous catheterization over the standard landmark technique, showing higher rates of puncture success, shorter procedure duration and lower mechanical complications [1]. However, complications such as dysrhythmias, as seen in the present case, are generally not prevented with this new technique. In summary, we report a case of a complete heart block due to an inadvertently central venous catheterization performed in the right internal jugular vein in a patient with a previous left bundle branch block. Thus, physicians should be aware of such lethal however preventable complication during central venous cannulations [4], and routinely adopt measures to diagnose and reduce its risk while performing this procedure. The main ones

are: continuous periprocedural ECG monitoring, and avoiding excessive insertion of guidewires, since in most cases, 18 cm should be regarded as the upper limit for introducing the guidewire during central venous catheterization in adults, and specifically for the right internal jugular vein, the mean distance to the superior vena cava-atrial junction is even shorter, with an average of 16 cm [5]. Additionally, in patients with higher risks for the development of dysrhythmias, especially if a previous left bundle branch block is detected, choosing femoral venous cannulation over the thoracic sites is an effective measure to prevent this potentially lethal complication.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Statement of human and animal rights The patient was treated following the ethical standards and cannot be identified by text or image.

Informed consent The authors declare that written informed consent was obtained from the patient included in this study.

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