NETWise
A Podcast About Neuroendocrine Cancer

Episode 43:
AI and Neuroendocrine Oncology
Transcript

If you're new to NETWise, we highly recommend you go back and listen to the first episode in this series. It goes over the basics of neuroendocrine tumors and how they're treated. And you can find a whole library of episodes on different topics at netrf.org/podcast, where you'll also find infographics and videos that expand on this material.

If you have a story to tell about your own NET journey, please email us and let us know – podcast@netrf.org.

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When Hector Perez thinks about how artificial intelligence could be used in medical care, he feels one thing: excitement.

> ***Perez:*** *Because I'm, I'm in this world, right? So I'm, I'm living and breathing how AI is being used in other organizations, in other ways, outside of medicine.*

Hector is a tech consultant. His job is to help organizations implement new technologies.

> ***Perez:*** *So yeah, AI has been the talk of the town in my area very much for the past year and a half, two years.*

The 39-year-old lives just south of Salt Lake City, Utah. When he's not working his day job, he spends time playing with his sons and curating his sneaker collection. And, once a month, he goes to get a shot of Lanreotide.

> ***Perez:*** *It's just one injection every four weeks. And that has a couple benefits, one of which is to control the symptoms that I have. And also, it has helped kind of halt any progression of the disease in my body.*

Hector was diagnosed with neuroendocrine cancer in February of 2017. His primary tumor is in his mesentery, which is part of the GI tract. He also has metastases in his liver.

Hector's diagnosis was fairly quick, and his treatments have so far been effective. But he knows it's not like that for everyone. And he believes that in the not-so-distant future, artificial intelligence will revolutionize cancer care, from increasing the accuracy of diagnosis to assisting doctors in the clinic.

> ***Perez:*** *I haven't seen that hit quite yet from like a, I think ground level, if you were to call it, where the rubber hits the road, me as the patient and then my doctor. But I'm excited for when that is commonplace. And I think there's going to be a lot of value that comes from that.*

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You're listening to NETWise. I'm Jessica Thomas, Director of Patient Education at NETRF.

In each episode of this podcast, we share expert information and patient perspectives to help neuroendocrine cancer patients and caregivers navigate their journeys.

At this point, pretty much everyone has heard about artificial intelligence, or AI. These kinds of technologies have been around for a while, but in recent years, they've come into the mainstream. AI has the potential to change many aspects of our lives – including cancer research, diagnosis, and treatment.

In this episode of NETWise, we're going to explore how AI is being used to push the needle in neuroendocrine cancer research, and its possible uses in the clinic.

Welcome.

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The way Hector Perez likes to think about AI is as an assistant.

> ***Perez:*** *Right now, you know, if I ask you, 'Hey, what are your plans Wednesday night?' you would go and you'd look at your calendar and you would tell me.*

With AI, you don't have to look at your calendar.

> ***Perez:*** *So whatever I ask, whatever I prompt, I'm able to get information back.*

This is because AI technologies can process far more information, much faster than people can.

> ***Perez:*** *What is really powerful about AI is that you have these systems that essentially go out and look at hundreds, thousands, millions of data points and come back and give you a very succinct set of information within less than a few seconds*

So how does AI do all that?

> ***Ralic:*** *So technically artificial intelligence, the whole concept was that: could we use technology to think like we do as people?*

This is Danielle Ralic [RAY-LIK], the CEO and founder of a company called Ancora AI. Her service uses AI to help cancer patients find clinical trials.

> ***Ralic:*** *Sorry. This is like my favorite topic. I'm so excited.*

In the most basic sense, AI is a data processing tool. Like our brains, it can take in a bunch of information, and recognize complex patterns. *Unlike* our brains, AI is instructed to do so by people, who program it with specific algorithms.

For instance, Danielle says, you could have an AI software that has been programmed to detect patterns in language. When you input two sentences, it can detect the similarities.

> ***Ralic:*** *Like, 'I fed my cat.' And then you have another sentence, 'I fed my dog.' So the model doesn't understand what these things mean, but if you think of technology as kind of zeros and ones or bytes, it learns from how it is in the sentence.*
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> *So 'I fed my cat.' 'I fed my dog.' It looks at the distance between the words and it sees like, okay, I'm doing the same thing. I'm quote, feeding my blank, feeding my blank. Maybe these are similar.*

This is how AI starts "learning," by identifying that cats and dogs fall into the same category: animals. It can build on this with more data, developing an exponentially complex understanding.

> ***Ralic:*** *And so kind of, that's the way we can – artificially – have an intelligence about what these things mean. But I like think of it as, very kind of pattern – I'm using pattern very loosely – but patterns statistically based.*

Depending on how it's programmed, AI could be trained to do things like synthesize information, analyze visual data, make predictions, or generate content. This can be applied to anything from words to images to sounds.

This technology has been around for a while, but developments in recent years have taken it to the next level. We've made advances in how we train AI models, more data has become widely available, and computer hardware has gotten more sophisticated.

> ***Ralic:*** *And I mean, now what we can do is just unprecedented in terms of the kinds of models we can run.*

> *If you've heard of these terms like super computers, I mean, incredible types of computation available. So I think we'll be learning and iterating a lot faster.*

Used ethically and with scientific rigor, AI and machine learning could increase the pace of research and improve patient outcomes. It could be used as an "assistant" in all kinds of ways – it could help researchers as they're processing data to refine a treatment, or radiologists when they're examining scans to make an accurate diagnosis, or clinicians as they are personalizing treatment plans.

> ***Ralic:*** *I think for the healthcare world, we just have so much information out there. It's just like, are we getting it to the right people at the right time? Are we able to effectively use it?*
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> *And if we can use things like artificial intelligence, that helps us just process all the information out there, and translate it and put the right information at the right time in front of the right person, I think we can do amazing things.*

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In the world of research, AI has revolutionary potential.

AI's power lies in its ability to process large volumes of data very quickly. Research is all about data, so having this kind of tool can increase the pace, depth, and breadth of scientific discovery.

Matthieu Foll is a researcher at the International Agency for Research and Cancer, part of the World Health Organization. He works in Lyon, France.

> ***Foll:*** *In the field of cancer, there are many different applications of AI. That goes from very basic research, trying to understand interaction between proteins, and*

> *genes. Very translational aspect, where we try to transfer as quickly as possible, the research findings into the clinics. And how can we improve the design of the clinical trials to optimize and maximize their impact.*

In his work, Dr. Foll uses AI all the time. He's a computational biologist.

> ***Foll:*** *So computational biologists mean that I use computational techniques, like advanced algorithms or informatics to try to answer biological questions. And this has become more and more important in the past year with, uh, new technologies in the labs that generate a massive amount of data.*

In the lab, scientists are working to understand the fundamental biology of neuroendocrine cancers. How they form, how they spread, and what their unique characteristics are. A lot of this work involves looking at the building blocks of cancer cells.

> ***Foll:*** *We are trying to identify which are these changes in the DNA or the RNA of the cell that makes them cancer as opposed to a normal cell that would not be cancerous.*

There are new technologies being used in this research known as "omics." Omics measure biological molecules in a highly detailed way. For example, proteomics can map out the proteins in an organ. Genomics can be used to sequence genes in a cell.

> ***Foll:*** *The size of a human genome is 3 billion nucleotides. So this indeed generates massive amount of data that we need to use advanced computational techniques and now deep learning or artificial intelligence to, to make sense of them.*

This work creates a goldmine of information about cancer. With the help of AI and machine learning, researchers can take this information and apply it in all sorts of ways.

In his lab, Matthieu Foll is using AI to refine the classification of lung neuroendocrine tumors.

> ***Foll:*** *Still today, even with these advanced genomics techniques, the way most cancers are diagnosed are under a microscope with examination of the tissue architecture, the cell, how they are organized just by a human eye of a pathologist.*
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> *And this is still the gold standard and this is working well. But now, all these images, they can be scanned at very high resolution and this generates a new type of data, which are extremely gigapixel size images, extremely large.*

He and his team are using AI to identify what visual characteristics on these complex images are associated with genetic changes in the cancer cells.

> ***Foll:*** *We have the opportunity to use again the images to try to identify what we found using genomics to actually see some morphological differences that are maybe have been missed over the years or are difficult to spot to translate this back to the clinics and back to the pathologist.*

Here's Emilie Mathian, Dr. Foll's research assistant.

> ***Mathian:*** *A trained pathologist will be trained to detect features that he knows help him to classify disease, but it's really hard to work on something when we don't know what to look for or where to look.*

This is where AI comes in.

> ***Mathian:*** *So we need something which is quite unsupervised. That is training itself to differentiate those features. And then we go back to pathologists to ask them, do you agree with the machine? Do you agree that it's differentiating stuff that are biologically meaningful?*

The hope is that this work can deepen our understanding of lung NETs, eventually allowing for more nuanced diagnoses.

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One of the most important applications of AI is in drug research. Here, the technology can help speed up the identification of new drugs and drug targets.

Dr. Aman Chauhan is a medical oncologist at University of Miami Sylvester Comprehensive Cancer Center, where he leads the neuroendocrine oncology program and co-directs theranostic drug development.

> ***Chauhan:*** *The traditional way of finding new drugs and targets is very rudimentary, very laborious. Basic scientists spend hours and hours and weeks and months into finding the targets and pathways which makes the cancer grow and metastasize. And then trying to find by clinical trials that this drug, when we block this pathway, will hopefully kill the cancer cells.*

With AI and machine learning, this process becomes much faster. These technologies can process data very quickly, around the clock.

> ***Chauhan:*** *So they can really help us decipher a lot of these mysteries and find the targets and pathways that eluded us so far. And helping us then find a treatment tailored to that particular pathway that might have not yet been discovered. So it's going to really accelerate the drug development process by multifolds.*

AI technologies can also help determine if there are new targets for drugs that are already in use, and refine drugs and the way they are administered.

> ***Chauhan:*** *They can really help us fine tune the structure of that particular drug – how an ideal drug should or would look like that will inhibit that particular pathway – much better than humans would. You know, we'll have to try and fail and try and fail, machines can do that much more efficiently for us.*

All this could be especially significant for neuroendocrine cancer, which has historically lagged behind other cancers in research and drug development.

AI has similar applications in clinical trials, where it can help researchers optimize trial design to maximize their impact.

> ***Chauhan:*** *Because one of the key things about AI is that it learns and self-learns and becomes more and more efficient. And it can really help us design trials, protocols, and then really learn from, okay, this study design did not work in this type of tumor because it was, uh, probably aiming for too high of a change, or feasibility was an issue. So it can really help us kind of design an appropriate trial for appropriate disease.*

AI could also help streamline the recruitment of participants in trials, and improve data analysis. This could help bring more effective cures to the right patients, quicker than ever before.

From understanding cancer to drug discovery to clinical trials, artificial intelligence is making waves in the world of oncology. But this data-processing powerhouse of a technology has uses that go far beyond the lab, and into the clinic.

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The applications of AI in the clinic are far-reaching. From improving detection and diagnosis, to personalizing treatment, this technology has the potential to improve patient outcomes.

Neuroendocrine cancers are both uncommon and heterogenous, which has historically made them difficult to diagnose. Having more data available through AI could help make diagnoses more timely and accurate.

> ***Chauhan:*** *If we can teach algorithms, softwares, to help us with diagnosing and standardize the diagnosis at a high volume and a low volume center, wouldn't that be wonderful?*

Dr. Chauhan says that when it comes to these diagnoses, we will likely see some of the biggest impacts of AI in radiology and pathology.

AI can help review scans, X-rays, and MRIs, helping radiologists work more efficiently and accurately. The same is true when it comes to pathology, which describes the extent and severity of disease.

> ***Chauhan:*** *Within neuroendocrine oncology, it's not a straightforward diagnosis. There are different flavors of neuroendocrine cancers from different grade of neuroendocrine tumors, to different morphology, from well differentiated to poorly differentiated, and then within poorly differentiated, large cell versus small cell, and there's a lot of peer reviewed data suggesting how inaccurate the pathological diagnosis can be, based on the experience of the pathologist.*

Incorporating artificial intelligence into reviewing these challenging and rare diagnoses could bridge that knowledge gap, increasing accuracy and precision.

Getting the right diagnosis more quickly can improve outcomes and quality of life for patients like Hector Perez, who we heard from at the beginning of the episode.

> ***Perez:*** *From a personal standpoint, one of the things we talk about in NETS is the fact that, for a lot of people, it's difficult to get a diagnosis that you have NETS. So, that's, I think, where a lot of the benefit will come in this world of medicine is just getting to a diagnosis to then get the treatment needed earlier rather than later.*

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When it comes to treatment, artificial intelligence shows some of the most promise in tailoring treatment plans to a patient and their particular diagnosis. This is often called personalized or precision medicine.

> ***Chauhan:*** *AI is a natural fit to augment precision medicine. As our knowledge about cancer, pathophysiology, gain momentum, we learned that at cellular level, at genomic level, each cancer is different. Each patient is very unique. So then the era of precision medicine came where we were tailoring or targeting these specific mutations for that particular patient.*

This is an innovative strategy that could be especially helpful in treating neuroendocrine tumors, because each one is so different.

Where AI can help is in looking at a neuroendocrine cancer patient's genomic data, and identifying potential drug targets in their cancer cells. This could help their oncologist decide which treatment to start them on, or which to try next.

And since science is happening more quickly than ever, AI can help doctors stay on top of all the options available for their patients as research evolves.

> ***Chauhan:*** *So if a new clinical trial, for example, suggests that a particular mutation have a very powerful target therapy now. And we know that that patient back in '22 had that particular mutation, the AI software can flag me that this can be considered a potential treatment for which we might not be aware of.*

Clinical trials are an important part of treatment for many neuroendocrine cancer patients.We talked earlier about how AI can help researchers design and interpret these trials. But for doctors and patients, it can be challenging to navigate all the trials that are out there, and find the right match.

> ***Ralic:*** *For patients, like, if you go to clinicaltrials.gov, how do you yourself weed through each of these trial results that you're seeing to say, even at the basic level, is this even relevant for NETs? Yes or no? It would be a huge effort at this point.*

Danielle Ralic is trying to change that with her company, Ancora AI. The website uses AI to search a vast database of clinical trials, which is constantly being updated.

It uses information about a patient to match them to potential trials. This could help patients and doctors find treatment options they would not have been aware of otherwise.

> ***Ralic:*** *So we're looking for things like: what is the staging of the cancer they're looking for? What subtypes of a cancer are they looking for in these trials or what prior lines of therapy are required or not allowed to be had for these trials?*

In addition to improving access to clinical trials, AI could also help patients learn about their disease. With a complex and rare cancer, this could be especially useful.

> ***Ralic:*** *Tech is this kind of like mega-translator between this complicated world of healthcare and research and*

everybody else. Because I think that's been one of the biggest gaps, is the language is really complicated, and if you go to try to research, like, I don't understand my diagnosis or I don't understand what treatments or options I have, it is such a huge lift.

Artificial intelligence could help explain things in a more accessible way, and answer the questions patients might have about their disease.

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Up to this point, we've been talking about what a useful tool AI could be. But it's a tool that is only as good as the people who make it, the people who use it, and the data available. Especially in clinical settings, there is still a lot of work to be done before AI is ready for primetime. There are three big things to keep in mind.

First: it's important to understand that AI can inherit human biases. For instance, women were excluded from clinical trials for a long time, so they aren't represented equally in the library of data that AI might be combing through. And that's just one way that data is imperfect.

Chauhan: *So disclaimers would have to be made when we use AI based algorithms. How was this data or this AI software trained and what was the patient demographics of the test case scenario? I think that will be very important.*

Second: despite its potential benefits, AI is not a replacement for human reason and robust science.

Chauhan: *We also have to make sure that our interpretation of data is accurate. You know, it's not a trivial thing. We are managing patients and their lives depends on it. So we don't want to be over-calling cancer diagnosis or under-diagnosing somebody.*

This goes for patients, too. When it comes to information you get from AI software, take it with a grain of salt. Be sure to fact-check what you read, and don't make medical decisions before talking with a doctor.

Third: security is key. Sensitive health information needs to be kept secure and private. You should never share your medical information with public AI, or anywhere else on the internet.

> ***Ralic:*** *You don't know where your data is going to go. I mean, medical records about your mutations, about you know, your medical conditions could affect things like your ability to get employment, insurance. So I just say just be super careful.*

For AI used in the clinic, there will need to be safeguards in place to make sure that data stays secure.

> ***Chauhan:*** *So AI algorithms must be transparent and their decision-making process should be understandable to clinicians and patients to ensure trust and safety.*

With those considerations, it will likely take longer for AI to become as commonplace in medicine as it will in other parts of our lives.

> ***Chauhan:*** *But I think we are at the cusp of, really launching AI in mainstream medicine, oncology, and definitely rare cancers like neuroendocrine oncology.*

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Like all technology, AI comes with both opportunity and risk. The one thing that seems certain is: it's here to stay.

It's rapidly changing the landscape of neuroendocrine cancer research, diagnosis, and treatment, and will continue to have impacts for a long time to come.

Dr. Chauhan says he would encourage neuroendocrine cancer patients, advocates, researchers and clinicians to be open-minded about the potential uses of AI.

> ***Chauhan:*** *I think it's going to transform oncologic care, especially when it comes to neuroendocrine cancers, where it often lags behind in drug development. I think this could be a big bridge to fill that void for us.*

At the same time, NET patient Hector Perez says that it's important to remember that as much benefit as AI could bring, it's not a silver bullet.

> ***Perez:*** *It is not the solution to all things. Humans are very much still an important part of the decision-making process.*

While AI can function as an assistant, synthesizing and processing huge amounts of data with rapid speed, it is not a replacement for our ability to think for ourselves and make our own choices about medical care.

> ***Perez:*** *Regardless of how great this technology becomes, we are still going to need experts that understand how all that data comes together, where that data is coming from, how to translate that, and it ultimately will help us make the best decision that will benefit us.*
>
> *But the human element in all of this is still going to be very much necessary from a doctor's standpoint and a patient's standpoint.*

As much buzz as there is about AI, it's still the early days. But Hector hopes that in the future, it will be a force for good for NET patients like him.

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Thanks for listening to NETWise. I'm Jessica Thomas, Director of Patient Education at NETRF.

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Special thanks to everyone we interviewed for this episode. We are grateful for your expertise.

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