HOSING IT IN THE NICU

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Have you ever really hosed it during clinical care in the NICU? Screwed up? Made a mistake? Botched it? If your claim is that you haven't made a significant error in patient care in the NICU, then you are either; 1) somewhat disingenuous, 2) disconnected from reality, or 3) too inexperienced. The "old school" about making errors went like this, "Good clinicians didn't make errors." The new school says, "Good clinicians report their errors and help themselves and others learn from their mistakes."

I remember an error I once made and never told anyone about. During the Nixon administration I was caring for an elderly woman with congestive heart failure. She had a central venous line and to take a CVP reading, you had to lower the head of the bed to flat, ensure that the CVP manometer was even with the mid-thorax from a lateral perspective, open the manometer stock cock and watch the IV fluid rise in the manometer. The top of the fluid level corresponded with the CVP in centimeters of water, which were the graduation markings on the side of manometer. After taking her reading, I sat her back up in bed and left the room. I did not return for many minutes. When I did I noticed a large pool of blood on the floor. I had forgotten to close the stopcock, so that as soon as her thorax was higher than the CVP manometer, blood flowed from her thorax through the central venous line into and out of the top of the manometer. I looked around quickly to see if anyone had noticed. No one did, so I closed the stop cock, quietly got out the mop and cleaned up the blood. I checked her BP and it was fine. In fact it was probably a little therapeutic, since she was in CHF and fluid overload. It was a sort of modern day leech craft. I was very lucky to have returned to the room when I did as she could have easily bled to death. Actually, I guess she was pretty lucky. I told no one about this at the time, which is too bad, because if I had, I would have probably learned that others had made the same mistake and maybe I could have learned from them how not to make the same or similar errors again.

Considering this, I thought it might be instructive to share neonatal type errors so we can learn from one another. The errors I will relate to you, actually happened. I may or may not have been in attendance. They may or may not have happened at hospitals I worked at in the past. The truth cannot be extracted from me, so don't bother.

EPISODE #1: NO NO, NOT THE NITROGEN:

A low birth weight baby was receiving sub-ambient oxygen therapy to induce pulmonary hypertension while awaiting cardiac surgery to correct a ductal dependent congenital right heart lesion. This was achieved by bleeding a low flow of pure nitrogen into the ventilator circuit, thus lowering the FIO2 by increasing the N2 concentration. Since no e-cylinder nitrogen regulator was readily available, an ingenious RT knocked the pins off an oxygen e-cylinder regulator and attached it to an e-cylinder of nitrogen. This worked very well for many days. The time came for the surgery and the nurse and the MD disconnected the infant from the ventilator, attached him to a flow-inflating resuscitator hooked to an e-cylinder of gas, and rolled the radiant warmer down the hall heading for the elevator. As soon as the elevator doors closed, the infant's heart rate dropped precipitously, and in spite of vigorous bagging, continued to drop. It was right about this time that it was discovered that the e-cylinder that was hooked to the flow inflating resuscitator was N2. No other gas was available, and since the bag was flow inflating, there was no other was to ventilate the patient. The MD began mouth to ETT breathing till an oxygen cylinder could be obtained. The patient survived the episode intact.

EPISODE #2: ARE YOU SURE THERE IS O2?

A premature baby was delivered via c-section and handed to the resuscitation team who placed the infant in the radiant warmer and began resuscitation. The baby required bagging. The color did not improve with bagging and the heart rate hung around 90 bpm in spite of vigorous stimulation and clearing of the airway. The RT double checked the O2 supply. The O2 flow meter on the wall was connected to oxygen tubing and set to 15 liters per minute. The self-inflating resuscitation bag was connected to O2 tubing and had a reservoir bag, which was fully inflated. The resuscitation continued, but the infant did not "pink-up". An umbilical artery blood gas revealed a PaO2 of 8 mmHg. The RT decided to recheck the O2 supply and physical-

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ly traced the O2 supply line with her hand. It went over the back edge of the radiant warmer, dropped down, but did not trace back up the wall to the O2 flow meter. Instead, it ran to a blender mounted on the wall behind the radiant warmer below the level of the mattress, and thus could not really be seen by those doing the resuscitation. The blender was set at room air. The O2 connecting tubing that was connected to the O2 flow meter that was mounted on the wall simply ran down the wall onto the floor and was laying there behind the radiant warmer. This error was corrected and the baby was finally resuscitated. This patient did not have a normal neurological outcome.

A look at both of these episodes reveals what are called latent errors. These are errors that are waiting to happen, and are caused by systemic design issues. In both of these cases, these were skilled, capable clinicians, trying to do the right thing. They were not screw-ups or losers; they were clinicians you would be happy to work with. Yet serious errors were made that put these patients in grave danger. So what caused these mistakes? Unsafely designed systems caused these errors. Consider the N2 episode. A flow meter and regulator that looks just like every other O2 regulator and flow meter were placed on a nitrogen cylinder. Nurses and doctors don't get a lot of training on handling and identifying the contents of cylinders. And the team left for the O.R. without an RT in attendance. It was very busy at that time and the O.R. was calling and the team did not want to wait for the RT to finish what she was doing, so they left without the RT. Consider the systems that were involved; policies and procedures, staffing, transport, and compressed cylinder systems. There was no extant policy prohibiting using a regulator in an unsafe fashion, e.g. knocking off the pins. A safer alternative to this had not been developed. There was no policy requiring an RT attend every intubated transport. If staffing were better, an RT might have been available in a timelier manner. A mix-up with a jury-rigged O2 regulator on an N2 cylinder was definitely a latent error waiting to happen.

Consider the botched resuscitation. Mounting both an oxygen flow meter and a blender on the wall in such a fashion that they could not both easily be seen was also a latent error. In fact, one might argue that having a blender there at all was an invitation for a gas concentration mix-up. Why add the complexity of it? They weren't using an oximeter at the time, so there really was no way to titrate FIO2. By having the blender there at all, you increased the risk of error. Thus, a latent error was waiting to happen. I know of no evidence to suggest that a blender during resuscitation reduces risk of retinopathy of prematurity.

The point of this discussion is our growing understanding that errors in health care are often caused by poorly designed systems. A culture that promotes reporting of errors and a compelling desire to learn from shared experiences in a blame free environment can help to make our care models safer for our patients.

Respiratory Text Review *Continued from page 50*

ic noninfectious parenchymal disease, neurological disorders and sleep apnea, plus newborn and early childhood respiratory disorders. All-in-all, these 9 parts of the book contain a total of 21 specific chapters. Part XIII, entitled "Other Important Topics," deals with some miscellaneous causes of respiratory embarrassment or failure from largely exogenous sources such as: near drowning, smoke inhalation, thermal injury, postoperative atelectasis and respiratory failure requiring ventilatory support. The section, Part XIV, contains a number of case studies demonstrating typical features of the admitting history, physical examination, and course for some of the more common causes of respiratory disorders such as: chronic bronchitis, emphysema, asthma, pneumonia, pulmonary edema, flail chest, pneumothorax, acute respiratory distress syndrome, idiopathic infant respiratory distress syndrome and postoperative atelectasis.

One of the nice features of the book is the inclusion of the S.O.A.P. approach to respiratory assessment and treatment planning at various points throughout the various chapters. While not every hospital permits this convention to be used in the recording of patient assessment and progress notes, it is, nevertheless, a useful technique to help organize one's thoughts and impressions and to help configure a treatment plan, even if only used in training. As for opportunities for improvement, there are just a few things I think could be included in future editions to add even greater value to an already excellent text. For one, I would have liked to have seen more emphasis on differential diagnosis, particularly within the realm of related disorders. For example, Part XI on neurologic disorders starts with an individual chapter on Guillain-Barré Syndrome followed by an individual chapter on Myasthenia Gravis. Instead of just diving in to Guillain-Barré, I would like to have seen some introductory material on the general respiratory implications of neurologic diseases, including a list of all the relevant neurologic disorders, not just these two, and the distinguishing features (differential diagnosis) between them. Another area that I would have welcomed would have been a separate chapter devoted to diagnosis and implications of cough, inasmuch as cough is very frequently the first and earliest sign of impending respiratory disease and it is often one of the manifestations that is most difficult to pin down at certain stages of disease. And, just to be nit-picky, the chapter on pulmonary function testing could have benefited from a chart like Table 6-3 in the chapter on cardiovascular system assessment. But those minor issues aside, this is most definitely the book that needs to be read and reread by those respiratory therapists who are charged with the important responsibility of conducting TDPs. Although we don't have a crystal ball, my prediction is that TDPs will comprise a major share of future respiratory therapy activities in a growing number of hospitals. The future belongs to those who are prepared to handle it. This book will prepare you for the future and help you to be a better therapist.