Article

Increasingly vital role of medical imaging in oncology

Collaboration between medical specialists and IT experts is important when it comes to improving the quality of life of oncology patients.

Medical imaging in the field of oncology is advancing in leaps and bounds. It is becoming increasingly easy to manage images and data, making it possible to determine with greater accuracy which treatments will improve the patient's quality of life and how those treatments can be applied in the most targeted way possible. It is also becoming clear that, in some cases, it's preferable not to provide any treatment at all. Sectra discussed these developments with two leading hospitals that both collaborate on a multidisciplinary basis to further improve their patients' treatment. We spoke at length with a number of thought leaders from AZ Delta Hospital and University Medical Centre (UMC) Utrecht about their views on the relationship between medical imaging, oncology and IT, and the improvement of patient care.

SECTRA

Knowledge and passion

Pathology and radiology learn from each other and work together at UMC Utrecht

- Prof. Dr. Paul J. van Diest, Head of the Department of Pathology, specialized in digital pathology, prevention, diagnosis and treatment of breast cancer
- Dr. Wouter B. Veldhuis, radiologist specialized in gastrointestinal and uro-gynecological tumors and breast cancer

Similar work processes in pathology and radiology

Prof. Dr. van Diest is Head of the Department of Pathology at UMC Utrecht and specialized in digital pathology and artificial intelligence (AI). Dr. Veldhuis is an oncological radiologist and co-founder of the UMC Utrecht radiology-AI start-up QuantibU. Prof. van Diest explains: "We are aware that pathology and radiology are very similar in terms of processes and content. We both advocate for a more integrated form of diagnostics and have been looking for opportunities for improved integration and collaboration at a technical and content level for some time."

When it comes to the digitalization of medical imaging and workflow optimization, there is a certain degree of overlap between pathology and radiology, as Dr. Veldhuis explains: "We [radiologists] had digitalized procedures, but if you look at structured reporting, we are lagging far behind. Attempts have been made for structure reporting, especially with respect to prostate and breast imaging. A system like PALGA (National Pathology Image Exchange platform in The Netherlands), which pathologists use, would also be very useful for radiology." Prof. van Diest adds: "Improving the workflow requires a local champion. Someone has to take the initiative. You have to start small and then grow from there."

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Prof. Dr. Van Diest, UMC Utrecht

Trends in digital pathology

Digital pathology mainly involves digitalizing tissue samples and setting up digital workflows. Prof. van Diest continues: "Sectra provides us with access to the Pathology Image Exchange (PIE) platform, which supports a digital exchange of images between laboratories for consultations, peer reviews and trials, and also for research and training purposes. As digitalization increases, there is a greater need for coordinated diagnostics. We are also seeing the emergence of regional networks with a shared PACS."

In terms of AI implementation, the workflow will continue to change in the future. "Ideally, the workflow can be automated in such a way that certain aspects of the review process are already finished when we receive the image—for example, it would be optimal if the system takes us directly to the specific tissue section where an abnormality has been detected. That would save time."

Trends in radiology

A great deal of progress has been made in the field of radiology: "If you look back at the last 15 years, there have been tremendous technical advances in MRI and CT. Moreover, medical imaging is being used more frequently before and during treatment, or as part of a medical assessment. As a result, we are receiving more and more detailed images. We are slowly starting to look at this in more quantitative terms. Likewise, specialists consult each other more often, providing a better mutual understanding and know-how," says Dr. Veldhuis.

He continues: "We have AI algorithms running that know when to start, so that a result is available when I begin my review. This is very important for patients and this is where we are going to make great strides in the future. One example of an area that is currently attracting considerable attention is prostate cancer—an area where we are using AI in a structured way. Our software reviews the sample along with us, segments the prostate, calculates the PSA density and indicates where lesions are likely to be found. If you approve this review, you get the volume of the lesion. This way, you are guided through the entire process. We now have a dedicated viewer that specifically helps us with prostate images. Ideally, this kind of interaction should take place in the PACS as much as possible so that it always works and is stored in the same way."

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Dr. Veldhuis, UMC Utrecht

Aspects for improvement in the short term

According to Dr. Veldhuis, progress is being hampered by the fact that there is not really a system for structured reporting yet. “For example, there is no support for the multi-faceted nature of reporting. Suppose someone has reviewed an image and then an expert opinion is added, or additional clinical information becomes available that changes the interpretation of the image. In such cases, I want to be able to record this information in an effective way. We can learn an awful lot from a system that supports more readers, measurements and measurement variations. More knowledge provides more nuances, and you want to be able to store that information along the way. This shows us where mistakes can be made, what we can learn from and what we are best at.”

Exchanging images externally and internally is another area where there is considerable potential for improvement. “Images from other hospitals, including radiology reports, are often received in the form of a scanned image file, which I can’t search or have analyzed by a computer. And if I include an addendum, it is not automatically sent back to the original hospital in a structured way. Yet the patient often goes back to the original hospital for part of their treatment and follow-up,” adds Dr. Veldhuis. “The data exchange process could also be improved internally. For example, there is still no structured way of reporting to help improve the interpretation of images following multidisciplinary consultations (MDC) other than filling in a field in the electronic health record (EHR). This makes it much more difficult to learn from these discussions and know for sure that important details are receiving a proper follow-up.”

Looking ahead: further digitalization and multidisciplinary collaboration

Within five years, Prof. van Diest and Dr. Veldhuis hope to have optimized the workflow even further, but according to Dr. Veldhuis, “it will take another ten years before we really feel an impact: more collaboration is needed, along with more data that can be stored in a structured way. What is currently available in terms of AI is only having a limited impact. It’s useful, but it’s not the same as making a diagnosis.”

Prof. van Diest identifies a number of important steps that need to take place: “First of all, (1) all pathology laboratories in the Netherlands need to be fully digitalized because the infrastructure needs to be in place first. At the moment, about half of the pathology labs have a digital infrastructure. Next, (2) you need to ensure permanent storage of images. We are one of the few pathology departments that stores images indefinitely. This poses a challenge in terms of costs, technical aspects and infrastructure if the images disappear at some point after you have done your best to digitalize everything. These images also need to be integrated into various patient information systems. Furthermore, (3) regional networks must be set up so that shared or joint systems for digital diagnostics can be created. The current Dutch Pathology Image Network could be expanded for diagnostic purposes. Also, (4) an increasing number of AI algorithms need to be implemented locally or centrally. (5) For training and research purposes, a central image archive can be created. Finally, (6) we can work more on a multidisciplinary basis, integrating various disciplines into the process.”

Using images to provide targeted treatment at AZ Delta Hospital

- Dr. Lieven Goeman, urologist specialized in uro-oncology, VP Belgian Society of Urology
- Dr. Kristof De Smet, Head of the Radiology Department, specialized in urological radiology (prostate MRI) and cardiac radiology (CT, MRI)
- Prof. Dr. Peter De Jaeger, Chief Innovation Officer at RADar, the learning and innovation center of AZ Delta

Intensive collaboration throughout the entire diagnostic and treatment pathway

Dr. De Smet is Head of the Radiology Department at AZ Delta Hospital in Roeselare, Belgium and specialized in urological, and cardiac radiology, with a particular interest in prostate cancer. Together with urologist Dr. Goeman, he performs transperineal NMR-guided prostate biopsies, along with other procedures. Dr. De Smet explains: “Our collaboration covers the entire process, from the initial complaint or increased PSA value during a doctor’s appointment to potential treatment, collection of PROMs and PREMs studies, and all the steps in between involving imaging and reporting. This enables us to optimize the subprocesses involved to achieve a better result.” It includes both the actual outcome and the subjective assessment of the patient’s quality of life.

Dr. Goeman and Dr. De Smet work closely with Prof. Dr. De Jaeger when it comes to data processing. As Prof. De Jaeger explains: "As an engineer, I try to make the doctors' requirements fit into an elegant process. This clarifies where there is an overlap and where improvements can be made." He believes that the hospital of the future will be a place where specialists not only collect patient data, but also collate this data in order to learn from it. "In the past, you had a photo to work with, now you have a dynamic report. You know what you should or shouldn't do, and this determines the treatment."

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Dr. De Smet, AZ Delta

The role of MRI in prostate cancer

Dr. De Smet continues: "Once a referral has been made, an MRI is an extension of the first-line examination. The images are needed to assign any prostate injuries of a PI-RADS classification." In his view, the MRI fulfils two roles: firstly, it is a pre-biopsy gatekeeper during the risk analysis and, secondly, it serves as a navigator when it is determined that a biopsy is still necessary. "This type of MRI, combined with other parameters such as PSA value and a physical examination, enables us to determine whether a biopsy is required. As we want to increase the accuracy of these types of decisions, we want to use data from the largest possible patient population, both inside our own hospital and from external databases." An MRI ensures that this can be done as precisely as possible. "A focal biopsy is different from the usual standard biopsy." In some cases, a standard biopsy is carried out instead, based on the data obtained, even if an MRI does not show any obvious injury.

Treatment is not always necessary

IDuring multidisciplinary consultations, structured and standardized reporting is of paramount importance. As Dr. De Smet explains: "This allows us to become smarter when using this data, ensuring that we learn from it and perform better in the long term." All the information collected can be used to train algorithms and achieve the most personalized result for the patient. "Precision medicine then enables us to provide the care that the patient expects."

The team is undergoing a transition where reporting is becoming more integrated, and it is less common for patients to be treated unnecessarily. As Dr. Goeman sees it: "Not treating patients unnecessarily is the most important outcome of this collaboration. We feel it is important for us to be able to offer patients the best possible quality of life. If someone is not treated, it doesn't necessarily mean they have been cured. It could mean that they just shouldn't be treated right now. We don't want to cause any harm by treating patients for a condition that isn't life-threatening and won't affect their quality of life. In order to make even better decisions, we carry out data analyses." Dr. De Smet adds: "This development is all about high-precision diagnostics and actually knowing what is going on, so that all treatment is provided as locally as possible."

Beyond the PI-RADS score

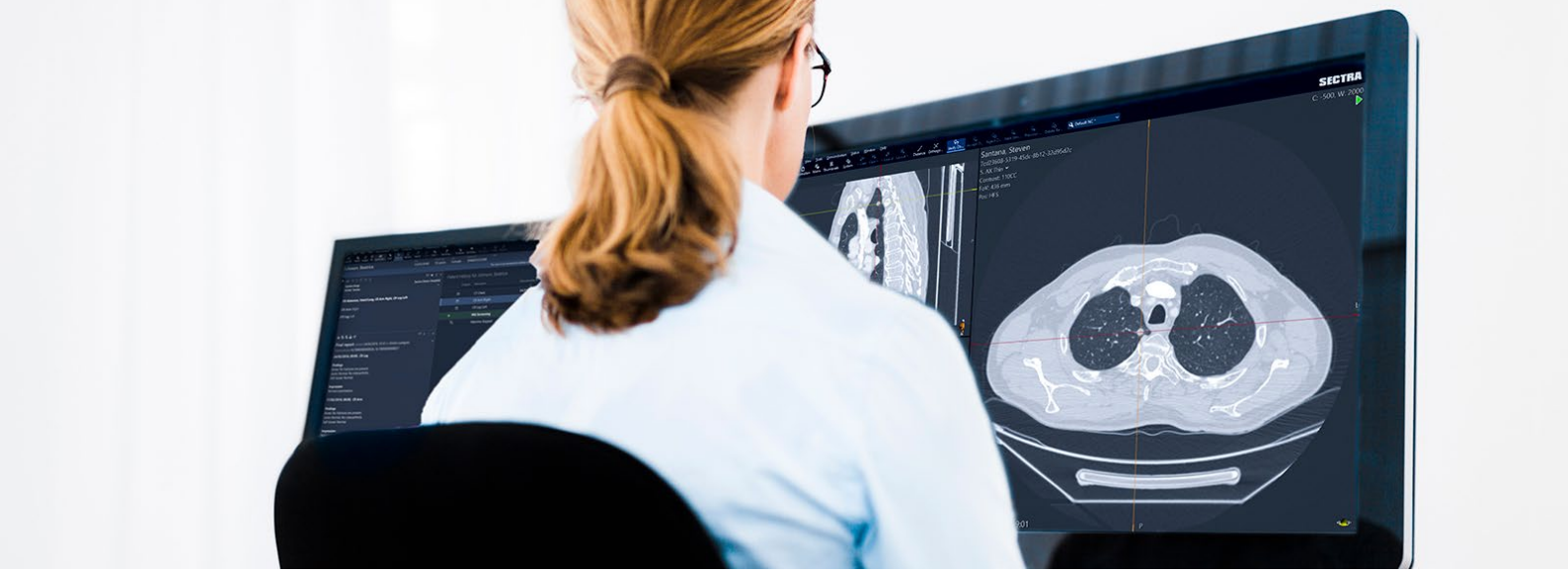
The first benefit of optimizing the workflow is an improvement in performance and continuity. Prof. De Jaeger explains: "The size of the data files isn't too bad at the moment because the data is in text form. It's made up of numbers and values. Images are currently converted into a PI-RADS score, but it would be [even] better to be able to create a kind of convolutional network in which characteristic features are taken directly from the image and combined with the PSA data from the laboratory. That would provide an even more objective system. This requires more storage and data processing but will be part of version 2.0. We will initially continue with version 1.0, using relatively simple data. In Flanders (Belgium), we also have the option to use the region's subsidized supercomputer center to perform complicated computational tasks."

"We don't want to cause any harm by treating patients for a condition that isn't life-threatening and won't affect their quality of life. In order to make even better decisions, we carry out data analyses"

Dr. Goeman, AZ Delta

A system that continuously learns

Prof. De Jaeger continues: "Ultimately, the outcome is the most important thing for the patient. If we collect data in a structured manner, we can train a separate model and predict the outcome of using treatment A or B. If this is not clear, we can also engage in a dialogue to provide doctors with much more data-driven support. The aim is to make assessments a lot more objective."



Dr. Goeman adds: “We want to gather as much ‘hidden’ data as possible and analyze it in such a way that it would guide us in a particular direction.” Prof. De Jaeger adds: “Retraining the system on a weekly basis will initially require a fair amount of data preparation, but you will eventually have a very powerful system that continuously learns.”

AI transforms the radiologist’s tasks

Moving forward, images will probably not be reviewed manually as often, unless during the testing phase of an algorithm. Dr. De Smet explains: “This goes hand in hand with the transition that is taking place in radiology, with a shift from manual reviews to a new set of tasks. This will involve a certain degree of health technology assessment, in which algorithms are selected and retrieved based on performance [for the specific use case]. The next step is to monitor the quality of the generated data. Based on more in-depth analyses, we will be able to consult with the referring physician about the process the patient will go through.” Health technology assessment, quality management and clinical consultancy will be new core tasks for radiologists—tasks where AI has the potential to free up the necessary time for the radiologist and facilitating further substantive depth. From this renewed focus, the role of the radiologist will only gain in relevance.”

Targeted treatment and multidisciplinary collaboration

AZ Delta is not lacking in ambition when it comes to prostate cancer. Dr. De Smet explains: “If the current rate continues, a great deal will have changed in five years’ time. I hope to perform our first focal treatment within a year.” Prof. De Jaeger initially foresees an acceleration of PROMS studies as a basis for training algorithms.

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De Jaeger, AZ Delta

In addition to ensuring that data processing is optimally structured, the interviewees recommend effective collaboration between data scientists and medical specialists. This will require a consolidation in the industry. Dr. De Smet continues: “I think this is how the future will be in all fields. If you take prostate cancer, for example, the incidence is increasing—the only form of prevention is to not grow old. It is a major problem for men, which is why we have to adopt this new way of working.”

Multidisciplinary collaboration requires open communication and coordination of various areas of expertise. As Dr. Goeman explains: “The fact that urologists and oncologists, for example, look at the same case differently is a sign of the times and part of today’s educational zeitgeist. Thanks to imaging, we now have a better understanding of how a tumor behaves. Urologists often still focus on biomarkers such as PSA value too much, which provides little more than a snapshot. Now we know that we can work together with radiologists and how much we can do with this data.” Prof. De Jaeger concludes: “I think we have a pioneering role to play. The more data there is, the more accurate the results [can be]. It’s good if more people are involved since we are ultimately doing this for the patients.”

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