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Measuring Oxygen Saturation in New Guinea Children

HOW DIAGNOSING HYPOXEMIA IN CHILDREN HAS MADE A DIFFERENCE

Change and challenge is in the wind as 2008 comes to an end. The same is true on when examining this month's ReachMD XM160 special series Focus On Global Medicine. We take a look at both the changes and the challenges impacting global medicine.

Another inconvenient truth; each year, more than 10 million children die, 98% in developing countries and more than half die from easily preventable or treatable condition. Here, how 1 physician made a difference?

You are listening to ReachMD, The Channel for Medical Professionals. I am your host Dr. Shira Johnson and with me today to discuss how diagnosing hypoxemia in children has made a difference is Dr. Trevor Duke, an Intensive Care Specialist at Royal Children's Hospital in Melbourne, Australia. Professor Duke is the director of the Center for International Child Health in the University of Melbourne, Department of Pediatrics. The center works closely with WHO and has a focus on improving child survival in developing countries. His areas of research have included respiratory infection, vaccine, preventable diseases, tuberculosis, neonatal care just to name a few.

DR. SHIRA JOHNSON:

Dr. Duke, welcome to ReachMD.

DR. TREVOR DUKE:

Thanks Shira, I am glad to be here. Thanks very much for inviting me on.

DR. SHIRA JOHNSON:

Many physicians feel that they should or that they would like to work in developing and underserved countries, but you have devoted years of your life to doing so. How did your work take you from Melbourne Australia to New Guinea?

DR. TREVOR DUKE:

Well, Papua New Guinea is on only half a day flying time away from Australia, so in 1996, I went to work there for the government for the Ministry of Health and obviously pediatrician in the Highlands of Papua New Guinea, one of the pediatricians in the Highlands of Papua New Guinea for several years and I have had a connection with that country ever since.

DR. SHIRA JOHNSON:

What was it like for you when you first visited New Guinea? Bit of a culture shock or?

DR. TREVOR DUKE:

I guess not really. It was almost more culture shock when I came back. Papua New Guinea say as many things with many sub-Saharan African countries and other countries in Asia in terms of resource availability and economy and health system development and disease burden and these important issues to grasp and to deal with and so there is a job to be done.

DR. SHIRA JOHNSON:

How did you have the resources or the funding to keep going that?

DR. TREVOR DUKE:

Well, originally, as I said, I just worked for the Ministry of Health, the National Department of Health, and then in 2001, I came back to Melbourne and joined the Department of Pediatrics in the Center for International Child Health, just like most people in most academics who work in this sort of field has variety of financial resources. They trouble to get it through mostly on sort of shoestring budgets for these type of work.

DR. SHIRA JOHNSON:

And you studied the impact of a very simple O2 saturation device on health care in children. How did you come to target that device or have that approach?

DR. TREVOR DUKE:

The Highlands of Papua New Guinea, probably the pneumonia Capital of the world. As you probably know, pneumonia is one of the most common cause of child death in the world, so 10 million children who die and 2 million children die of pneumonia and probably another 1 million newborn neonates die of pneumonia and hypoxemia, lack of oxygen in the blood is a common reason for death. It's a common complication that leads to death, so when I worked in Highlands of Papua New Guinea, it became clear that lack of oxygen and lack of detection of hypoxemia was a major preventable cause of death.

DR. SHIRA JOHNSON:

How did you carry out the trials? Tell us how that started and what were some of the challenges?

DR. TREVOR DUKE:

Initially, in 1997, we set up a beta oxygen system in the hospital in which I worked and we saw that had a dramatic effect on mortality from pneumonia and other diseases, but particularly from pneumonia. And at that only seemed to work in 1 hospital and I guess the challenge was to see if it could work more broadly in other hospitals where perhaps there was not in where people weren't well trained and so in 2001, the Pediatric Society of Papua Guinea which was the main pediatric body endorsed this trial and we set it up in 5 hospitals. It was before and after trial, so we looked at the time before this system was introduced and the time after and again we found a dramatic reduction in mortality.

DR. SHIRA JOHNSON:

So you gathered the data for a period of how long on patients before you implemented any therapy?

DR. TREVOR DUKE:

About 48 months.

DR. SHIRA JOHNSON:

It's a very long time?

DR. TREVOR DUKE:

It is a long time, but wasn't 1 month think it's a long time to be observing without doing any thing, but in reality it took us that long to actually get any funds to actually implement the improved oxygen system. I originally had hoped and promised the hospitals that I would have the beta system within a year or two, but it took somewhat longer than that, but that also had its advantages because it allowed us to really get a sort baseline of what mortality rates for pneumonia were really lack in those hospitals.

DR. SHIRA JOHNSON:

Was there any intervention during that time in terms of your group helping with antibiotics or contributing any way because it will be very painful just to watch, but was other interventions being carried out to help those children?

DR. TREVOR DUKE:

Well, fortunately, Papua New Guinea has had a long history of banded treatments, so in western countries now we follow clinical guidelines all the time, but it's a little known fact that some developing countries, some poor countries have had for decades sort of standard treatment and Papua Guinea is one of those and it has had standard treatment for 30 years and that means that at least antibiotics are provided in a standardized way and at least there are standard criteria for admission and standard criteria for other treatments that are given, so in terms of basic standard of care, it has been relatively standardized for several decades and <____> a baseline for mortality rates and also for the quality of clinical care. A big deficiency has been in oxygen, so as I said, it took some time to do that.

DR. SHIRA JOHNSON:

And then how did you administer the O2 and who received it?

DR. TREVOR DUKE:

The two reasons why I think children with pneumonia don't get oxygen is the most common method for delivering oxygen is using an oxygen cylinder, so a compressed gaseous oxygen in the cylinder, and in developing countries oxygen cylinders are very expensive to transport and in countries that are really challenged by difficult geography like Papua Guinea, it is very costly and logistically very difficult to transport oxygen cylinders a long way, so what we did was use oxygen concentrators, they are small machines that draw in atmospheric air and extract nitrogen and what you are left with is almost pure oxygen. So these machines that need a continuous power supply to run, but they provide an inexhaustible supply of oxygen and so we used oxygen concentrators and for the detection

of hypoxemia, we used pulse oximetry and I think that the pulse oximetry was perhaps the key element in improving outcomes for these children. Before the use of pulse oximetry, the detection of hypoxemia was by some clinical signs alone in heavily pigmented children; it is very difficult to detect cyanosis for example.

DR. SHIRA JOHNSON:

So, you explained to us about the O2 concentrators and the sat monitors, so tell me how you went about with the sat monitors and how did you carry out the rest of the study?

DR. TREVOR DUKE:

In Goroka, which was the hospital in which I worked in Highlands of New Guinea in the late 1990s. We introduced pulse oximetry and we told nurses how to use it in a standardized way, so every patient that came into the ward was admitted to the ward that would have the pulse oximetry checked their oxygen saturation checked, and if their saturation was below 90%, they would receive oxygen. That was a method to ration a really scarce resource. We did note that oxygen was a very scarce resource.

DR. SHIRA JOHNSON:

How did you come about the cut off 90? Because in the states it would be somewhat higher. It is the rationing of what little supplies we had correct?

DR. TREVOR DUKE:

Yes, that's right and the other reason is because the Highlands of Papua Guinea are at moderate altitude, so 1600 to 1800 meters. In fact, in some of the hospitals in the early stages before we did this trial, we had to ration oxygen only to children who had saturations of less than 85% because on the altitude to also has very limited oxygen resources.

DR. SHIRA JOHNSON:

So, you are telling us about the availability of antibiotics? How do you treat pneumonia in New Guinea?

DR. TREVOR DUKE:

Pneumonia is treated along same lines as <____> as the World Health Organization recommends and that is children who have

got 3 categories of pneumonia. There is non-severe pneumonia or at least what we call mild pneumonia in Papua New Guinea and then moderate pneumonia and then severe pneumonia, and non-severe pneumonia was treated with an oral antibiotic. Severe pneumonia was generally treated with penicillin, so benzylpenicillin intramuscular or intravenous, crystalline or benzylpenicillin and then severe pneumonia was treated with chloramphenicol or penicillin and gentamicin. In Papua New Guinea, there isn't the luxury of being able to use the third generation cephalosporin for pneumonia because, one, it's costly, and two, pneumonia is so common we will exhaust supplies of third generation cephalosporins very quickly if we do that.

DR. SHIRA JOHNSON:

What was the response of the other health care providers when you were checking the sats giving oxygen and probably seeing improved survival? What was their response?

DR. TREVOR DUKE:

Very remarkable to me in the late 1990s. How quickly this technology was taken up by the nursing staff. They learnt how to do it. The nurses in Papua New Guinea, like in many developing countries, are the front line health workers rather than physicians. There are few physicians, but many nurses and they took this up with great enthusiasm and they knew the protocol, they knew how to monitor children, and they saw the benefit it had to survival and they also saw pulse oximetry as being a vital sign on which you can act, so that puts a bit different to heart rate. If the heart rate goes up, there is not any particular action that can be taken apart from noting it. Whereas if a child's oxygen saturations go down, then there is an action that can be taken. If the saturations are okay, then is another action that could be taken such as reducing the oxygen or taking the child off oxygen, so it became a really vital sign that nurses could monitor regularly and uses a basis for making clinical decisions. So, not only were health care workers, the nurses and the doctors enthusiastic about pulse oximetry as basic technology, but also the families were very enthusiastic about it too. Introducing oximetry into the hospitals in Papua New Guinea considerably reduced the absconding rate from hospitals.

DR. SHIRA JOHNSON:

Now, how did you sustain funding for this prolonged period of time?

DR. TREVOR DUKE:

Well, it was difficult and it is even now. It is based on piecemeal funding from various sources. For example, there is no major funding from an organization like the AIDS Foundation or any other major donor for this type of work, but we have sought and received small amounts of funding from the World Health Organization and from other donors whom we have asked in order to make it happen on that basis. That has some advantages and it is really testing what can be done in reality if there was very big grant funding available and perhaps it wouldn't reflect what can be generalized to the whole country.

DR. SHIRA JOHNSON:

And what would you say to other physicians who want to get involved in something like this where they are giving care or providing some care that is above their standard for a third world country?

DR. TREVOR DUKE:

One shouldn't think that technology is beyond so-called third world countries, but the technology has to be appropriate and it has to be well tested and it has to be very well sort out and there has to be a system for implementing it and sustaining it and I guess the problems with integrating technology into developing countries are well documented and they are real and so any attempt to implement even the most basic of technology has to have all ingredients that I mentioned before.

DR. SHIRA JOHNSON:

And where can physicians listening to this go for more information if they want to get more involved.

DR. TREVOR DUKE:

There are variety of sources, the WHO website has some resources and Center for International Child Health in Melbourne we had a website that has some resources as well.

DR. SHIRA JOHNSON:

Thank you for being our guest today.

DR. TREVOR DUKE:

You are very welcome Shira. Lovely talking to you.

Thanks to Dr. Trevor Duke, who has been our guest and we have been discussing the impact of measuring O2 sats in children in New Guinea. I am Dr. Shira Johnson. You have been listening to The Clinicians Roundtable from ReachMD, The Channel For Medical Professionals. Please visit our website at www.reachmd.com which features our entire library through

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