Comparison of iNIBP, linear inflation non-invasive blood pressure measurement, and conventional deflation NIBP in detecting hypotension during Caesarean section

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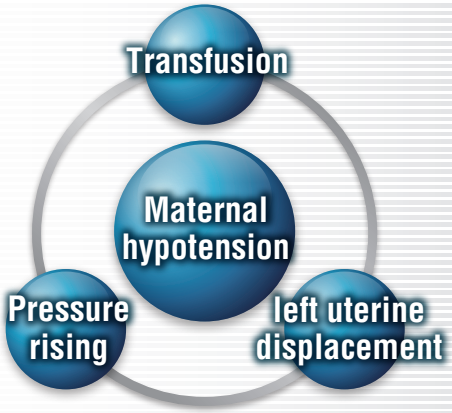
Introduction

The first choice for anaesthesia in Caesarean section (C-section) is combined spinal-epidural anesthesia (CSEA). Management of maternal hypotension is important to maintain the physical well-being of the baby in C-section under CSEA during delivery. Management of maternal hypotension consists of prevention, detection and treatment. Since it is impossible to prevent maternal hypotension in all cases, prompt appropriate treatment is required. Therefore, it is important to detect hypotension as soon as possible. We prospectively evaluated if Nihon Kohden's linear inflation non-invasive blood pressure measurement technology (iNIBP) can detect maternal hypotension during anesthesia more quickly than conventional deflation non-invasive blood pressure measurement technology (dNIBP).



Three key approaches to deal with maternal hypotension.

Materials and Methods

Female patients with single pregnancy who were scheduled for C-section under CSEA from August to December 2015 were included in this evaluation. We obtained institutional review board (IRB) approval and written informed consent from all patients before enrollment. An iNIBP cuff was placed on the same arm as an intravenous line, and a dNIBP cuff was placed on the other arm. iNIBP and dNIBP were simultaneously measured at 2 minute intervals. Anesthesia was induced and maintained with combined spinal-epidural anesthesia (CSEA) through a single puncture. To prevent hypotension, preloading with intravenous fluid and left uterine displacement (about 10 degrees) were performed soon after anesthesia induction. We defined hypotension as systolic arterial pressure of 107 mmHg or less on the left arm which is about 10 cm lower, and pressure of 92 mmHg or less on the right arm which is about 10 cm higher. Measurement time was the time from induction of anaesthesia to delivery of the baby. A two-tailed z test was performed to statistically analyze the difference between iNIBP and dNIBP measurement results.

Results

Out of 100 cases, 76 patients were diagnosed with hypotension (76.0%). Of these, iNIBP detected hypotension sooner than dNIBP in 47 cases (61.8%) ($p=0.03$). The average time for iNIBP to detect hypotension after induction of anesthesia was 379 seconds, an average of 45 seconds sooner than dNIBP (424 seconds).

Conclusion

iNIBP detected hypotension more quickly than conventional deflation NIBP without compromising the measurement reliability, even in the clinical setting of C-section under CSEA where there are various artifacts that may interfere with the measurement of blood pressure.

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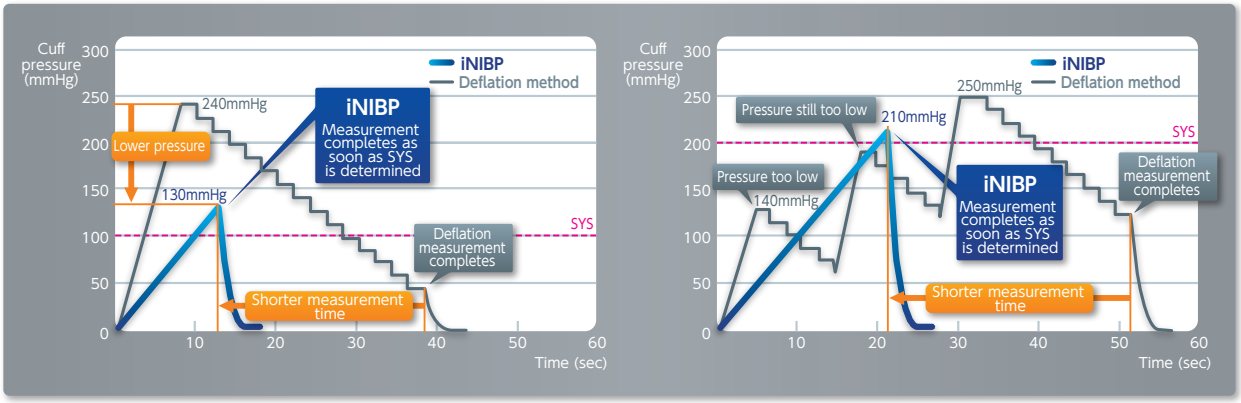
iNIBP is Nihon Kohden's non-invasive blood pressure measurement algorithm using linear inflation technology. iNIBP completes the measurement while inflating a cuff. It has been shown that the iNIBP measurement time is shorter and target inflation pressure is lower as compared to the conventional method [1), 2)].

The conventional step-deflation method sets the target inflation pressure based on the previous systolic blood pressure. Therefore, when the patient's blood pressure increases compared to previous measurements, the target inflation pressure may be set to a level which is insufficient for the measurement. In these cases, another inflation-deflation cycle is required, and may be repeated, increasing both the measurement time and potential for patient discomfort (Figure 1). When the patient's blood pressure has dropped since the previous measurement, the target inflation pressure is set significantly above the previous systolic blood pressure, which again leads to longer measurement time and excessive pressure applied to the patient (Figure 2). On the contrary, the iNIBP algorithm effects a slow inflation of a cuff while simultaneously detecting oscillations, then deflates the cuff as soon as systolic blood pressure is determined. It has been reported that iNIBP can be useful even in situations where patient's hemodynamics is greatly varying [3)].



References

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2) Sasaki J, Hori S et al. Validation of inflationary non-invasive blood pressure monitoring in emergency room patients. Blood Press Monit. 2015 Aug 3

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