ICU MANAGEMENT & PRACTICE

ICU Volume 7 - Issue 2 - Summer 2007 - Forum

Tested Disposable Invasive Blood Pressure Transducers all Perform Excellently

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Forum is the new rubric of ICU Management providing a discussion platform for critical care practitioners.

The following article is a response to Dr. Cochard's "Performance evaluation of European pressure sensors."

Introduction

Reliable diagnosis and therapeutic interventions on critically ill patients require accurately measured hemodynamic parameters. Invasive blood pressure measurement is still based on the pressure signal transmission within fluid-filled cathetermanometer system (CMS), which should be accurate within the bandwidth range of the blood pressure signal (0 to 12 Hz for adults and 0 to 30 Hz for neonates). With this paper we will describe the accuracy test method by means of the square wave test (SQT), the swept frequency sine wavetest (SFT) and the patient signal simulation test (PST), and for each of them the performance of the major European disposable transducers will been shown (Van Gerdingen et al. 1994, Billiet and Colardyn, 1998).

Materials

• Biotek Model 601A. Pressure generator.

• HP 35660A Analyser. Bandwidth:

0.1 to 51,200 Hz.

• Analog Devices Amplifier. Bandwidth:

0 to 15,000 Hz.

• GE PDCR 35/D reference transducer. Bandwidth: 0 to 5,000 Hz.

Tested Transducers

• Becton Dickinson DT- XX

• Braun Combitrans

• Edwards PX600F

• Medex LogiCal (MX960) and Transtar (MX950)

• Pulsion PV8015

Test Principles

The Swept Frequency Sine Wave Test (SFT).

The SFT results in the total dynamic response of a DUT. A sine wave with a constant amplitude but swept frequency is applied to the input, and the output amplitude is measured for each corresponding frequency value showing the ratio of the output amplitude to the input amplitude within the bandwidth of interest. The frequency value, at which the amplitude ratio reaches its maximum, is called the resonance frequency FR.

The Square Wave Test (SQT).

The SQT results in a limited characterisation of the DUT. When a pure square wave is presented at the input then the output will show a damped oscillation (fig 2). As a result, one can only calculate the oscillation frequency Fo and damping coefficient æ as a discrete parameter of the total characterisation.

A Biotek 601A can generate a steep and repetitive step signal, but a flush device cannot. Unfortunately and mistakenly, the Gardner laboratory SQT (Gardner, 1981) employed the clinical fast flush device test as an easy tool to evaluate the invivo CMS, which can lead to hazardous interpretations (Billiet and Colardyn, 1992).

The Patient Signal Simulation Test (PST).

With all of the transducers simultaneously connected to the Biotek 601A, we simulated the radial artery patient signal and registered the resulting waveforms on a patient monitor.

Test Results

In Table 1, the tested transducers are not referenced by brand or type as each of them perform superbly within the bandwidth of 0 to 30 Hz and a ranking would be incorrect and misleading.

Conclusion

Despite other published results such as Performance Evaluation of European Pressure Sensors by J-F Cochard, which appeared in ICU Management, Issue 3, 2005, the high quality of each of the tested transducers is unarguably proven, which reveals that the major European devices show a perfect response characteristic indicating no distortion within the bandwidth of 0 to 30 Hz. Other test results will be obtained when adding pressure lines, stopcocks, catheters and patient monitors (Billiet and Colardyn, 1998). It is strongly discouraged to use the fast flush test to evaluate the accuracy of a CMS system when already installed on the patient.

Published on : Thu, 15 Aug 2013