Dr. Bob Wood - Using the Observation Checklist to Reach a Differential Diagnosis

Dr. O'Keefe: Recently, we published an OASIS post in which there was a number of radiological challenges and we provided you with a systematic checklist to look at those radiographs and come up with a differential diagnosis. Today, I welcome back Dr. Bob Wood specialist radiologist, Princess Margaret Hospital in Toronto to walk through one of those cases in some degree of detail and we'll see what he comes up with as a potential differential diagnosis.

Dr. Wood: So, today we're going to take up or look at together the first two of five cases that were posted, rather, to OASIS. And we're going to use the observation checklist that was also attached to the last presentation. And, the observation checklist is literally that; it's a list that you can check or highlight the findings that you find. And, we're trying to slow ourselves down. By using that observation checklist, which I have sort of incorporated in my brain, what's left of it, it's much easier to force yourself to go through the checklist and make the observations as you go, rather than try to think of observations on the fly, especially for the novice person. So, we're trying to make things easy by doing that. We're going--you can download that as well.

Dr. Wood: So, we're going to talk about these cases and as I said this is the first case where you've got the observation checklist. I've given you images of different quality. Way Back at the beginning we talked about having optimum images and optimal imaging. Some of these are not good. Some of these we might point out are adequate for what we need and some of them, realistically we should have gone back and done better imaging. We're not going back and doing any better imaging. So, this is what you have. Some of them you might be thinking, well we really need more imaging and that's okay to ask for more imaging. We're going to use the observation checklist and that will lead us towards the diagnostic sieve or that flow diagram that we talked about and we're always going to be thinking a couple of things. As we go through it and we're looking at the radiograph, we're looking always in the back of our mind is, am I looking at normal, not normal, normal, not normal, normal, not normal? As we proceed through the radiograph and look at them systematically and then at the end of the observation checklist we're going to, by using the sieve determine what things are not first. But broad categories, disease, we can actually, we can actually throw. So, we're going to examine the radiographs. Really what we want to focus on here is to list all the observations, so list all the observations. I made it easier for you because you can check them off and then we're going to attach significance to those observations. So, that's where the, as you go through your films: is this is normal or not normal, the normal, not normal? And then, we'll decide the basic nature of disease, we'll formulate a differential diagnosis, okay? That's what we're focusing on. If you're dealing with an actual patient or clinical situation, we're going to, after we decide what it's, what the differential is, we would include clinical, histological and patient history information that we've already taken. We'd make a working diagnosis, we might consider some special testing, which might include imaging and ultimately treat the patient. I think, unfortunately in dentistry, what we do is actually we jumped to the end and treat the patient and then stand back and then see if they explode. Sort of like diffusing a bomb. We do something because there's something that has a code attached to it; and we're doers, we are a kinetic type of medical specialty, if you like. We do something like disarming a bomb and if it doesn't explode then, we're pretty happy. Whereas I think it'd be better if we had our, you know, as I said, pants first then shoes, get the diagnosis first and then develop a treatment based on sound underlying principles.

Dr. Wood: So, that's what we're doing and as we go through in the basic nature of disease, remember we're trying to think of our undergraduate education. As we go through an individual case think, okay it's not say it's not a metabolic or systemic type disease. We just put all that stuff aside. We'll throw all that those diseases aside for this case. Say we decided it's not a fracture, we'd throw all of that information aside and gradually try to figure out initially, not what the case is, which is what we always do, put a radiographic up, and I was just in South Africa, some very good friends of mine, and some people you'd put the case up and they would guess what it is. I think the chance of you guessing what it is off the start, and you should never guess anyway, the chance of determining what a condition is as what it looks like on a radiograph, the chance of getting it right is very, very low right off the start. So, we talked about stamp collection technique and picture matching. So, we want to whittle that down in a way and we're trying to determine what it isn't. And then after we decided what broad category or even categories, sometimes it's two categories, then we do a little bit of differential diagnosis.

Dr. Wood: So, let's look at our first case. Our first case is a patient and I'm not giving you much clinical information because I'm mean, okay? That's the way I was trained. This is a patient had a runny nose with a post-nasal drip and clogged sinuses. So, this patient has a panoramic radiograph and on this panoramic radiograph, we're going to make our observations. So, we're going to go around and we're going to look at all of the different parts of the radiograph, I always start in the right condyle. I'm going to follow that around, trace out all the bony cortices, and then I'm going to do the same thing in the maxilla. Then I'm going to look at the inside of the bone. I'm going to count the teeth. I'm going to look at the periodontal level. I'm going to look for any abnormalities and hard and soft tissue. And then I'm going to maybe look at it again and then start making my observations. So, that's the way we want to do things. We want to look at the image the same way every time. I don't care whether you started in the right condyle, Doctor Chadwick who's left-handed starts on the patient's left side, but there's nothing I can do about that. I've tried for years and he's still not willing to open up his egg of the little end. So, so he's going to just do that.

Dr. Wood: So, as you go through this, as you go through this radiograph, you're going to ask, is this normal, not normal, normal, not normal, normal, not normal? And you're going to go through the mandible. Now, I will just spoil it for you and say that we're not going to focus on the mandible because it's essentially, although there's some minor things going on, it's essentially normal. So, then if we go to the maxilla, we're going to see that the patient's right side is actually pretty normal. We can see the pterygoid palatine fissure, we can see the posterior wall of the maxillary sinus and maxilla. We can see infratemporal surface of the zygomatic bone for the orbit, median wall of the sinus, the floor of the sinus. We can see the pterygoid plates. We can see the see the zygomatic arch there, but that's the right side. If we go over to the left side, you can see that it's quite a bit different and I've just helpfully put some small arrows on here to help people out. And, there are problems or issues, not problems, but there are differences between normal and abnormal in this film with respect to the left maxilla. So, we already said that we want you to make your observations, so let's make your observations. You can see here one thing that I can see, and this is the lovely thing about a panoramic radiograph, two things: one, it fits very nicely in the lab coat pockets, five and a half inches. If you have a film on, they fit very nice thing, lab coat pocket and, and they're very easy to hold up to the light when you can't find a view box when you have a film; but another nice thing about them is that they have two sides and often you'll have a normal side like you do here on the right side to compare the abnormal side on the left side here.

Dr. Wood: So, we have a number of issues here. For one thing, we can see the pterygoid palatine fissure here and the posterior of it. We can see infratemporal surface of the zygomatic bone. We go over to this side, we don't see--we see that, but it's altered. This is ballooned out and the pterygoid palatine fissure is not really well visualized. We can see two areas of just call them relative radiopacity here. We can see that there's some problems here with respect to the nose that the soft tissue nose is actually on both sides is abnormal; and we can't really see the sinus floor as well on this side as it goes medially. So, there are abnormalities. We go normal, not Normal. Not normal, Mrs. Gump, not normal, not normal, not normal, not normal. This is not normal. There's so many things here that are not normal. So, then we're going to go through and we're going to remember the patient's history, they had a runny nose, post-nasal drip, and a clogged sinus. What I'm guessing this is the sinuses that's clogged on the patient's left, but we're going to go through our checklist and we're going to check off the things that we'd find in this area of interest, which is the area highlighted by the red arrows, the area of interest, and we're going to call it a region of interest. Remember, we're not going to call it a lesion because a lesion gives a cachet to something you might not necessarily want to give it. So, I call it a region of interest. If you call something a lesion, you better get on it quickly because you've called it a disease. This is a region of interest. So, let's look at a couple of things.

Dr. Wood: First of all, one of the things we do first is look at, what did we, when we talk to each other, we talk about radiolucencies is radiopacities or mixed. This would be a mixed region of interest. There's a mixture of radiolucent areas, areas that had been destroyed and there's some additives sort of albeit soft tissue or relative radiopacity. So, it's a mixed radiolucent radiopaque region of interest. It's position is in the maxilla. Now I'm just going to stop here on the position, because position is really, really important. When you choose position, you're actually choosing or you're actually striking off certain things. If you choose a position, for example, not in this case, above the mandibular canal as opposed to primarily below the mandibular canal, you're looking at two different types of diseases. Generally, things below the canal, generally, are non-odontogenic, not from teeth or tooth-forming structures. Things above the canal are generally of odontogenic or dental causation, but they can be both. But by far the most common above the canal, mandibular canal are odontogenic. So, position is important for talking with each other about things, but also important for sort of, it's another way of whittling down, possibilities. And ultimately, you can use it after your sieve to say, well, you know, if we find something in the maxillary sinus, I know it's probably not a big toe because there's no big toes maxillary sinus on its facetious, but position tells us a lot about what the possibilities are when we get to starting to throw in our library. So, it's not something to be taken lightly. So, this is a mixed radiopaque radiolucent region of interest in the left maxilla extending from, we're going to get there in a second, it's an osseous tissue, both cortical and cancellous bone and it's in the maxillary sinus, which is of course an air filled cavity. It is both in the maxillary sinus and the nasal cavity and it's inside that area growing out. In other words, it's probably started in the sinus and we can tell from the [inaudible] out of the posterior wall of the sinus and we can tell from the fact that it's largely the sinus is infected, it's probably an inside-out region of interest. In other words, it started in the sinus as opposed to something that came from outside the sinus, which would look very different because it would invade the sinus and it would look quite a bit different. So, it's inside the bone or inside the maxillary sinus and there is an associated soft tissue mass. That in itself we've got areas clearly where we don't see things we should see, so that's, that's bone destruction and bone destruction with a soft tissue mass is a very sinister sign. So, even without even getting into the description of the lesion, I've used that word, in the description of the region of interest, we already started to think, hmm, this is something that we need to pay attention to. So, just this part overall degree radiolucency and opacity, the anatomical position and the size and you can do size in relative size, you can do size in actual size measured in centimeters estimated in centimeters, tells us a lot about what we're looking at. So, that's how I would describe, that's how I'd use the observation checklist; when we can see those, we can see that area of destruction and we can see the soft tissue areas and we can see things that don't look normal on the patient's left as opposed to the patient's right. That's very important.

Dr. Wood: The next thing we're going to look at is what does the border look like? What is the area where this region of interest meets what we take to be normal tissue? And there are some specific things we look at. They're mainly three. If you do these three, you're going to be fine. The border subtypes are sort of like showing off or things that radiologists would use and there's a lot more here than I've included. But for the sake of learning, we look at demarcation, cortication and encapsulation. So, what are those things? Well, first of all, this is a well demarcated in part the soft tissue parts are very well demarcated. We can see the soft tissue parts in this area here they actually have well, very well demarcated soft tissue parts, but the osseous parts are not terribly well demarcated, at least in part, especially in the posterior. And there's osseous destruction we're going to get there. So, parts of this are well demarcated, the soft tissue parts that are highlighted in blue here. And parts of this are poorly demarcated. The osseous components are actually pretty demarcated. And how about corticaton? There's no cortication anywhere. So, demarcations important because generally well demarcated things are sort of benign-y type things and pretty demarcated things are usually not benign type things. With respect to cortication, there isn't any cortex around this and think about your typical classic cortex. Think of a radicular cyst or [inaudible] cyst or a [inaudible] blastoma which have a thick cortex. So, the demarcation is important because it tells us a little bit about the behavior and the cortication is important because it tells us that if there's no cortex or let me put it, that the other way around, if there is a cortex, it takes time for a cortex to form.

Dr. Wood: So, if you see a cortex, which is a white line around something and it can be thin or thick, if you see a thin white line or thick white line, we think more benign processes. But we also think it took a while to form that cortex. Cortexes is don't form overnight. So, it tells us a little bit about behaviors. We've got a pretty demarcated, not corticated. And then the third thing we look at us encapsulation. Why do we look at encapsulation? We look at it because encapsulated things generally are odontogenic. So, if you think of something, you know, like an [inaudible] with your classic, where you have a radiopaque are mixed radiopaque radiolucent center and then you have a really loose zone around that and then a radiopaque zone around that. That's a capsule with a cortex. So, this is not encapsulated this particular case, has no capsules. So, we've got well demarcated soft tissue, but poorly demarcated hard tissue borders not corticated, not encapsulated. The border subtypes, if we're looking at it, this is again showing off--the blue one refers to the soft, the blue mark highlighting here refers to the soft tissue areas inside the left maxillary sinus. They're smooth edged, so they're, they're smooth edged. But the osseous borders really to a large extent our moth-eaten or ragged. We have a ragged, moth-eaten border. But the most important thing there is the demarcation cortication, encapsulation. The other stuff is just, it's just a little icing on the cake. So, how about the internal structure? So we've looked at where it is, how big it is, and we've looked at what it looks like as it meets normal tissue. And then, we can look at internal structure and if we look at the internal structure of the maxilla in that area of the area that's affected, there's a diminished density of the trabeculae and a diminishing number of trabeculae that's really just destruction. But there is destruction in the center of that. There's things we can't see that we should. And with respect to the radiopacity in the sinuses, it's either--any radiopacity is either tooth bone or something else. And something else has either calcifications or foreign body. But in this case, it's actually soft tissue. And these two soft tissue dome-like or circular, if you like, radiopacities, relative radiopacities overlying the maxillary sinus is very familiar to people as mucus retention phenomena if that's what they are. But that's the same sort of appearance. So, there's no cortex around those, but they are soft tissue. They're radiopaque only because they're over top of the maxillary sinus, which is filled with hair. So, this is all we need for internal structure in this particular case. We could see those soft tissue structures if I can find it in my mousy over here... you can see that they do not have a [inaudible] they're pretty uniform and in their appearance. And yet the bone, we can't really see a cortex--this is the hard palate--we can't really see a really good cortex here. We can't see a capsule certainly, and it's a little bit ratty even up on the inferior aspect of the orbit. So, it's just doesn't look good. And we can see if we look high enough that the orbital floor is actually looks like it's partially effaced. So, these are our observations so far. And then the next thing we want to look at is what is the effect of this region of interest on things that we should see? What do we see with this and what do we not see that we should see? So, there are changes in bone density in this particular region of interest. There's changes in bony architecture, certainly doesn't look like the other side. There's thinning of the normal anatomical boundaries. That's fair to say. There's expansion of the bone on the posterior aspect of the maxillary sinus and there's destruction of bone. There are problems with the maxillary sinus walls, with its floor, with pterygomaxillary fissure, with the orbital cortices. These, these are all partially effaced or destroyed. So, we have to train ourselves, and that's why I like these lists, at least when you get going. And I know I'm beating this case to death, but I'm doing it to show you how to do it case slowly because first you get good, then you get fast. Okay, so, again, the yellow ones are the primary condition in the region of interest. And the blue highlighting there are abnormalities in the maxillary sinus walls and floor, which appear to be soft tissue in nature.

Dr. Wood: So, this patient, we've now sort of sucked as much information as we can out of a panoramic. We might say to ourselves, what are we going to do in a case like this? Well, we've got a pretty poorly demarcated, pretty demarcated, uncorticated destructive thing that's caused some bone destruction. I think this would be a case that would be good to get advanced imaging and cone beam CT or multi-slice medical CT or MRI or whatnot. We're not going to do that because we'll get to that. But we know enough now that we have been able to make our observations and I think we can progress because you're not going to send a patient down to the hospital to get an MRI because they're going to say from whom you know, you're going to have to go through a couple of steps before you're going to be able to get an MRI.

Dr. Wood: So, here's a summary of our observations and when we take up the next cases, maybe not next time, but the time after, I'm just going to go through this and I'm not going to present all this stuff. I'm just going to go through it and spit ball at as I go through it. We have a mixed radiolucent radiopaque, I'm going to call it a lesion now, okay? Lesion in the left maxilla that involves osseous in tissue, cortical and cancellous bone. And also, as a soft tissue component. It originates in the maxillary sinus or perhaps the nasal cavity. It's inside these areas growing out. There is an associated soft tissue mass. With respect to the border, it's the soft tissue is well demarcated, the osseous parts are poorly demarcated. They're not corticated. There's no capsule and they have ragged, moth-eaten borders. Inside this, we see diminished number of trabeculae and diminished density of trabeculae, which means there's bone destruction and then we also see soft tissue, let's call it a mass, a soft tissue mass in the sinus which may be part of this or it may be that these are indeed mucous retention phenomenon, something that we see frequently and almost considered like a variation of normal. With respect to the bone, there's changes in bone density, there's changes in bone architecture. This thinning of normal anatomic boundaries is expansion of bone with some cortical breaching, certainly the nasal side and perhaps even on the orbital floor and the structures that are involved are the maxillary sinus walls and floor, pterygomaxillary fissure and orbital cortices. And then you have to consider what you, what you see and what you do not see. And we don't see, really well, we don't see the infratemporal surface of the zygomatic bone. So, we see the infratemporal surface of the zygomatic bone, here, we don't really pick it up here. So it's gone. And that's not good. Everybody needs a cheekbone.

Dr. Wood: So, we've made a great set of observations now. I am patting myself--give myself a pat on the back now, but the observations are made now, and would we have made all those observations that we just looked at this radiograph and waited for divine intervention? I don't think so. I don't think so. I think we need to get in the habit of disciplining ourselves by going through this checklist and using it. Now, this is just the way I do it. If you want to develop your own checklist, go for it. And I think that's perfectly reasonable. This is the way that I was taught the quote unquote 'Toronto Way', if you like. That's enough to make anyone hate me just from there. But, I think that we've got a lot of information we've sucked out of this that we might otherwise have missed, okay? I think that's important. So, there we, then we find ourselves like, like Dorothy the proverbial fork in the yellow brick road. Where are we going to go from here?

And again, there's some things we can glean from anatomy. Like we know that this is not, for example, a stuffy bone defect in the mandible because it doesn't occur in the maxilla. Certainly, doesn't look like this anyway. So some things we can rule out by position. But if we look at our sieve, first thing, we've got to record an observation that we made the recorded observations. And so then, I remember sitting in an undergraduate oral exam recently in Cape Town and I was trying to just, there's like there's too many students being examined and I just, I was just, I'm old, I'm not expected to live long. And I thought for God's sake would you just tell me whether this thing is normal or abnormal? I think everybody should be able to do that. And I just, you know, after a while just I had to be restrained. So, the first thing we're going to ask is, is this condition that we're looking at on this panoramic radiograph, is what we see explainable on the basis of being normal? And Worth used to say if you know normal, you know a lot because the variations of normal are enormous. But I think, we are probably going to be very safe in saying that this is not only not normal, it's abnormal. And then the next fork in the road is, is it developmental or acquired? Right? That's the next fork in the road. Does anybody think this is developmental? I can't think of any developmental conditions that destroy part of the cheek bone, balloon out the sinus, have soft tissue masses of underlying bone destruction and destroy perhaps the inferior part of the orbit and the medial part of the sinus or lateral wall of the nasal fossa. These are things that I don't consider developmental, I don't consider them normal. So, we're down to, we're down to basically acquired.

Dr. Wood: So, this is an acquired condition. I think we would, I think most people would agree this is an acquired condition. So, let's just look at our list of possibilities for acquired and let this be the part where we start, where we've already started, we've already thrown our developmental chapter out of our pathology or oral radiology texts. Just throw it away. It's not developmental and it's not normal. So, we forget that stuff. Then we ask ourselves, okay, let's pick off the easy ones that we can rule out, okay? We can rule out metabolic or systemic conditions because this affects only one quarter of the entire maxillofacial skeleton. So, there's very few things that, metabolic things, that affect the, just a small part. There's some, but very few. So, we can rule those out. What about cysts or cysts-like structures? I think we're confident ruling that out based on the features of the border. The border is not corticated, not well defined, it's just not a cyst border. And in fact, it's also not a benign tumor border. It's not something we see in benign tumours. They're usually well demarcated, well corticated in both benign tumors and cysts. And we're gonna come back and look at all the features of the various acquired conditions. What are the border features? What are--the kind of stuff they teach in dental school? Hopefully, in a more entertaining way. So, we've ruled out almost half of the acquired conditions. Is there an infection or inflammatory reason? Well, if you looked at the teeth, they're really more or less, okay. I suppose you could have an infection in the sinus that could do this, but I don't think you have infection of the sinus that would destroy bone walls like this. So, I'm going to go out on a limb and rule out infection or inflammatory conditions as well. So, now, and I'm going to rule out traumatic conditions, I don't know of any, if you think of... What traumatic condition do I know that could go in hollow out a maxilla, partially efface the floor of the orbit and the immediate wall of the nose, and then plop a couple of pieces of soft tissue in there? I don't know of any traumatic things. So, now we're down to basically fiber-osseous and malignant. So, what are the features of each of these? Well, fiber osseous conditions generally they're generally pretty well defined and they generally have fiber osseous tissue in them. And there is no fiber osseous tissue in this. This is, there is soft tissue in this, but there's no fiber osseous tissue this like your typical big fibers dysplasia of those ilk. You know, Florid osseous dysplasia, PCD, what have you. They don't have internal structure like this.

Dr. Wood: So, you can see now I want to say wisdom, but I hate to attach it to anything I say. Just sort of the foresight of making those observations because in making those observations, it allows you to rule out these normal, allows you to rule out developmental, and it allows you bit by bit, so you're playing a little bit of percentage here, but it allows you to rule out everything but malignant tumor. So, and this was, in fact, a malignant tumor. It was a [inaudible] cancer of the maxillary sinus, I believe. And but all I care about is malignant tumor. There is not a panorex center there, panoramic radiograph on earth that I've seen that shows H and E stain cells. So, I'm happy if I get malignant tumor. Now, I'm going to just be greedy because this is the nature of me. John knows him now retired, so I'm not going to even quit. My father used to refer to as a greedy gray. I'm going to be a greedy old person and say, okay, I'm going to try to figure out what malignancy this is. So, my choices really are hematologic malignancy, which is really sort of a systemic malignancy. So, I'm going to rule that one out. And then, I have a choice between primary cancer and secondary or metastatic cancer. And I'm going to pick primary cancer because, sorry, I've got a lot of experience working in a cancer center and I know, and you should know that primary cancers are way more common and squamous cell cancer is the most common of the primary cancers, affecting the maxillofacial area. So, I'm going to choose primary cancer. You don't have to do that. No one has to do that. Because if you can get to malignant tumor or if you can get to this broad category of malignant tumor, that patient's going to get more advanced imaging.

Dr. Wood: This is the time where you say, I'm worried about this patient has a malignancy. I'm going to call my local oral surgeon or the family physician, which I suggest the former rather than the latter, or whoever the local specialist or the local hospital can facilitate getting this patient into a proper diagnosis. But that's the critical element is getting down to a malignant tumor and then going to your advanced imaging, not doing imaging, everything out of this--getting every imaging system under the sun and then trying to go through it like this, try to get as much information as you can from the least amount of let's say the most responsible amount of imaging. Because you're not going to treat the malignant tumor. So, the person is going to treat them like a tumor is going to order his or her own imaging. So, that is basically the process in this case.

Dr. O'Keefe: Thank you very much, Bob, for walking us through that,

Dr. Wood: If that makes sense, John?

Dr. O'Keefe: Yeah.