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Be on the alert again for the risk of pulmonary air embolisation in paediatric patients during the insertion of a central venous catheter under general anaesthesia with spontaneous respiration

Tomohiro Yamamoto, Yusuke Mitsuma, Hiroshi Baba

Division of Anaesthesiology, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan

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Dear Editor,

Air embolism is a very rare but well-known and potentially fatal complication of central venous catheter insertion [1, 2]. We experienced a paediatric case of suspected pulmonary air embolisation during insertion of a Hickman catheter with a peel-off sheath system (Medicon Inc., Osaka, Japan).

A tunnelled double-lumen Hickman catheter was inserted in a two-year-old patient (height 86 cm; body mass 13 kg) for planned chemotherapy due to yolk sac tumour with multiple metastases. Because the anaesthesiologists considered it to be a minimally invasive procedure, perioperative anaesthetic management was performed under general anaesthesia with a laryngeal mask using pressure support ventilation to maintain spontaneous respiration of the patient via sevoflurane and intermittent bolus administration of fentanyl. Paediatric surgeons scanned the bilateral subclavian veins of the patient in the Trendelenburg position, and the right subclavian vein was chosen for the puncture site of the 7.5 Fr Hickman catheter insertion. The puncture needle was successfully inserted into the right subclavian vein in the Trendelenburg position using real-time ultrasound-guidance [3–5]. The guide wire was inserted through the puncture needle in the direction of the superior vena cava using a portable X-ray machine. The peel-off sheath and dilator were inserted together over the guide wire. Then, the dilator was drawn out, leaving the peel-off sheath with a free opening at the distal end. Next, the Hickman catheter was inserted into the sheath, and then the sheath was peeled off gradually. During the procedure, the operator put his thumb on the free opening at the distal end of sheath at his own discretion, and the anaesthesiologist attempted the Valsalva manoeuvre with 30 cm H_2O (3 kPa) positive pressure intermittently to maintain positive intrathoracic pressure under close communication with the operator regarding the timing of it, to prevent air from entering the vein. However, the anaesthesiologist felt through the anaesthesia reservoir bag in his hand that the patient unexpectedly breathed in very deeply during the procedure when a Valsalva manoeuvre was released. Directly after that, SpO_2, heart rate, and noninvasive systolic blood pressure declined to 70%, 120 min^{-1}, and 70 mm Hg, from 100%, 140 min^{-1}, and 85 mm Hg before the episode, respectively. The anaesthesiologist suspected that air had entered the vein; therefore, 1 mg kg^{-1} rocuronium was administered to the patient, and positive pressure mechanical ventilation was started with pure oxygen giving 5 cm H_2O (0.5 kPa) positive end-expiratory pressure (PEEP). CO_2 capnography showed a small and irregular curve. Definitive diagnosis using transoesophageal echocardiography was impossible because airway management was performed with a laryngeal mask. The shape of the CO_2 capnogra-

CORRESPONDING AUTHOR:

Tomohiro Yamamoto, MD, PhD, Division of Anaesthesiology, Niigata University Graduate School of Medical and Dental Sciences, 1-757, Asahimachi-dori, Chuo ward, Niigata, 951-8510, Japan, phone: +81-25-2272328, fax: +81-25-2270790, e-mail: yamatomo270@hotmail.com; yamatomo@med.niigata-u.ac.jp

phy recovered and SpO_2 increased back to 100% within a few minutes. The patient did not fall into right heart failure, and no administration of medications such as catecholamine was required. General anaesthetic management progressed without any problems, and the patient woke from anaesthesia without any complications.

We have contacted the maker of the Hickman catheter (Medicon Inc., Osaka, Japan) because our paediatric surgeons experienced a similar episode several years ago, also when a patient was managed under general anaesthesia with spontaneous respiration. However, Medicon Inc. was not aware of such suspected pulmonary air embolisation cases during the insertion of Hickman catheters. The instruction for the Hickman catheter states that patients should hold their breath intermittently during the insertion procedure. However, this is impossible in paediatric patients; therefore, general anaesthetic management is necessary. It is also possible that a spontaneous breath through an airway device, such as a laryngeal mask, requires more effort because of increased resistance due to its thin and long lumen, and it can have faster breath stream velocity [6, 7]; therefore, such breathing condition can pose a risk that the intrathoracic pressure of the patient momentarily becomes strongly negative enough to suck the air into the vein.

The pitfall of the anaesthetic management in this case was the planning to maintain spontaneous respiration of the patient, because the anaesthesiologists found that a Hickman catheter insertion is a minimally invasive procedure. As a result, intermittently performing the Valsalva manoeuvre was required, and this led to exposure of the risk of air sucking into the vein during the catheter insertion procedure.

Considering the pitfall of the anaesthetic management in this case and the fact that air embolism is reported as a very rare but a well-known possible complication during central venous catheter insertion [1, 2], we recommend general anaesthetic management using positive pressure mechanical ventilation with PEEP when inserting a Hickman/Broviac catheter as well as a central venous catheter in paediatric patients, in order to prevent unexpected deep breathing in a spontaneous respiration, and to maintain a continuous positive intrathoracic pressure during the entire procedure from a risk management point of view, even though suspected pulmonary air embolisation cases during Hickman catheter insertion in paediatric patients have not been reported and its maker was unaware of such cases.

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