An Uncommon Cause of Arterial Waveform Artifact!

Vattipalli Sameera[1] Ratnesh K. Shukla[1] Rajendra S. Chouhan[1] Indu Kapoor[1]

[1]Department of Neuroanaesthesiology and Critical Care, Neurosciences Centre, All India Institute of Medical Sciences (AIIMS), New Delhi, India

Address for correspondence Indu Kapoor, MD, Department of Neuroanaesthesiology and Critical Care, Neurosciences Centre, All India Institute of Medical Sciences, New Delhi – 110029, India (e-mail: dr.indu.me@gmail.com).

J Neuroanaesthesiol Crit Care 2019;6:49–50

Invasive blood pressure monitoring is widely used in operating room for continuous beat-to-beat monitoring of arterial blood pressure. Analysis of arterial waveform gives additional information about systemic vascular resistance, intravascular volume status, and certain valvular lesions. Proper acquisition of arterial waveform without artifact is a fundamental prerequisite for its accurate interpretation.

We report the case of a 37-year-old woman with atlanto-axial dislocation scheduled for occipitocervical fixation under general anesthesia. Her routine blood investigations were unremarkable. A written informed consent was taken from the patient. General anesthesia was induced with propofol 100 mg preceded by fentanyl 100 µg. Tracheal intubation was facilitated with rocuronium 50 mg. Anesthesia was maintained with oxygen, nitrous oxide (50:50), and sevoflurane (1.0–1.5 minimum alveolar concentration [MAC]). Right radial artery was cannulated with a 20-G cannula for arterial pressure monitoring. On connecting it to pressure transducer, a normal arterial pressure waveform was observed. About half an hour after positioning the patient prone for surgery, an aberrant waveform was noticed with every alternate beat (►**Fig. 1**). Corresponding electrocardiographic and plethysmographic waveforms were normal. Fast flush test was performed multiple times to achieve normal arterial waveform. Next, the tubing connecting arterial cannula to the transducer was examined and found to be softer than usual. Replacing this highly complaint tubing with a stiffer tube led to the disappearance of the artifact. Excessive compliance of the tubing was the cause for the initial artifact, which later started showing damped waveform with absent dicrotic notch.

Proper reproduction of arterial waveform on the monitor is dependent on natural frequency of transducer system and its damping coefficient. Natural frequency of the cannula-tubing-transducer system determines how fast the system oscillates after a stimulus. Most commercially available pressure transducer systems have a natural frequency of 200 Hz. This value decreases by the use of very long, excessively compliant tubing, decrease in tubing diameter, presence of air bubbles, blood clot, and unnecessary stops in the tubing. All these factors increase damping of the system and lead to distortion of waveform.[1] In our case, excessively compliant tubing usage showed lower invasive blood pressure values when compared with values from stiffer tube reading (difference of [systolic blood pressure of 12 mm Hg, diastolic blood pressure of 8 mm Hg, and mean blood pressure of 5 mm Hg]). Fast flush test or square wave test is a bedside dynamic response test that can be employed to determine the natural frequency and damping coefficient of the transduction system in vivo. While calculation of these values requires measurement of amplitude and duration between oscillations, simple visual inspection of fast flush gives required information about damping of the system.[2] Saline pressurized to 300 mm Hg is flushed through the system by fast flush valve. The test would be successful only if tubing is stiff enough to generate the pressure. Our case is

Fig. 1 An aberrant waveform with alternate beat.

received
September 28, 2018
accepted after revision
November 12, 2018
published online
February 8, 2019

DOI https://doi.org/10.1055/s-0038-1677645
ISSN 2348-0548.

a reminder to all anesthesiologists who routinely use invasive pressure monitoring, to be aware of such miniature hindrance, which can majorly influence the interpretation of the arterial pressure waveform and values, thereby leading to inaccurate monitoring with the potential risk of patient harm due to under/overtreatment.

Conflict of Interest

None declared.

References

1 Schroeder B, Barbeito A, Bar-Yosef et al. Cardiovascular monitoring. In: Miller RD, ed. Miller's Anesthesia. 8th ed. Philadelphia: Elsevier Churchill Livingstone; 2014; 1:1349–1361

2 Jones A, Pratt O. Physical principles of intra-arterial blood pressure measurement. World Anaesth Tutor Week 2009; 137:44–49