MEASURING RADIATION FOR DOCTORS AND HOSPITAL STAFF:

REAL-TIME RESULTS INSTEAD OF A FOUR-WEEK WAIT

RaySafe i2 outperforms conventional film badge dosimeters at Erlangen's university hospital

For many years, the neuroradiology department at Uniklinik Erlangen has played a leading role in the development of innovative new imaging processes and treatments that entail a minimum level of invasiveness thanks to their use of cutting-edge technology. Just over one year ago, senior physician Dr. Med. Tobias Struffert started using RaySafe i2, designed by Unfors RaySafe to provide a means of assessing radiation exposure in real-time. Just like conventional film badge dosimeters (FBDs), the new system measures the radiation levels doctors and hospital staff are exposed to. According to Dr. Struffert, the main advantage of the new system in comparison to conventional FBDs is the real-time access dose information. Describing the various impacts of using RaySafe i2, the specialist says: "Today, our team is much more aware of how seriously they need to take radiation, and we have made a number of changes to our behavior during procedures in the interventional lab."

One day a few years ago, Dr. Struffert received the results of his monthly FBD reading, a routine process. There, amid all the usual, unremarkable figures, one particular reading stood out – seven millisieverts. "Our radiation safety officer highlighted this reading with a red question mark, but I had no way of knowing when I was exposed to such a high dose of radiation – it was impossible to identify the date, let alone pinpoint the particular medical procedure responsible for it," the senior physician says. "Even today, I have never been able to explain what caused that spike." The university hospital's neuroradiology de

partment is always busy, with scores of patients coming to the angiography unit every day for scans and treatment. It takes a month for the FBD readings to come back from the lab, and by this time it is impossible to remember specific patients from weeks beforehand – this, however, would have been necessary if Dr. Struffert wanted to act on the high dose of radiation revealed by the FBD and make procedural changes to enhance his personal protection. Faced with this tricky situation, he was quick to agree when Siemens Healthcare, the clinic's partner and well-known manufacturer of X-ray equipment, proposed running scientific tests on a new personal dosimetry system.

KEEPING A WATCHFUL EYE ON RADIATION LEVELS

RaySafe i2 is a product developed by Unfors RaySafe, previously known as Unfors Instruments. This Swedish company is the world's leading supplier of measurement solutions for quality assurance of diagnostic X-ray. Just over a year ago, the company launched its real-time personal dosimeter, a system designed to enhance protective measures for medical staff. This practical device is worn over radiography staff's protective lead aprons instead of underneath them, and it creates a record of the wearer's exposure to radiation. Easy to use and without any need for maintenance or adjustment, these dosimeters show their results in real time on a special display mounted where it can be seen by staff providing treatment in the hospital's therapy room. This monitor displays the dosimeter's readings as a clear, logical bar chart, and different readings are assigned specific colors for ease of correlation with individual members of staff. The system's integrated analytical software also provides users with a log of their readings over time, enabling them to change their working behavior quickly if the need arises. Simultaneously, the radiology department management can access the timestamped data and use it in their evaluations and analyses.

PUTTING THE FIRST LESSONS INTO PRACTICE

The real-time dosimeters went into operation at Uniklinik Erlangen at the end of 2011. "At the beginning, I simply hung the meter around my neck and checked the real time display to see if any readings were in the red," says Dr. Struffert. However, at the start of 2012, he began to track the data in a more systematic way, and it quickly became clear how important it is to position the lead glass barrier correctly. Another thing that is easy to forget, the doctor says, is to modify radiation protection measures while actually treating patients. For example, a typical scan can, he says, start with checking the carotid artery, before the doctor repositions the table in order to create a second scan of the head. "If the lead glass barrier isn't in the perfect position, a lot of scatter radiation can get through, and RaySafe i2 displays this immediately." Now they have been alerted to this, the team in Erlangen have acquired an additional mobile lead glass barrier to improve safety levels.

A second, informative lesson came when Dr. Struffert began to take a closer look at the analysis software. "First, I thought that I'd get a specific radiation reading for each day, but the results are actually

PD Dr. Struffert can see the real-time display from where he stands when working.

a lot more subtle. Each angiograph even leaves its own typical 'fingerprint'." Dr. Struffert gives an example. When generating an image of an aneurysm or angioma, he creates two long series of lateral and anteriorposterior scans. Venous scans are created using a frequency of 1/s, while a higher frequency (4/s) is used to generate arterial scans. Radiation levels vary as a result, and the system's analysis software provides a visual record of any spikes. In addition, because it registers exposure second by second, Dr. Struffert can even see how long a specific scan lasts. "The peaks in the software-generated graphs show me what imaging series I generated using the angiography procedure," he says. Equipped with this information, he then started systematically harvesting data from standard diagnostic examinations with the objective of creating a table of radiation values to which medical staff are routinely exposed when generating specific types of angiograms, under particular conditions, and when following correct procedures. He took part in a congress held by Germany's DGNR neuroradiology society in Cologne in 2012, where he presented his findings to date by means of a poster based on the average figures he had already identified.

"There's no way we can completely avoid exposure, which makes it all the more important that we are aware what situations can result in a particularly high dose of radiation. When we know this, we can improve specific protection measures in the future," is how Dr. Struffert sums up his ambition.

FURTHER PRACTICAL TRIALS AND CHANGING TREATMENT PROCEDURES

It is almost impossible to calculate the average radiation dose generated by interventions or individual X-ray scans, so it is of vital importance that medical staff can precisely analyze their existing work routines and factors that can potentially influence exposure. The Erlangen doctor has a long list of situations he wants to test using RaySafe i2. Modified treatment procedures with new or improved protective measures can, for example, change the degree of radiation exposure. Similarly, medical staff's personal experience plays a role. "So far, I am the only person on our team who regularly uses the real-time dosimeter at work. What I'd like to do in

PD Dr. Struffert explains the tell-tale peaks of an angiogram that the evaluation software reveals.

future is involve junior doctors more and increase their awareness of the issue of radiation exposure," Dr. Struffert states. For him, keeping an eye on the appliance's readings has now become part of his daily routine. In recent months, Dr. Struffert has relied almost completely on the new dosimeter, and he is now planning to combine a conventional FBD with RaySafe i2 in the hope that his findings will results in a fundamental shift in habits. "FBDs never actually show a relevant dose, and even if they did, there isn't much you can learn from that. We're obliged by law to use the system, but it is, to my mind, antiquated. RaySafe i2 represents a useful new development and should ideally replace the FBD." This, he believes, would also make its integration as part of everyday clinical practices easier: medical professionals already have pressing work schedules and are normally unenthusiastic about having to take on something new, but the new dosimeter is just as easy to use as its manufacturers promise. "It is brilliantly easy to work – you don't even need to turn it on. A USB stick is all that's required to transfer the data to a computer for analysis, and the software is very user friendly," Dr. Struffert maintains. In his view, the only process that needs optimization is how the software is integrated in hospitals' angiograph procedures – it would be good if data could be automatically synchronized, he says, because then it would be possible to tell immediately which readings went with which scans.

ABOUT DR. MED. TOBIAS STRUFFERT

Dr. Struffert has been worked in neuroradiology since June 1999, and he specializes mainly in angiography and intervention. After positions in Aachen and Homburg in the state of Saarland, he took up a post as senior physician at the neurology unit of Universitätsklinik Erlangen's cranial treatment facilities. The 41-year-old medic has since then made a name for himself, particularly due to his collaborative research with Prof. Dr. med. Arndt Dörfler, who oversees the unit. This research focuses on imaging processes for intervention-based neuroradiology, and together with Siemens, the two doctors developed a workflow for the wellknown Syngo Neuro PBV IR application. For the first time ever, neuroradiologists can now access up-to-the-minute data about blood flow in the brain tissue during treatment, previously only possible with computer tomography or magnetic resonance imaging. Developing better treatment for stroke patients is of particular importance in this work. Dr. Struffert hopes to improve treatment procedures in angiography and other fields of radiology with his scientific studies into the use of RaySafe i2.

Email: Joerg.Jurtschak@raysafe.com
www.raysafe.com
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