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### Are we ready for non-invasive blood pressure monitoring?-reply

Kalmar, A. F.; Vos, J. J.; Poterman, M.; Scheeren, T. W. L.

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## Are we ready for non-invasive blood pressure monitoring?

A. Karnwal\*, M. Lippmann and C. Kakazu

Los Angeles, USA

\*E-mail: karnwal@gmail.com

Editor—We read the recent articles dealing with a new non-invasive blood pressure (BP) monitoring device called 'Nexfin'. The article by Vos and colleagues<sup>1</sup> compares a 'finger' BP attachment with a radial artery catheter (A-line), which is the 'gold standard', when anaesthesia providers are taking care of high-risk patients. Their results showed a bias using a statistical analysis against the Nexfin device. Nexfin may not be superior, even if not 'inferior', as the author's point out, especially on a finger. In reading further within the issue, there is another article dealing with the Nexfin device. Weiss and colleagues<sup>2</sup> also compared the Nexfin device to a radial artery catheter (A-line). The author's also found a 'bias' and concluded that the Nexfin device is not interchangeable with invasive monitoring and may be used to detect variations in blood pressure. The two articles in the journal truly show us that the Nexfin device is not perfected as yet and anaesthesia providers should refrain from using the non-invasive device. In patients with stable haemodynamic parameters, an upper arm BP cuff is still the way to go. For decades, non-invasive blood pressure cuffs have been used in most patients and invasive arterial catheters in high-risk patients. These are the 'gold standards' in anaesthesiology practice.

Another study by Schumann and colleagues<sup>3</sup> showed good correlation between the new non-invasive BP device and the A-line in a series of morbidly obese patients (mean BMI 48 kg m<sup>-2</sup>). They also found a statistical bias compared with an A-line. They suggested that the differences in pulse pressure variation between the invasive and non-invasive approaches likely reflect the specific technologies and algorithms used by each monitor. When a patient's instability overwhelms non-invasive technology and algorithms, they become largely unreliable, and an invasive A-line is still the gold standard. Kim and colleagues<sup>4</sup> also found 'bias' when comparing continuous

non-invasive BP monitoring with invasive monitoring in a meta-analysis. As the artery is much smaller at the finger level, the pulse oximeter's waveform can tell you the quality of the pulse. When the patient takes a deep breath, it affects the venous return to the heart, which changes the volume of the pulse and the size of the trace. This may serve as an early warning system of the patient's volume status. Most of these authors<sup>1-3</sup> have found bias when using the Nexfin device. Its use should be limited as an adjunct to monitor variations and patterns rather than as a true estimation of BP.

### Declaration of interest

None declared.

### References

1. Vos JJ, Poterman M, Mooyaart AQ, et al. Comparison of continuous non-invasive finger arterial pressure monitoring with conventional intermittent automated arm arterial pressure measurement in patients under general anaesthesia. *Br J Anaesth* 2014; **113**: 67–74
2. Weiss E, Gayat E, Dumans-Nizard V, LeGuen M, Fischler M. Use of the Nexfin device to detect acute arterial pressure variations during anaesthesia induction. *Br J Anaesth* 2014; **113**: 52–60
3. Schumann R. Alternative to A-line? Device offers noninvasive view of pulse pressure variation. *Anesthesiol News* 2014; **40**: 7
4. Kim SH, Lilot M, Sidhu KS, et al. Accuracy and precision of continuous noninvasive arterial pressure monitoring compared with invasive arterial pressure. *Anesthesiology* 2014; **120**: 1080–97

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### Reply from the authors

## Are we ready for non-invasive blood pressure monitoring?—reply

A. F. Kalmar\*, J. J. Vos, M. Poterman and T. W. L. Scheeren

Groningen, The Netherlands

\*E-mail: Alain.Kalmar@azmmsj.be

Editor—As pointed out by Karnwal and colleagues, our report<sup>1</sup> demonstrates a bias of Nexfin with the arterial line and an accuracy that is for many clinical indications insufficient to replace invasive monitoring. Our main research question however was to assess the accuracy of Nexfin compared with conventional non-invasive blood pressure (NIBP) monitoring (upper arm BP cuff), and we must strongly disagree that 'our article truly shows' that anaesthesia providers should refrain from using these

continuous non-invasive devices. Our research demonstrates that within the clinical context of the study population, the accuracy of Nexfin tends to be better than that of conventional NIBP monitoring (in addition to its advantage of being continuous). While conventional NIBP monitoring may be the clinical standard, it is certainly not a gold standard for arterial BP monitoring. Therefore, when using Nexfin as an NIBP monitor, we would advise to also use conventional NIBP monitoring, but

take advantage of the continuous nature of continuous NIBP monitoring and be aware of the generally higher accuracy of continuous NIBP compared with intermittent NIBP monitoring.

Just as with any monitoring device used in anaesthesia, the reliability of the monitor is highly dependent on the signal quality, whether it is heart rate calculation from ECG, end-tidal carbon dioxide (CO<sub>2</sub>) from the capnogram, or any other derived variable. Signal quality is difficult to quantify and requires some experience to be able to judge these waveforms in routine clinical practice. Therefore a clinician aspiring to use continuous NIBP measurement should get acquainted with appraising signal quality in order to assess the reliability of measured pressures. Whereas any clinician can to a comfortable degree assess the reliability of the oxygen saturation number based on the quality of the pulse oximetry waveform, or the reliability of the end-tidal CO<sub>2</sub> value based on the capnogram, equivalently most cases of unreliable continuous NIBP can be appreciated based on the waveform. Consequently, the clinical reliability of continuous NIBP systems such as Nexfin or CNAP is arguably determined by the ability of the clinician to appreciate the quality of the pressure waveform. We would therefore advise any clinician who has

access to a continuous NIBP monitoring system to use it several times in patients along with invasive and NIBP monitoring in order to learn to appreciate the quality of the signal and the additional information obtained by the non-invasive technology. We expect they will observe the same results as we demonstrated in our report, namely, sometimes a considerable bias with the IBP, to a degree unacceptable in many patients, but with a bias that is considerably smaller than conventional intermittent NIBP.

### Declaration of interest

None declared.

### Reference

1. Vos JJ, Poterman M, Mooyaart AQ, et al. Comparison of continuous non-invasive finger arterial pressure monitoring with conventional intermittent automated arm arterial pressure measurement in patients under general anaesthesia. *Br J Anaesth* 2014; **113**: 67–74

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## Does anaesthesia really cause persistent atelectasis?

G. B. Drummond

Edinburgh, UK

E-mail: g.b.drummond@ed.ac.uk

Editor—The article by Defresne and colleagues<sup>1</sup> is a complex study using several outcomes that assess different effects of anaesthesia and surgery on the body. Thus functional residual capacity (FRC) is usually a measure of the static, relaxed, elastic properties of the respiratory system. In some conditions, muscle action at end expiration will affect this static equilibrium. For example, in patients who have had abdominal surgery and received opioid analgesia, expiratory muscle action is a prominent feature.<sup>2</sup>

On the other hand, vital capacity after surgery reflects the ability of a patient to take a full inspiration and then fully exhale, a test more of fortitude and desire to cooperate than of the effects of the procedures on the lung. Changes in forced expiratory volume are generally closely related to changes in forced vital capacity. Blood oxygenation is the only useful summary index of the likely effects of anaesthesia and surgery on the function of the lung itself (one of which may be atelectasis, which is the main interest of the study by Defresne and colleagues).

The first of the 'editor's key points' unfortunately confuses the issue: 'General anaesthesia causes a reduction in functional residual capacity (FRC) that can last several days'. This is quite incorrect, general anaesthesia does not cause persistent changes in FRC.

The articles cited by the authors to support their initial hypothesis are studies of patients who had open upper abdominal

surgery. It is not clear how much relevance such studies have in relation to the aims of the article's authors.

They studied the assumption that lung opacities seen on CT scans during anaesthesia (which are associated with the decrease in FRC during anaesthesia) are in any way the same as postoperative atelectasis, which has never been shown to have the same causes. The present study suggests strongly that these are different entities and extrapolation from the intra- to the postoperative period is mistaken.

### Declaration of interest

None declared.

### References

1. Defresne AA, Hans GA, Goffin PJ, et al. Recruitment of lung volume during surgery neither affects the postoperative spirometry nor the risk of hypoxaemia after laparoscopic gastric bypass in morbidly obese patients: a randomized controlled study. *Br J Anaesth* 2014; **113**: 501–7
2. Duggan J, Drummond GB. Activity of lower intercostal and abdominal muscle after upper abdominal surgery. *Anesth Analg* 1987; **66**: 852–5

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