Avant® 4000 Bluetooth® in the hospital: A cost-effective wireless pulse oximeter expands monitoring capabilities

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"Nonin Medical's Avant 4000 wireless tabletop oximeter has proved to be an ideal, cost-effective solution that has taken pulse oximetry monitoring in our hospital to the next level. The portability and ease of use of the device enabled a multidisciplinary approach to monitoring heart rate and SpO_2 saturation levels on a broader spectrum of patients than previously possible."

CLINICAL SETTING

As the respiratory director for a 92-bed multi-specialty hospital, I recently was faced with the task of identifying a solution to expand our pulse oximetry monitoring capabilities. The Cardiac and Pulmonary Rehabilitation department and Sleep Laboratory had dedicated pulse oximetry units, while the general medical-surgical floors were limited to six telemetry rooms with pulse oximetry (an additional nine rooms had telemetry without pulse oximetry); three hand-held oximeters and five tabletop oximeters. The goal was to identify a pulse oximeter device with alarms that could be used throughout the hospital for continuous monitoring on a range of patients.

We considered additional telemetry rooms and tabletop pulse oximeters. Telemetry was excluded early due to cost and lack of portability. Although financially appealing, tabletop units present significant concern of alarm audibility.

To assess audibility concerns, the Biomedical Director and I did a comprehensive study on ten inpatient rooms in our facility to measure feasibility of hearing alarms at the nursing station when the device was placed in a patient room. The initial assessment included no patient or background noise. We found only two of ten people, ranging from nurses to physicians to housekeeping staff, were able to detect alarms. The same test was again performed with the addition of minimal background noise and the two of ten that initially were able to distinguish an alarm were no longer able to hear the alarm, confirming our concerns for conventional tabletop oximeters.

CLINICAL SOLUTION

During the course of our research, we came across the Avant 4000 tabletop oximeter with Bluetooth wireless technology from Nonin Medical. At first glance, the Avant 4000 presented the perfect solution to the audibility concern as it provides remote monitoring capabilities. The device consists of two components – the patient module and the display monitor. The pulse oximetry results are transmitted from the patient module to the tabletop display that can be placed outside the patient room. Initial testing of the alarm audibility was successful with the oximeter being able to transmit a strong signal so the tabletop display could be placed at the nursing station for monitoring.

The patient module weighs 4.4 ounces and can be worn by the patient on the wrist or forearm or placed in a pocket. A full-line of disposable and reusable sensors are available with neonate through adult sizes, including fingertip and forehead options. With the advantage of a wireless

patient/monitor connection, we are able to fit patients with a lightweight wrist-worn module that remotely transmits to a tabletop monitor placed in a nearby nursing station.

The nursing staff considers the Avant 4000 monitor the "norm" due to its ease-of-use and mobility.

INITIAL BARRIERS AND CONCERNS

Initial testing and research indicated the Avant 4000 device met our fundamental criteria for a portable, continuous pulse oximeter with adequate alarm volume at a cost-effective price. Although this arrangement has proven to be a remarkable solution to my audibility concern, the prospect of implementing a novel device with wireless technology was faced with some skepticism and doubt. Prior to implementation, the team and I identified a list of concerns to be addressed. All concerns were addressed to our satisfaction during our trial period.

Cost. The administration understood the benefits of proper monitoring and the cost-effective advantages of utilizing Bluetooth pulse oximetry in the many described clinical settings. For example, we now have the ability to accurately monitor isolation patients on a continuous basis without repeatedly having to gown, glove, mask and wash due to false alarms — saving crucial time and resources.

Staff Acceptance/Education. The education of respiratory therapy, nursing, physicians and family has been almost seamless with minimal training needed. The device performance has been outstanding and our staff, which at first was reluctant, is now excited to utilize the Avant 4000. The nursing staff considers the Avant 4000 monitor the "norm" due to its ease-of-use and mobility.

Signal Range. In our facility, the wrist unit is able to send a signal over 70 feet through walls to a nursing pod or main desk with no evidence of dropped signals.

Patient Versatility. We have found a number of novel applications for use on adults, infants and children where traditional monitoring would either be less convenient or not feasible.

CLINICAL USE / IMPACT

The Avant 4000 units are utilized throughout the facility on an "as needed" basis. The primary reason the units were purchased was the intrinsic additional value of monitoring patient populations that may otherwise be overlooked. Although applications such as post-operative patient monitoring were anticipated, we have also found new applications that were not expected or where traditional monitoring would either be less convenient or not feasible. The unique characteristics of the Avant 4000 are especially relevant and useful in the following applications.

A number of applications have been identified where traditional monitoring would either be less convenient or not feasible.

Post Operative Patients. For patients that retain sedation longer than anticipated, but do not meet the criteria for admission to the Intensive Care Unit, the Avant 4000 has played a key role in vital signs monitoring. This population can sometimes have periods of shallow breathing and/or apnea, leading to desaturation episodes. The units have alerted us to several patients that needed prolonged attention from nursing and respiratory therapy. Several patients were monitored 48 hours with an expectation of sleep apnea and as a result were subsequently scheduled for comprehensive sleep studies.

The impact of having the Avant 4000 pulse oximeters has been more thorough and constant monitoring of patients.

Post Operative Duromorph. Patients receiving Duromorph have standing orders for 24 hour monitoring of telemetry and oximetry. Due to our highly advanced cardiology services, the telemetry units with pulse oximetry are commonly in use. When the combined telemetry and oximetry is not available, the Avant 4000 oximeters allow continuous oximetry monitoring of these patients during a critical portion of their recovery. Remote monitoring is especially valued as this population often ambulates throughout the unit while still under monitoring protocols.

Post-operative Cesarean Section. Patients that receive narcotics and analgesics through an epidural catheter for Cesarean section require additional monitoring including oximetry for 24 hours. The base units located at the nursing station receive transmission from the paired wrist module from every patient room in this ward — allowing for continuous remote monitoring. With no cables connected to the display, the mother has the freedom to move about her room and tend to her new baby.

Maternity Unit. Mothers who experience shortness of breath following vaginal birthing require monitoring after delivery. The Avant 4000 allows us to closely monitor oxygen levels and titrate the use of oxygen while providing the mother and baby privacy when feeding and bonding.

Newborn Nursery. Newborns may require pulse oximetry monitoring for a number of reasons. The Avant 4000 is used when other units are in use and the infant does not require full telemetry monitoring. If there are concerns about the infant's oxygen saturation during feeding, the Avant 4000 allows for privacy of the mother and baby while still providing continuous oxygen saturation monitoring during breastfeeding. The portability of the Avant 4000 allows for simultaneous utilization with a second oximeter to study suspected shunting in newborns.

CASE REPORT #1

ER Admit of Chest Pain Results in Detection of Sleep Apnea

Male, age 37, was admitted through the ER with chest pain. The patient's troponin level was slightly elevated and S-T elevation noted on EKG. Patient was sent to the Cath Lab, a stent placed, and the patient sent to recovery. Desaturation events of 83 to 85 percent were noted during recovery while the patient was on room air. As a result, the patient was admitted and placed on 2 to 3 liter oxygen by nasal cannula with oximetry monitoring. The telemetry units with pulse oximetry were all in use, so the wireless Avant 4000 was utilized for this patient. Desaturation events during the night included oximetry levels in the high 50s and mid 60s. Because the Avant 4000 device allows for remote monitoring, the alarms did not wake the subject, but allowed staff to monitor him throughout the evening. These episodes of low saturation were able to be documented while the patient slept throughout the night. As a result, sleep apnea was suspected. A full polysomnograph sleep test was ordered, performed and scored indicating a positive diagnosis of sleep apnea. The patient is now utilizing BiPap at home and desaturation episodes have resolved.

CASE REPORT #2

Continuous Oximetry Monitoring in Isolation Room

Male, age 55, presented with persistent cough, night sweats and shortness of breath. He was immediately placed in a negative air flow room for suspected tuberculosis. The Avant 4000 was immediately implemented after admission to allow for continuous monitoring of oxygen levels. The patient started on 3 liter nasal cannula and was gradually increased to 30 liter high flow nasal cannula. He was negative for three consecutive sputums. The Avant 4000 was invaluable in monitoring his oxygen saturation throughout his stay and allowed staff to detect desaturation in the low 80s while on 6 liters. He was unable to tolerate a Venturi mask at 50% and a non-rebreather. Due to his intolerance to masks, a decision to place him on the high flow nasal cannula was acted upon. Just as important to the desaturations noted, we were able to closely monitor his saturations while weaning oxygen. The remote monitoring capabilities of the Avant 4000 allowed for continuous monitoring of oxygen saturations without the added time and cost of gowning and entering the patient's room.

CASE REPORT #3

Remote Monitoring of an Infant with RSV and Shortness of Breath

Female, six month-old presented with possible respiratory syncytial virus (RSV) and shortness of breath. She was stabilized in ER and the Avant 4000 was attached to allow for continuous monitoring during transfer to the pediatric unit. This was the first time the Avant 4000 unit was used on an infant in the facility, so a second monitor that provided heart rate and respiratory rate was also utilized. Although staff initially had apprehension about the use of the Avant 4000 on the infant, this was quickly alleviated given the ease of the disposable probe placement and wrist strap placement on the calf of the baby. The ability to closely monitor continuous oximetry proved valuable, especially at night when the parents were sleeping and the infant would remove nasal cannula and desaturate quickly to the low 80s. Portable, remote, continuous monitoring was instrumental to the proper multidisciplinary care for this patient allowing transfer and seamless care throughout the different hospital departments.

CONCLUSION

Prior to using the Avant 4000, traditional tabletop monitors were utilized in patient rooms with alarms set to the highest volume. In addition to the staff not being able to hear the alarms, the alarms would wake patients and result in wasted staff time to check false alarms – especially of note with a sleeping infant or a patient in total isolation. Not only has the Avant 4000 been able to meet our audibility requirement, but has also alleviated these additional issues.

The impact of having the Avant 4000 pulse oximeters has been a more thorough and constant monitoring of patients. For the staff, the Avant 4000 has resulted in a more multidisciplinary approach to 24/7 monitoring of oximetry. Placing the base unit at the nursing desk or work station has given our staff confidence that the patient is being monitored at almost every moment.

A number of applications have been identified where traditional monitoring would either be less convenient or not feasible. The portable, wireless, continuous monitoring of the Avant 4000 has brought pulse oximetry monitoring to the next level.

This publication was supported by Nonin Medical, Inc. Minneapolis-based Nonin, a privately owned company specializing in the design and manufacture of physiological monitoring solutions, distributes its products to health and medical professionals in more than 125 countries and to over 90 OEM partners. Since 1986, Nonin has developed a broad product line of pulse oximeters, capnographs, sensors, accessories and software for use by medical professionals. Its industry-leading capabilities in signal processing, sensor design, and an innovative combination of features not available in competitive products are the foundation of its success.

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