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Case Report

Inaccuracy in Invasive Blood Pressure Due to Water Film Ingressed Inside Pressure Transducer

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Abstract

Invasive Blood Pressure (IBP) measurement has revolutionized the realm of hemodynamic monitoring. However, a cautious watch and systematic approach needs to be adopted to detect and resolve any erroneous readings. We are hereby discussing a case of 49yr old female with left lung hydatid cyst undergoing video assisted thoracoscopic surgery (VATS) where the invasive BP was showing erroneously low values. We believe that there was a water film within the first transducer that was the culprit behind the overdamping of the arterial waveform and the error in readings. Faulty low readings of IBP can prompt into inappropriate interventions like overloading of fluids and use of vasoactive/inotropic support. Hence, a faithful representation of arterial waveform and IBP are the foremost prerequisites in intensive care, anesthesia, and modern medicine. Hence, we want to emphasize on the need to properly check for any air bubble or water inside the transducer assembly also when employing a reuse after sterilization.

Keywords: Invasive Blood Pressure (IBP); VATS; Hydatid Cyst

Introduction

Invasive Blood Pressure (IBP) measurement has revolutionized the realm of hemodynamic monitoring. However, a cautious watch and systematic approach needs to be adopted to detect and resolve any erroneous readings. After obtaining consent for possible publication in literature, we are hereby discussing a case of 49yr old female with left lung hydatid cyst undergoing video assisted thoracoscopic surgery (VATS) where the invasive BP was showing erroneously low values.

Case Description

A 49yr female, weighing 42kg, American Society of Anesthesiologists (ASA) grade 2 was diagnosed with left upper lobe hydatid cyst and was posted for drainage by VATS. Inside operating room, all standard monitors were attached to the patient and baseline parameters were recorded as heart rate (H.R) - 102/min, Non invasive Blood pressure (NIBP) -114/76mm Hg and room air oxygen saturation (spO_2) of 97%. Patient was induced with inj. propofol, fentanyl and muscle relaxation was achieved with inj. atracurium IV. Airway was secured with a left sided double lumen tube of size 37Fr. This was followed by a right radial artery catheterization for invasive Blood pressure (IBP) monitoring employing an Edwards True wave Pressure transducer. However, the IBP value was coming very low- 60/36mm Hg. NIBP value recorded at the same time was 104/68mm Hg. In an attempt to correct the apparent dampening of arterial waveform, we recalibrated and zeroed the system but the arterial BP values were still low. This was followed by performing a square wave check, confirming the correct height of transducer and arm position but to no avail. We ruled out any air bubble, blood clots and kinks in the system. Finally, we decided to change the transducer and found that the IBP value (116/75mm Hg) was now coinciding with the NIBP value (116/84mm Hg). This was again

immediately cross-checked by re-attaching the old transducer which again showed erroneously low reading (61/37mm Hg). (Image 1 and 2 respectively) Later, we found that there was a water film within the first transducer (Image 3). This probably was the culprit behind the overdamping of the arterial waveform and the error in readings.

Image 1: Comparable NIBP and IBP values with new transducer.

Image 2: Disparity between NIBP and IBP values with old transducer.

Image 3: Water film seen inside the erroneous transducer

Discussion

Blood pressure measurement is essential to evaluate the performance of cardiovascular system and tissue perfusion. In patients undergoing major and high-risk surgeries, invasive blood pressure measurement is considered to be the gold standard. It has various advantages as compared to NIBP like allowing beat-by-beat measurement, respiratory changes in blood pressure as one sign of hypovolemia can be detected easily, more apparent pressure changes induced by the autonomic nervous system [1]. IBP measurement is subject to distortions that can reduce its accuracy because of damping and resonance. Unexpected IBP readings demand error quantification through the comparison of NIBP and IBP values, identification of the predisposing factors or other causes associated with damping/resonance. Over damping can result into erroneously low values. The various factors that contribute to overdamping include inappropriately high level of transducer, presence of air bubble or a blood clot in the system [2]. Faulty low readings of IBP can prompt inappropriate interventions like overloading of fluids and use of vasoactive/inotropic support. Hence, a faithful representation of arterial waveform and IBP are the foremost prerequisites in intensive care, anesthesia, and modern medicine. After ruling out all the probable causes and trying the possible ways of resolving the problem, we finally changed the transducer to find that it was the faulty transducer that was resulting into error in the IBP readings. Thorough examination of this faulty transducer revealed presence of a water film within the transducer. Pressure monitoring transducers used by us are reusable kits. However, sometimes owing to the limitation of resources, these are reused multiple times after sterilization. We in this case had employed the arterial transducer which was reused after hydrogen peroxide gas plasma sterilization. Brandt et al have found that after nearly 60 reuses of the reusable transducer, there were nearly >5% errors [3]. We found that the transducer had been already used nearly 40 times previously and was being reused after plasma sterilization. At the end of the cycle, plasma is "cracked" into the byproducts of water and oxygen, which then evaporates

into air and the instrument is packed and sealed. However, in this case, there might have been ingression of water within the transducer system somewhere during this process. We believe that this water led to increased damping of the arterial waveform. The physician should be attentive and cautious of the prospect that IBP can be over or under-estimated in a consistent number of situations.

Conclusion

With our case, we want to emphasize on the need to properly check for any air bubble or water inside the transducer assembly also when employing a reuse after sterilization.

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