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ANNINO:**

This is Dr. Donald Annino, and I'm going to be discussing, today, trans-oral robotic surgery for head and neck cancer of the oropharynx.

To start with a little bit of the background of head and neck cancer-- will be presented. It's the sixth most common cancer, which is encountered in the United States, with 40,000 new cases diagnosed every year. When you look at a worldwide occurrence, it's 500,000 cases a year. And statistically in the past, the greatest risk factors have always been tobacco and alcohol use. However, in the recent past few decades, we've seen a real endemic and a real explosion of cancer related to human papillomavirus.

Most of what I'm going to discuss today applies more to the HPV, or the human papilloma related cancers. As I said, it's an epidemic, which is occurring, which we're just starting to realize now. What we've seen is cancers involving the tonsil, the back of the tongue, the back of the throat-- between 1973 and 2004-- have increased 1.3% per year. Whereas those cancers which are not associated with the virus and associated, at this point, still with tobacco and alcohol use have actually been decreasing. As an example of that, you can see the oral cavity has decreased almost 2% per year over that same time period.

And looking further at the tumor, which we removed extending back to 1973 in the United States, you can do so staining on archival tissue or tissue that's already removed. And at that point in the early 1970s, 18% of the tumors involving the oropharynx have been HPV positive. And 2004-- it's now been up to 3/4 or 73% of the tumors are HPV positive. And there's even further indication that that rate has even increased since then.

When we look at other Western countries-- and Sweden is a very good database to observe this-- they had very similar findings. In the 1970s, it was in the low 20%. And then 2007-- some more recent data has actually shown that more than nine out of every 10 cancers, which they diagnose, is HPV related in the oropharynx. This picture, which we see here, shows the tongue in the midline and the tonsils on the left and right with the left tonsil, which is the tonsil on the right hand side of the screen, being larger than the left and having a tumor within it.

So as we look at HPV and this epidemic, what we see is similar to GYN cancers-- that certain subtypes or phenotypes of the HPV virus are more related to forming cancer with HPV subtype 16 by far the most common. With up to 90% of all the HPV related cancers do you find the phenotype 16 involved within it. For patients who have a known human papillomavirus oral infection, their risk of cancer is 50 times greater than that of the general population.

What we have seen with this epidemic of HPV related cancer is that the patient population itself is changing significantly. The epidemiology is changing. Instead of patients who were males, who were elderly, and with significant tobacco and alcohol use, we're now seeing it occur, still in males, but in young well educated males that are usually in their 40s and 50s. And this graph that's on the side on the picture here-- what we're seeing is the gold color is the overall incidence of pharyngeal cancer slowly increasing. And if you compare it to the darker line, which is HPV negative cancer decreasing-- that related to smoking and drinking as it's become more well known and accepted that smoking is a risk factor-- is decreasing. Whereas that related to the virus, which is in the light blue line, has significantly increased over the last few decades.

So HPV related oropharyngeal cancer, as stated before, we're seeing a shift in the patient population. It's now in younger, predominantly, white males, usually in their 40s and 50s. They have a very high socioeconomic status. They're well educated. They function at a high level. They do have a history of increased lifetime sexual partners with the greatest risk being more than five sexual partners over a lifetime.

What we are finding also-- which is different from cancer, which previously was related to smoking and drinking-- is that the primary sites or the site where the cancer arises, such as the tonsil or the base of the tongue, is very small. There on the right hand side of the picture, we see a PET CT with the CT portion on the left and the PET portion on the right. The top arrow on the CT portions of the image on the left shows a very small bump by the base of the tongue, which is a cancer, which you can see increased uptake, or the white area, on the PET scan to the right. The lymph node is the rounded area with the second arrow to it on the CT scan with, again, the increased uptake on the right.

So we're finding these patients that are very small primaries with extensive lymph nodes where the previous smoking and drinking patients had very large primaries, or very large cancer, in the base of the tongue with very small lymph nodes. So this is changing.

So as this epidemiology has changing and as there's a rapid epidemic arising in HPV related cancer, we've now started to really look at all our treatment for this type of cancer. When you go back prior to the 1990s, the main treatment had been surgery with radiation. However, starting in the early '90s, there has been an attempt to try and minimize side effects and have organ preservation. And most of this work has come from examining laryngeal cancers.

And what's happened is that chemotherapy and radiation have become the forefront of treatment because to access these cancers and to remove it involves very aggressive, highly morbid surgery. And surgical salvage has been only used for failures from chemotherapy and radiation. However, what we have found-- despite preserving these organs, preserving the tonsils, the base of the tongue, the larynx-- these patients still do not always have improved function.

Most of these patients, after chemoradiotherapy have significant dysphagia, which is difficulty swallowing. Up to 30% or a 1/3 of the patients will have a feeding tube or remain G tube dependent. The radiation causes fibrosis, particularly within the muscles that help you swallow, and result in poor movement of the larynx and swallowing as well as an increased risk of esophageal stricture or narrowing in the esophagus resulting in difficulty swallowing.

So because of these concerns, the poor functioning, the younger patients-- the patients, actually, have fewer comorbidities. They don't have as great other medical problems related to their significant smoking or drinking. These patients function at a better level because they're younger. They usually have young children, and they're usually functioning in a high level job-- that we wanted to try things to improve their quality of life.

Because of this, it's been investigated-- the use of the robot-- because it offers the advantage of avoiding external incisions. It's all done through the mouth. It avoids the need to split open the jaw to get access to the back of the throat and the mouth. The hospital stay compared to conventional surgery is markedly reduced from-- we're up to 10 days down to as little as one to three days.

And it avoids the need for extensive reconstruction-- reconstructive procedure where we take tissue from another part of the body to replace that which was removed. This was done previously with a sense of surgery because you obviously created a communication from under the skin in the neck to in the mouth. And at this point, when we do this separately, we do not have that connection.

So what it entails is the robot is used-- this is a picture. What we can see is the robot in position. There's an assistant who sits at the head whose hand you see. We see the three arms of the robot. The center arm is the camera, which gives 3-D visualization. And then the two arms on the side can be interchangeable with different instruments to help you do it. So there's no external incisions, and the approach is done through the mouth.

When you cannot use a robot is if the patient cannot open their mouth wide or they have a very small mouth. At this point, there's no way to cut through bone with the robot. So if the mandible or the bone of the mandible is involved, we can't do it. If more than half the tongue base is involved, the concern is that you'd have to remove so much of the base of the tongue that the remaining time-- the vascularity to it-- would be compromised. And that's the same for a tonsil cancer, which is fixed, and that you can't move.

The concern is that would be attached to the internal carotid artery which cannot be resected. And that's with the bottom thing as well. If it's attached to the common internal carotid artery, either the primary or the neck disease, and it can't separate it from it-- it's a contraindication to surgery.

The onset of TORS is being compared to open surgery. What is seen is that the length of stay within the hospital is dramatically reduced with TORS procedures. Where it's decreased from a little over a week for the open surgery to anywhere from one to four days, but closer to three to four days for the TORS. Also the need for a tracheotomy at the time of the procedure has markedly decreased. The initial experience with TORS resulted in approximately just under 1/4 of the patients requiring tracheotomy as opposed to almost 80% for the open surgery. Though even that now, it's more the exception to do a tracheotomy for TORS. So the majority of patients actually do not get tracheotomy tubes.

These patients also do better from an eating and feeding point of view in that the need for a persistent feeding tube has dropped from 30% after open surgery to 3% with TORS. And the patients also experienced significantly less blood loss since so much less tissue is actually manipulated through the surgery. So comparing it-- just open surgery-- it's much less chance of having poor healing from the mandible since you don't have to split it open. There's no hardware that needs to be placed to hold the mandible in position. And you don't need complicated reconstructions following the surgery.

At this point, TORS is indicated for small tumors-- tumors that are less than 4 centimeters in size, tumors that don't have extensive lymph node involvement. And with those features alone, the use of the TORS alone without radiation or chemotherapy results in a greater than 90% cure rate. TORS procedures-- people who have cancer of the tonsils-- they swallow as well, once they've healed from the surgery, as they did prior to the surgery. Cancers involving the base of the tongue or the back of the throat have just a slight change after the surgery and they return back to their baseline by six to nine months.

When you compare it directly to chemoradiotherapy, again, the need for long term G-tube dependency, meaning greater than six months, drops from 10% to 1%. Quality of life is vastly improved if surgery can be done because surgery allows a de-intensification of the chemotherapy and the radiation.

So this video is going to be trans-oral robotic resection of a right tonsil cancer in a woman who's previously undergone treatment with chemotherapy and radiation. So here's the tumor in the right tonsillar fossa. That's the anterior tonsillar pillar being pushed on. The forceps was pushing at the base of the tongue.

Now the incision is going to be made through the anterior tonsillar pillar. This is done through the pillar identifying the musculature below it and also through the muscle. This is the incision starting from the area by the tongue extending up to the soft palette or the roof of the mouth on the right side of the patient.

As I said, the dissection goes around the tonsil and through the musculature. This is showing it at a plane as the muscular constrictors are being divided and removing the tonsil as a whole through what would be called a radical tonsillectomy. The part that's getting divided right now is the mid-portion of the tonsil, at this point, extending up towards the palette or the roof of the mouth.

This is where it's getting separated from the roof of the mouth. The structure just to the left of the cutting instrument is the uvula-- the part that hangs down. And when the tumor's removed, it's always removed with the cuff of normal tissue, so it clearly extending beyond the tonsil for this.

This is just showing the blood vessel, which is a branch going to the tonsil first, getting clamped right here and then divided. That's a close up picture of the clamps in place. And then the blood vessel's going to get divided. This is done to minimize bleeding and also to prevent post-operative operative bleeding.

This next part shows the lower part of the resection involving the incision going through the base of the tongue. That cut, right now, is being made through where the tongue and the tonsil join. So again, a cuff of normal tissue is done going towards that.

As part of the dissection, the lingual nerve, which is the nerve that gives sensation to the tongue as well as the taste, is being shown just top of the cutting instrument. It's being separated from it and preserved, period. Once all those other regions have been adequately cut-- this is an incision through the posterior or the back wall of the throat and down through the lining of the throat and then down through the musculature, which will allow a complete 360 degree mobilization of the cancer and removal.

And this shows the final cuts which are being done more on the posterior wall and then the delivery of the tumor out. And these are just the final incisions. So as you look at this, one thing you can see-- the area of resection it's much larger than, actually, where the tumor was itself . Once we're done, this is not sutured close. It's allowed to heal on its own. Also visible underneath the number two there is the endotracheal tube or how the patient is being ventilated during the procedure.

So in conclusion, we're seeing an epidemic of HPV related oropharyngeal cancer. We're seeing it happen in younger patients than historically was the case when smoking and drinking were driving the cancer. These patients function at a much higher level, and it's an option to allow vastly improved quality of life afterwards.

What has been seen is that it's a safe option for tumors in this location, results in a reduced hospital stay, and improved quality of life. And at this point, multiple studies are ongoing, but it looks like the use of surgical recession through the TORS will allow de-escalation or decrease in the need for radiation and chemotherapy, and therefore, an improved quality of life. Thank you.