EUROPEAN HOSPITAL @ MEDICA
SPECIAL NEWS ISSUE: MEDICAL | TECHNICAL | PHARMACEUTICAL | INDUSTRIAL
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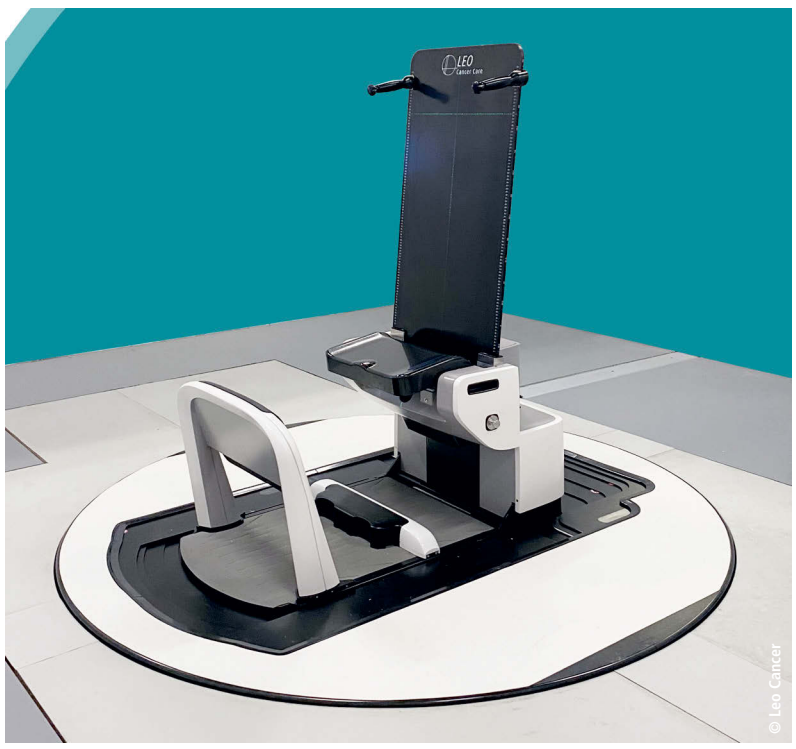
Patient positioning during cancer radiotherapy: Upright is alright



The concept of delivering radiation therapy to cancer patients seated in an upright position is undergoing a major resurgence.

Evidence is already highlighting that patients feel more comfortable seated upright and enjoy better communication with radiotherapists during their care. In addition, there are indications of less internal organ movement, enabling more accurate treatment delivery. Manufacturers also point to upright systems taking up significantly less space by removing the need for a gantry (particularly evident in proton therapy) and being more cost-effective.

Upright technology brings a new dimension to cancer treatment by keeping the radiation beam fixed and slowly rotating the patient through it while seated in an upright position.

Delegates to the recent ESTRO (European Society for Radiotherapy and Oncology) trade event in Glasgow heard the advances – and challenges – in the field, while a satellite consortium meeting organised by upright systems manufacturer Leo Cancer Care also attracted considerable interest with speakers and delegates from across the globe.

While not a new technique, upright radiotherapy is enjoying a revival and becoming a hot topic. Dr Ye Zhang from PSI in Switzerland told the ESTRO session that the 'potential for upright treatment is significant' in terms of reduced cost and clinical benefits.

Meanwhile, Dr Lennart Volz from the Department of Biophysics at the GSI Helmholtz Centre for Heavy Ion Research in Germany noted that several industry vendors are developing cost-efficient upright imaging systems. But he warned: 'While upright radiotherapy has a lot of potential, many challenges remain. The most crucial challenge is that we need more data and evidence to support the different decisions that have to be taken for upright radiotherapy.'

Reduced setup time, greater patient comfort

Among the speakers was radiation therapist Sophie Boisbouvier of the Centre Léon Bérard (CLB) in Lyon, France. This academic institution dedicated to cancer care, research and education, has conducted research with Leo Cancer Care's equipment and recently announced it will install one of the company's patient positioning systems to treat cancer patients.

A CLB study has suggested that patients prefer the upright posture while receiving radiation therapy, that organs move less during the treatment and that setup time is reduced. Boisbouvier said: 'Patients seem more comfortable and more satisfied in the upright position than the supine position.' Leo Cancer Care CEO Stephen Towe said: 'The centre has been instrumental in gathering the research data that has really validated the use of upright therapy clinically.' The ESTRO session also heard Thomas Bortfeld from Massachusetts General Hospital discuss treatment concepts facilitated by upright radiotherapy, while Mark Pankuch from Northwestern Medicine Proton Center in Chicago told how his centre has treated almost 700 patients on an upright system.

510k clearance paves way for mainstream success

Leo Cancer Care presented its upright technology, which has seen installations across several centres on both sides of the Atlantic. The underlying Marie concept – named after Nobel laureate and radiology pioneer Marie Curie – combines a CT scanner with an upright patient positioning system. Its positioning system recently gained 510k regulatory approval in the United States for clinical use, with a similar process under way in Europe.

UW Health in Madison-Wisconsin and McLaren Health in Michigan have begun installing the system while in Europe, CLB is being followed by the National Center for Oncological Hadrontherapy (CNAO) in Pavia, Italy, which will use the upright approach to deliver proton and carbon ion radiation therapy.

Medical physicist Thomas 'Rock' Mackie is co-founder and Board Chair of Leo Cancer Care, and particularly thrilled with the 510k approval. 'I think upright is going to become mainstream,' he said.

Implementation in the NHS

In the UK, the charity Macmillan Cancer Support has announced a strategic investment of an undisclosed amount in the company and hopes that the funding will also pave the way for the upright care option to become available through the NHS.

Experts acknowledge there are still challenges with upright radiotherapy solutions, there are advantages and potential benefits, but there is optimism and enthusiasm within the sector that such technology is destined to have a key role in cancer care in the not-too-distant future. ■

An overview

DON'T MISS: Trends and innovations at the HEALTH IT FORUM

How can innovations help to master the great challenges and demands with which healthcare is confronted across international borders? This central question will be given solid answers again at the MEDICA Health IT Forum, an established part of the programme at the trade fair.

Sessions and talks will centre on issues like Artificial Intelligence (AI), Robotics and Virtual Care. The very first session deals with no less than two important topics on the programme stage of the forum, in Hall 13 on Monday, November 11, starting at 11.00 a.m.: "Sustainable AI" not only considers technological, but also ecological, social and ethical aspects. AI systems should be powerful as well as responsible and friendly to the environment. There is still much work to do: Speaker Prof. Peter Boor, University Hospital RWTH Aachen, only recently emphasised the issue in a publication about deep learning within pathology. The widespread use of deep learning in pathology could thus on the one hand cause a negative contribution to the warming climate. Using digital pathology as an example, however, together with other authors he proves that with a few measures quality can be maintained while at the same time greatly reducing carbon emissions.

In this context, generative AI has for some time now been the focus of public interest. On Tuesday, November 12, starting at 1.00 p.m., this topic will be the discussed on stage. Dr. Julia Hoxha, head of the work group Health at the German AI Association, will moderate the discussion. She is also the co-founder and managing director of Zana. This start-up uses human speech as biomarker for example for COPD.

This is how it works: AI models analyse and recognise voice patterns in order to predict a possible decline of health, especially for shortness of breath and the risk of exacerbation, by recognising an acute deterioration beyond daily fluctuations. This solution also supports clinical decisions and objective assessment of the course of illness – and is a very innovative method. In this field, what is the view on the "AI Act" with which the EU member states have adopted the first law to regulate AI in the world? "This law has far-reaching consequences for everyone involved, including hospitals and other users. If things go badly, the costs for these applications will increase." This could however be mitigated by good planning and intelligent design, so Hoxha. For example, manufacturers should take care not to let their AI system fall into an unnecessarily high category of risk. Providers of AI solutions also expect that the "AI Act" will allow exceptions and mitigations for small companies and for science. Hoxha regards AI-based development of precision therapeutics by generating novel molecular structures and predicting their properties as an important area of application for AI within healthcare.

Artificial Intelligence for new active agents

The company Merantix Momentum is among those using AI to optimise active agents in the area of large molecules. In this context, it is helpful that AlphaFold by Google DeepMind makes it possible to predict the three-dimensional structure of proteins. Dr. Bertram Weiss, Pharma Lead at Merantix Momentum, will also take part in the AI panel on stage during the MEDICA Health IT Forum – just like Dr. Augusta Modestino, Head of Strategy at AICura medical. The company uses its proprietary platform to support biopharmaceutical companies in evaluating data and imaging using AI, in order to predict the reaction of patients to active agents, identify ideal candidates for clinical studies, recognise at-risk patients and accelerate the development of medicines. Dr. Nilofar Badra-Azar will explain the use of data in this context from a political point of view. She is a consultant at the German Federal Ministry of Health in the Division Key Policy Issues Concerning Novel Technologies and Data Use. During the discussion, Badra-Azar will be able to point to the Act governing the use of health related data and to the Act on regulation and strengthening of medical registries.

Smart phones for therapy

Digital solutions are already being used as therapy themselves. These companions during recovery, "Health Companions 2.0" are the focus of Tech Talk on Monday, November 11, starting at 2 p.m. For example, the company Frisk supports other companies developing innovative strategies and solutions. On the programme stage, Dr. Cinthia Briseño, founder and managing director at Frisk, will meet Rouwen Hirth. He is the business development manager for the app solution "Constanze Care". In this app, an integrated female AI assistant and a team of female experts work together to provide the best answers to questions by pregnant users. The app provides information regarding which prenatal examinations are recommended during pregnancy, how women can prepare for the time post-partum and what helps babies with a tummy ache. The AI draws its knowledge from current scientific results, new medical guidelines and expert experience.

Concerning medicines, Redcare Pharmacy's "Shop Apotheke" is among the most well-known online pharmacies in Germany. The company sees itself as the leading online pharmacy in Europe. Currently, it is active in seven countries: Germany, Austria, France, Belgium, Italy, the Netherlands and Switzerland. With the "eHealth-CardLink" solution, Redcare Pharmacy offers an option to hand in electronic prescriptions.

With the help of their electronic health insurance card and a smart phone, customers can pass electronic prescriptions to the Shop-Apotheke app. Alexander Braden, as Director Medication Management at Redcare Pharmacy, will be available for questions from an audience of professionals at the Tech Talk.

Robots can help in many ways

One feature of the digitalisation of healthcare is the use of robots. "Smart Robotics" is therefore the forum topic for the Tech Talk on Tuesday, November 12, starting at 12.00 noon. Dr. Manuel Ferla, TU Munich, School of Engineering and Design, is convinced that robot-assisted surgery provides doctors with valuable tools, which lessen the stress during surgery and which could lead to improved outcomes for patients. However, the volume of use regarding this new technology is still regarded as limited, due to the lack of integration into existing clinical procedures. Novel methods and technologies aim to improve system integration in order to realise an improved perspective for applications.

Lukas Bernhard, Scientific Head at the TUM University Hospital Klinikum rechts der Isar in Munich, has been part of the research group MITI and has worked on a robot that takes over various tasks during surgery in the unsterilised area. The robot fetches sterile materials – for example sutures or surgical gloves – from storage, delivers them to the operation theatre, opens the packaging and passes the sterile goods to the operating surgeon. In a current publication, Bernhard reports that such systems have the potential to become invaluable tools for overcoming a lack of trained staff and to rationalise work processes within healthcare. However, the challenges which result from the strict requirements inherent in a clinical environment, are large.

A special exhibition provides impulses for digital clinical networking

Clinical hospitals are currently facing thorough changes – brought about not least by the increasing concentration of medical treatments at specialised sites, the result of the hospital reform in Germany. In this context, digital networking and telemedicine will play an important part. How exactly this can happen is on view at the special exhibition "Hospital of the Future" in an activity area in Hall 13 (booth C04). Here, decision makers from clinics will receive input and consultations regarding the following topics:

- Digital infrastructure in a hospital: finding trustworthy solutions for telecooperation,
- Intelligent summaries of and processed patient data in stead of manual documentation: efficient use of medical resources,
- Data driven telemedicine and artificial intelligence in intensive care medicine: Care for patients in a personalised and predictive manner,
- Far away yet with a close view of the patient: carrying out data-based teleconsultations.

"Hospital of the Future" is organised by the German telemedical society "Deutsche Gesellschaft für Telemedizin e.V." in cooperation with Messe Düsseldorf. Expert support on planning and implementation is provided by the German centre for telematics and telemedicine Zentrum für Telematik und Telemedizin GmbH (ZTG) and the Clinic for Surgical Intensive Medicine and Intermediate Care at the University Hospital RWTH Aachen. Visiting professionals at MEDICA 2024 and especially the delegates of the 47th German Hospital Conference, which for the first time will be held right in the middle of the trade fair in the neighbouring Hall 12, will have the opportunity to participate in exclusive guided tours through the special exhibition. They will be provided with an insightful option among many to gather information on the digitalisation of healthcare within this year's MEDICA. ■

» Hall 13 / A33

Improving radiology workflows

AI weeds out unremarkable chest X-rays

A commercial artificial intelligence (AI) tool used off-label was effective at excluding pathology and had equal or lower rates of critical misses on chest X-ray than radiologists, according to a new study.

The findings were published in Radiology, a journal of the Radiological Society of North America (RSNA).*

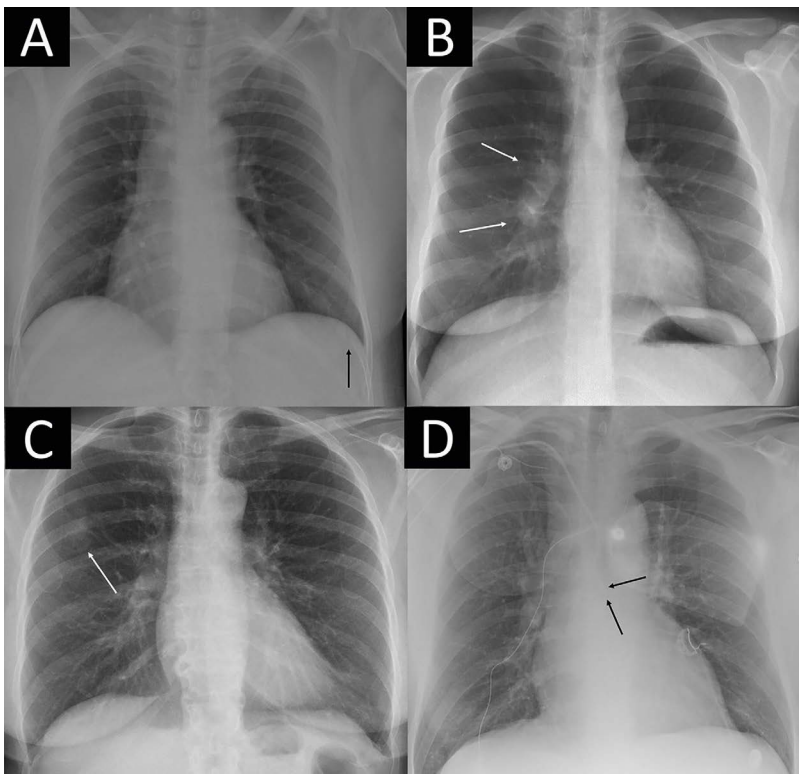
Recent developments in AI have sparked a growing interest in computer-assisted diagnosis, partly motivated by the increasing workload faced by radiology departments, the global shortage of radiologists and the potential for burnout in the field. Radiology practices have a high volume of unremarkable (no clinically significant findings) chest X-rays, and AI could possibly improve workflow by providing an automatic report.

Researchers in Denmark set out to estimate the proportion of unremarkable chest X-rays where AI could correctly exclude pathology without increasing diagnostic errors. The study included radiology reports and data from 1,961 patients (median age, 72 years; 993 female), with one chest X-ray per patient, obtained from four Danish hospitals.

"Our group and others have previously shown that AI tools are capable of excluding pathology in chest X-rays with high confidence and thereby provide an autonomous normal report without a human in-the-loop," said lead author Louis Lind Plesner, MD, from the Department of Radiology at Herlev and Gentofte Hospital in Copenhagen, Denmark. "Such AI algorithms miss very few abnormal chest radiographs. However, before our current study, we didn't know what the appropriate threshold was for these models."

The research team wanted to know whether the quality of mistakes made by AI and radiologists was different and if AI mistakes, on average, are objectively worse than human mistakes.

The AI tool was adapted to generate a chest X-ray "remarkableness" probability, which was used to calculate specificity (a measure of a medical test's ability to correctly identify people who do not have a disease) at different AI sensitivities.



Four examples of remarkable chest X-rays with missed critical findings. The artificial intelligence (AI) tool was postprocessed by the AI vendor by scaling each of the 85 remarkable individual predictions to a normalized value and using the case-level highest of the scaled scores as the overall probability score from 0 to 1 for "remarkableness" (ie, the probability for abnormal or remarkable findings by the AI). (A) Chest X-ray in a 49-year-old female patient shows a slightly visible acute rib fracture (arrow) that was missed by the AI at all thresholds and also missed by the radiology report. (B) Chest X-ray in a 30-year-old female patient shows enlarged hilar lymph nodes (arrows) missed by the radiology report but not the AI at any threshold. (C) Chest X-ray in a 67-year-old female patient shows a tumor mimicking pleural plaque (arrow) that was reported in the radiology report (where the patient was referred for CT) and missed by the AI at the 98.0% threshold but not the 99.0% and 99.9% thresholds. (D) Chest X-ray in a 64-year-old male patient shows a central venous catheter possibly entering the azygos vein (arrows), which was classified as unremarkable in the radiology report. The AI missed the critical finding at the 98.0% threshold but not the 99.0% and 99.9% thresholds.
© RSNA; adapted from: Plesner LL et al., Radiology 2024

Two chest radiologists, who were blinded to the AI output, labeled the chest X-rays as "remarkable" or "unremarkable" based on predefined unremarkable findings. Chest X-rays with missed findings by AI and/or the radiology report were graded by one chest radiologist–blinded to whether the mistake was made by AI or radiologist – as critical, clinically significant or clinically insignificant.

The reference standard labeled 1,231 of 1,961 chest X-rays (62.8 %) as remarkable and 730 of 1,961 (37.2 %) as unremarkable. The AI tool correctly excluded pathology in 24.5 % to 52.7 % of unremarkable chest X-rays at greater than or equal to 98 % sensitivity, with lower rates of critical misses than found in the radiology reports associated with the images.

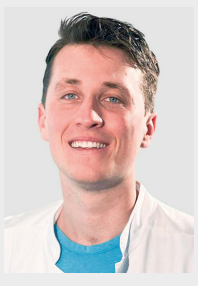
Dr. Plesner notes that the mistakes made by AI were, on average, more clinically severe for the patient than mistakes made by radiologists. "This is likely because radiologists interpret findings based on the clinical scenario, which AI does not," he said. "Therefore, when AI is intended to provide an automated normal report, it has to be more sensitive than the radiologist to avoid decreasing standard of care during implementation. This finding is also generally interesting in this era of AI capabilities covering multiple high-stakes environments not only limited to health care."

AI could autonomously report more than half of all normal chest X-rays, according to Dr. Plesner. "In our hospital-based study population, this meant that more than 20 % of all chest X-rays could have been potentially autonomously reported using this methodology, while keeping a lower rate of clinically relevant errors than the current standard," he said.

Dr. Plesner noted that a prospective implementation of the model using one of the thresholds suggested in the study is needed before widespread deployment can be recommended.

* *Plesner LL et al.: Using AI to Identify Unremarkable Chest Radiographs for Automatic Reporting; Radiology 2024; DOI: 10.1148/radiol.240272*

Source: Radiological Society of North America



Louis Lind Plesner

Louis Lind Plesner, MD, is a Medical Doctor, PhD Student at Herlev and Gentofte Hospital. His research interests include Radiology, Medical Imaging, Magnetic Resonance Imaging, Ultrasound, and Computed Tomography.

An overview

DON'T MISS:
Hot issues, current trends and innovations at the LABMED FORUM

Skills shortages and digitalization, trends in cardiology and oncology, future prospects in laboratory medicine, and healthy aging – these pressing topics are at the forefront of discussions at this year's MEDICA Labmed Forum.

What are the most exciting developments in medicine at the moment? The specialist forums at MEDICA in Düsseldorf, the leading international trade fair for the healthcare and medical technology industry, will once again provide in-depth insights into this topic with their stage program during this year's trade fair (11 – 14 November), for example on health IT, medical technology trends, healthcare policy or laboratory medicine. The MEDICA LABMED FORUM has become one of the main attractions of the MEDICA supporting program in recent years with its informative short presentations and expert panel discussions.

Under the buzzword "Laboratory 4.0", a trend towards massive digitalization and networking as well as big data applications and artificial intelligence (AI) is currently emerging in laboratory diagnostics, says the Scientific Director of the MEDICA LABMED FORUM, Prof. Stefan Holdenrieder from the German Heart Center Munich, with a view to this year's focus. „So far, we have mainly looked at individual laboratory values. In the future, we will analyze increasingly complex data patterns with machine learning and combine them into complex diagnostic scores. Laboratory medicine is currently evolving from pure analytics towards data science. Interdisciplinary collaboration between laboratory experts and specialized data scientists, especially computer scientists and biostatisticians, is becoming increasingly important."

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Day 1: Skills shortage and digitalization

The MEDICA LABMED FORUM, chaired by Prof. Dr. med. Thomas Streichert, University Hospital Cologne, will address the highly topical issues of digitalization and AI on the opening day (11 November) of MEDICA 2024. The morning session will focus on the shortage of skilled workers, which, according to current surveys, is the most pressing problem in laboratory medicine. Dr. Ronald Biemann from Leipzig University Hospital, head of the Young Laboratory Section of the German Society for Clinical Chemistry and Laboratory Medicine (DGKL), will report on the sometimes dramatic shortage of young professionals in the medical and medical-technical field. In the panel discussion, the speakers will look for ways out of the crisis with the help of automation and digitalization.

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In the afternoon, the focus will be on AI and big data tools that are already available and those still in development. Image recognition using deep learning is already state of the art in the automated evaluation of differential blood images, while machine learning from large multivariate data sets, such as those generated every day in laboratory diagnostics, is still in the development stage. The exciting question of how large language models can help to make abstract laboratory findings more comprehensible and whether AI really makes us smarter (or possibly dumber) will also be discussed.

Day 2: Trends in cardiology and oncology

Traditionally, on the second day of the fair, Prof. Stefan Holdenrieder will discuss current developments in laboratory medicine for the two disease complexes that determine mortality in the western world: Cardiovascular diseases and cancer. In cardiology, the focus this year is on congenital heart defects. They can increasingly be corrected surgically in childhood and are also playing an ever greater role in adult medicine due to improved life expectancy. The speakers from the German Heart Center and the Technical University of Munich will shed light on the topic from a clinical perspective, and mathematician Prof. Frank Klawonn from the Helmholtz Zentrum Braunschweig will demonstrate the possibilities of modern data analysis using machine learning as a guest scientist at the Heart Center.

The afternoon program is dedicated to highly sensitive blood-based cancer diagnostics. With this examination technique, known as "liquid biopsy", laboratory medicine is opening up completely new ways in oncology to monitor tumor progression more closely than is possible with conventional tissue biopsies. This makes it possible to recognize at an earlier stage when a treated cancer will flare up again, making a change in therapy necessary. New methodological approaches such as the analysis of methylation profiles for the early detection of hereditary forms of cancer or single cell analysis using microfluidics are being discussed.

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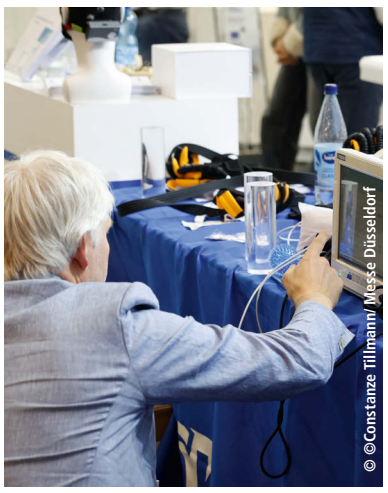
Day 3: Future perspectives of laboratory medicine

On the "Young Scientists Day" of the MEDICA LABMED FORUM, young scientists will present their views on the future of laboratory medicine. As an introduction, the session leader, PD Dr. med. Verena Haselmann from the University Hospital Mannheim, will give an overview of the latest advances in the field and the obstacles that need to be overcome. New opportunities include, e.g., wearables for the continuous recording of diagnostic parameters, while obstacles include new quality requirements and the shortage of specialists. In the afternoon, the discussion will revolve around personalized therapies based on individual laboratory value patterns, the interdisciplinary interaction of laboratory and imaging in integrated diagnostics and the use of AI.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Day 4: Healthy ageing

The final day of the forum is traditionally dedicated to diagnostic research institutes and companies that want to open the door to new areas of application for laboratory medicine. The two sessions will be led by members of the Association of German Diagnostic Manufacturers VDGH, Dr. Kai Prager and Dr. Peter Quick. They have chosen research into ageing from the perspective of pathophysiology, diagnostics and therapy as the topic for 2024. Discussions will include the latest findings on the genetic and epigenetic life clock, protein misfolding and aggregation as the basis of neurodegenerative diseases such as Alzheimer's and Parkinson's and the role of the intestinal microbiota in stroke.

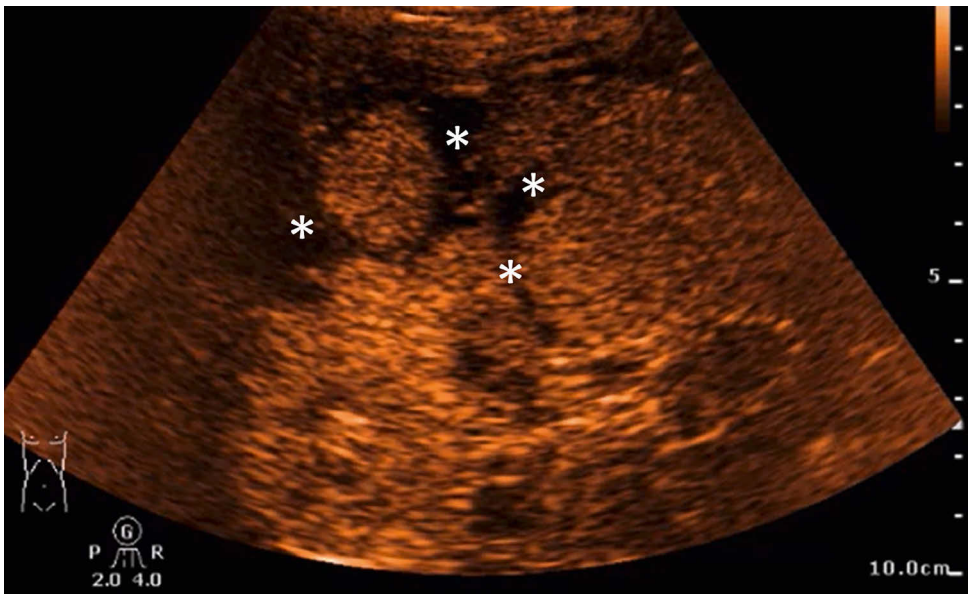
For the "finale" in the afternoon, interesting theories and practical experiences will be discussed on how the ageing process can be slowed down. Prof. Dr. Emrah Düzel, University of Magedeburg, will present various anti-ageing drugs, Prof. Dr. Wolfram Ruf from the University of Mainz will explain the influence of anti-inflammatory agents, Prof. Dres. Monique Breteler from the German Center for Neurodegenerative Diseases (DZNE) will talk about the influence of the environment on the ageing of the central nervous system, and Prof. Dr. Claire Jacob, also from the University of Mainz, will discuss ways of repairing lesions in the nervous system. ■

» Hall 1 / G37

Point-of-care ultrasound in trauma

Returning e-FAST ‘to its roots’

Stagnation, under-use, unfulfilled potential: At the EUSEM congress in Barcelona, leading emergency physician Dr Joseph Osterwalder describes how e-FAST (Extended Focused Assessment with Sonography for Trauma) – a key point-of-care ultrasound (POCUS) technique for trauma – has changed over the last two decades, and not necessarily for the better.



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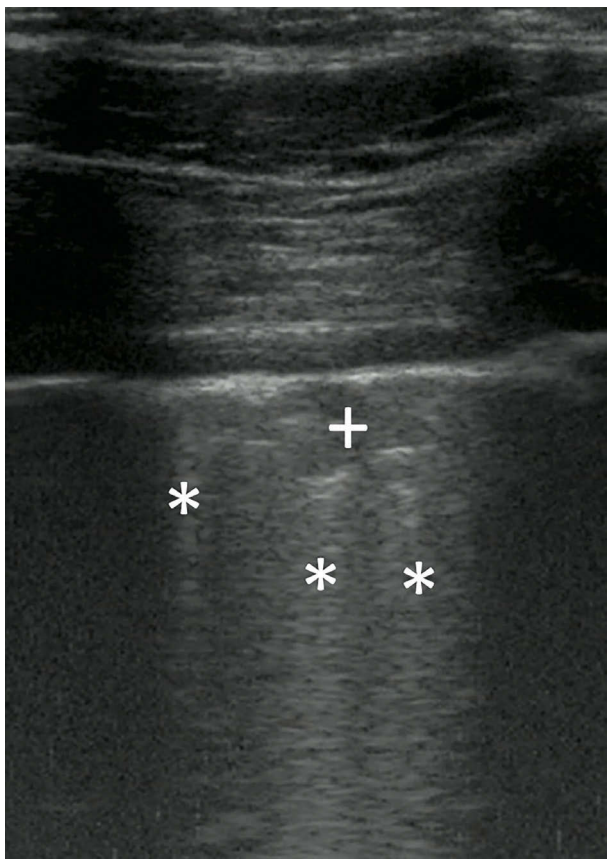

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Despite ultrasound having made great progress in terms of technology, price and indications, e-FAST – a standardized protocol-based POCUS that looks for bleeding in the chest and abdomen and pneumothorax – has seen a marked, the expert added. Originally intended for the primary survey in the ATLS (advanced trauma life support) system, it is now being used for wider applications and lesser conditions.

At the European Emergency Medicines Congress (EUSEM), Osterwalder outlined how he believes that e-FAST should ‘return to its roots’ to redefine its place in imaging. ‘The traditional use was intended for unstable or non-stabilizable patients to detect large haemorrhages in the peritoneal, pleural and pericardial cavities as well as a large pneumothorax within a maximum of 1 to 2 minutes using ultrasound,’ said Osterwalder, who, until 2017, was Head of the Emergency Department at Kantonsspital St Gallen, Switzerland.

Use cases in the shock room

In stable patients, he said e-FAST should be used to detect small bleedings in the peritoneal cavity by means of four additional sonographic views; include the examination for retroperitoneal bleeding/hematoma; injuries to the spleen, liver and kidney; and free intraperitoneal air in the patient with repeat examination as necessary in the shock room. It was also intended to apply the long-established ultrasound indications during the emergency ‘ABCDE’ protocols in e-FAST patients: to look for airway obstruction, false intubation, pulmonary contusion, intracranial hypertension, retro-orbital hematoma, and fractures, and assist in monitoring and volume management.

Osterwalder continued: ‘Because musculoskeletal injuries are the most common injuries in moderate and severe trauma patients, MSK ultrasound should also be used as part of the secondary survey, especially as its diagnostic accuracy is often equal to MRI.’

Exaggerated expectations

Since the 1990s, e-FAST has been extended to stable patients and those with mild to moderate trauma, the expert said. However, he believes that this has led to exaggerated expectations, with users not fully aware of the limitations of the technique, and even resulted in studies questioning the usefulness of e-FAST.

Osterwalder points to the clear benefits for clinicians from e-FAST: more certainty for decision-making on further procedures such as an indication for CT, operating theatre, interventional radiology, and hospital admission for monitoring. ‘It also enables faster processes,’ he added. ‘There are no waiting times for CT examinations. It saves resources for teams that care for and monitor the patient, makes the attending physician more independent and also increases the degree of satisfaction.’

Benefits for patients include reduced risks from CT examinations such as radiation exposure, allergic reactions, and renal insufficiency from the contrast medium. The technique also avoids the need for emergency intubation in children and restless patients before a CT scan can be performed.

‘There is no evidence to date that this reduces mortality and morbidity, nor that CT leads to better results,’ explained Osterwalder, who remains convinced that redefining e-FAST has opportunities to advance the field. ‘It can improve the diagnosis and treatment of moderate and minor injuries in places with limited resources, especially CT scanners, and lead to faster assessment and care of patients in highly specialized institutions.’ He also feels there is an opportunity for industry to work more closely with clinicians.

Wide range of applications

Osterwalder, who has significant experience operating as a field medic, further pointed out the potential of e-FAST in disaster, expedition, and military medicine. The technique is already being used in all emergency situations, not only in EDs but also pre-hospital, in the offices of general practitioners, hospital wards, ICUs, ships, expeditions, and theatres of war, he said. Application ranges from trauma, unclear shock, women of childbearing age to abdominal pain during and after resuscitation.

However, he said: ‘e-FAST has not developed any further for over 20 years, even though ultrasound has made huge progress in this time regarding technical innovations such as Microflow, better and high-resolution probes, CEUS; falling prices, handheld devices and countless new, scientifically well-founded indications.’ He hopes that the profile of e-FAST can be raised and redefined to ensure it is used for optimal medical and clinical benefit. ■

Report: Mark Nicholls

Joseph Osterwalder

Emergency physician **Dr Joseph Osterwalder** was Head of the Emergency Department at Kantonsspital St Gallen in Switzerland (1988–2017) and Associate Professor for Emergency Medicine at the University of Geneva. He is a Fellow of the Swiss Society of Rescue and Emergency Medicine, the European Society of Emergency Medicine, the Swiss and German Society of Ultrasound in Medicine and is a pioneer of emergency medicine and emergency ultrasound in Switzerland.

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Between good practice and financial pitfalls

Delivering molecular pathology at lower costs


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Molecular pathology should become centralised in fewer labs to improve efficiencies and affordability, according to leading European experts.

Ed Schuuring, Senior Clinical Scientist in Molecular Pathology and Professor of Molecular Oncology in the Department of Pathology at the University Medical Center, Groningen, suggested this would deliver a concentration of knowledge and lead to a more cost-effective solution in the way molecular pathology labs operate. In a session at the 35th European Congress of Pathology in Dublin, which also looked at pathology in favour of developing countries, delegates also heard the experiences and challenges of molecular pathology in African countries.

In his presentation, Schuuring outlined how molecular pathological methods are classified into five categories, based on size-tested genome and the associated costs of each. Explaining that costs are calculated on factors such as the ongoing costs of the assay, purchasing equipment, personnel, validation and lab and IT infrastructure, he noted that there are significant variations in drugs and tests across Europe.

The expert also compared the availability of biomarker test types for cancer patients in eastern and western European and Asian countries, and then globally. He further discussed the cost-effectiveness of parallel versus sequential testing of genetic aberrations for Stage IV non-small cell lung cancer (NSCLC) in the Netherlands; and cost-effectiveness analysis of cell-free DNA-based molecular tumour profiling platforms for the detection of EGFR mutations in NSCLC. In conclusion he said: 'The availability of targeted drugs varies enormously between countries worldwide, and consequently there is a large variation in predictive testing methodologies.'

How to lower the costs of NGS testing

Observing that predictive testing is moving to next generation sequencing (NGS)-based testing as the new standard of molecular profiling testing, he made suggestions for lowering costs when using NGS assays. For those countries that require comprehensive molecular testing, his tips included:

- use one large NGS panel for all indications;
- ensure a daily large volume of cases to efficiently fill each run;
- ensure yearly large volumes of cases to efficiently use the same equipment, personnel, and infrastructure;
- ensure yearly large volumes of testing that will lower the price of equipment and assays significantly; and
- use competition among companies as hope for a future decrease in overall sequencing costs.

With the field of predictive prognostics and diagnostics rapidly growing for many indications in the coming years, his take home message was to move to centralisation of pathology. He suggested that this would lead to only very few labs which not only have efficient knowledge and concentration of knowledge, but are also able to stay cost effective.

The Tunisian perspective

Professor Karima Mrad, Head of the pathology department at Salah Azaïz Institute in Tunis, Tunisia, outlined the position with molecular pathology in her country. In her presentation, she looked at the funding opportunities and issues for middle income countries, and shared the experiences from neighbouring African countries.

She said: 'Molecular pathology in middle income countries is a big challenge; it is a challenge to get not only the devices but also the reagents, and to get assurance quality tests.' With limited access for new cancer therapies, she said there were issues around availability of reagents, lack of space for machines and concerns among doctors about access to molecular pathology tests. However, she said there were good quality staff, though some were taking up posts in Europe.

Mrad, who is President of the Tunisian Society of Pathology and Cytology, compared the molecular pathology service in Tunisia with neighbouring countries.

While Tunisia has access to six real-time PCR units, an NGS platform coming soon, two FISH (Fluorescence in situ hybridization) stations and good quality IHC, Algeria has one NGS platform, five PCR platforms and FISH; Morocco has two NGS platforms, five PCR and three FISH stations. Furthermore, other countries in West Africa see even greater lack of availability for molecular pathology and immunohistochemistry (IHC).

She said: 'Developments of molecular pathology programmes should take into account the local incidence and mortality of diseases. To improve molecular pathology, sustainable collaboration in activities and funding is highly needed. We hope by this we can improve molecular pathology in Tunisia so we may be part of larger international collaborations and research efforts.' ■

Report: Mark Nicholls


Karima Mrad

Karima Mrad is Head of the pathology department at Salah Azaïz Institute in Tunis, Tunisia, and President of the Tunisian Society of Pathology and Cytology. She is associate editor on the board of French journal "Annales de pathologie". Her research interests include gynaecopathology, particularly ovarian and uterine tumours.


Ed Schuuring

Ed Schuuring is senior clinical scientist in molecular pathology and Professor in Molecular Oncological Pathology at the University Medical Center Groningen, Groningen, the Netherlands. His research includes identification of prognostic/predictive epigenetic and molecular markers for clinical outcome, response to immune-chemo-radiotherapy, and gene-targeted therapy and treatment-resistance in cancers. He is a senior member of the Dutch Society of Pathology and has co-authored various international guidelines on Molecular Pathology.

DON'T MISS!

MEDICA INNOVATION FORUM - Highlights

MONDAY

11:10
Wearables and Health Tech – Predicting, developing devices, and exploring new technologies

12:45
Driving cybersecurity in the Internet of Medical Things

13:30
Bridging healthcare and technology – Taiwan's vision for the future of smart health

TUESDAY

11:05
Transforming healthcare – The disruptive power of ambience intelligence and AI agent networks

12:25
Healthcare in the era of Generative AI

15:00
13th MEDICA Startup Competition: Welcome and introduction

WEDNESDAY

11:05
3D-Bioprinting technology enabling biofabrication of biomimetic and biosynthetic tissue precursors

11:45
Optimizing custom medical device production with 3D printing & online solutions

12:45
Cancer treatment using ultrasound technology

THURSDAY

11:35
Rescaling NMR drug discovery – A holistic approach to the lab of the future

12:10
Worldwide access to high quality bio-sampling and diagnostics for all people

12:40
Net zero health impact – Towards sustainable hospitals

Hall 13 / E63

Challenges and opportunities

Molecular pathology in Europe: in search of standardization


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Tackling standardization of molecular pathology at a European level remains a major challenge, according to speakers at the 35th European Congress of Pathology in Dublin. One leading expert warned it would be 'very difficult' to achieve, though the session also heard about potential solutions such as educational steps to consistently train future pathologists at a high and consistent level.

Session co-chair Olli Carpén, Professor of Pathology at the University of Helsinki, said that as new assays emerged for prognostication and prediction of drug distribution to appropriate patient groups, standardization of pathology was of paramount importance.

In his presentation, Giorgio Stanta, Professor of Pathology at the University of Trieste, said: 'Everything is changing continuously and we have to follow these changes, but standardization of molecular pathology is not an easy task. We have an urgent need for standardization of the molecular analysis, reproducibility, and exchangeability among European institutions to obtain safety and efficacy of treatment for the patient.

'The necessity of molecular pathology standardization in Europe is related to a more precise diagnosis, prognosis, and prediction of the most suitable therapy and basis of choices of treatment.'

Stanta, an expert in molecular pathology and diagnosis for oncology, outlined the work conducted so far, and challenges still to be overcome. He highlighted how the European Society of Pathology (ESP) Molecular Pathology Working Group is working with the Organisation of European Cancer Institutes (EEIC) towards standardization in heterogeneity, pre-analytical conditions, and clinical evaluation of NGS (next generation sequencing) in breast and colorectal cancer. 'All these projects are very important for clarity,' said Stanta.

Ensuring reproducible results through standardization

A central issue is irreproducibility of clinical research, Stanta pointed out. At the root of this, he also pointed out, lie problems of experimental design and interpretation, the complexity of biological and medical information, the pre-analytical condition, highly sophisticated methodologies, intratumour heterogeneity, and institutions using similar, but different biomarkers.

Solutions, however, include design and analysis support, medical tumour boards, CEN (European Committee for Standardization) technical specification and ISO standards, internal and external control, and new sampling techniques such as liquid biopsy. Stanta underlined the need for an expert steering committee, suggesting that those driving the European Masters on Molecular Pathology would be best placed for this task.

'We have huge difficulties in standardization because of continuous development of diagnostic molecular pathology, so the standardization must be plastic with continuous corrections,' the expert summarized.

IVDR: No time to waste

Kurt Zatloukal from the Institute of Pathology at the Medical University of Graz discussed reference materials for standardization, guiding delegates through the IVDR (in vitro diagnostic medical devices regulation) and its associated challenges, particularly with calibration of devices and control materials.

Even though the window for implementation has been extended until May 2026 due to the challenges of the Covid-19 pandemic, he warned that time was of the essence as the process could take several years: 'The new regulation gives very specific requirements for a diagnostic assay, not only if it is manufactured by a company and CE marked but also when we do it in our own laboratory.'

IHC biomarkers and LDT – still alive and kicking

Frédérique Penault-Llorca, professor of pathology at the University of Clermont-Ferrand, focused on standardization of the theranostic immunohistochemistry (IHC) through the preanalytical, analytical, and postanalytical phase. She stressed that IHC biomarkers will be around for a while, despite suggestions of their declining importance. Regarding the quality of the tissue and the results, she underlined the need for education and training as well as providing guidelines for scoring, reporting, and monitoring internal quality.

She also examined implementation of new biomarkers safely into clinical practice, emphasizing the need for a sufficient number of cases; testing, training, and monitoring; and standardized reports that are clear for clinicians in line with current guidelines. 'Heterogeneity still exists, despite major progress in the last 20 years,' she said, adding that standardization of the pre-analytical phase is the cornerstone of the subsequent analysis. The use of lab-developed tests (LDTs) will remain important in Europe because of economic issues and equipment constraints, despite IVDR regulation. She also pointed to the value of education and the Molecular Pathology Masters course, outlined in detail by Marius Ilié as the final presentation of the session.

During his lecture on standardization through training, Ilié, Professor of Pathology at the Nice Medical School and co-chair of the congress session, outlined the benefits of the course:

- delivering objective evaluation of knowledge and competences of the new professionals in the field;
- facilitating movement of young molecular pathologists within the EU;
- improved harmonization and standardization of clinical and molecular pathology; and
- providing support for the continuously increasing use of diagnostic, prognostic and predictive biomarkers directly related to treatment choices.

Ilié said of 87 applications, 23 students from 18 countries were admitted on the two-year course. With an array of modules, candidates will be certified molecular pathologists on the course, which will reinforce a standardized approach to molecular pathology. ■

Author: Mark Nicholls

Marius Ilié is Professor of Pathology at the Nice Medical School, University Côte d'Azur and Surgical Pathologist at the Clinical and Experimental Pathology Laboratory/ Biobank Côte d'Azur, Nice University Hospital. He is Co-Chair of the ESP Working Group on Molecular Pathology, with special interests in thoracic pathology, melanoma, molecular pathology and biobanking.


Frédérique Penault-Llorca

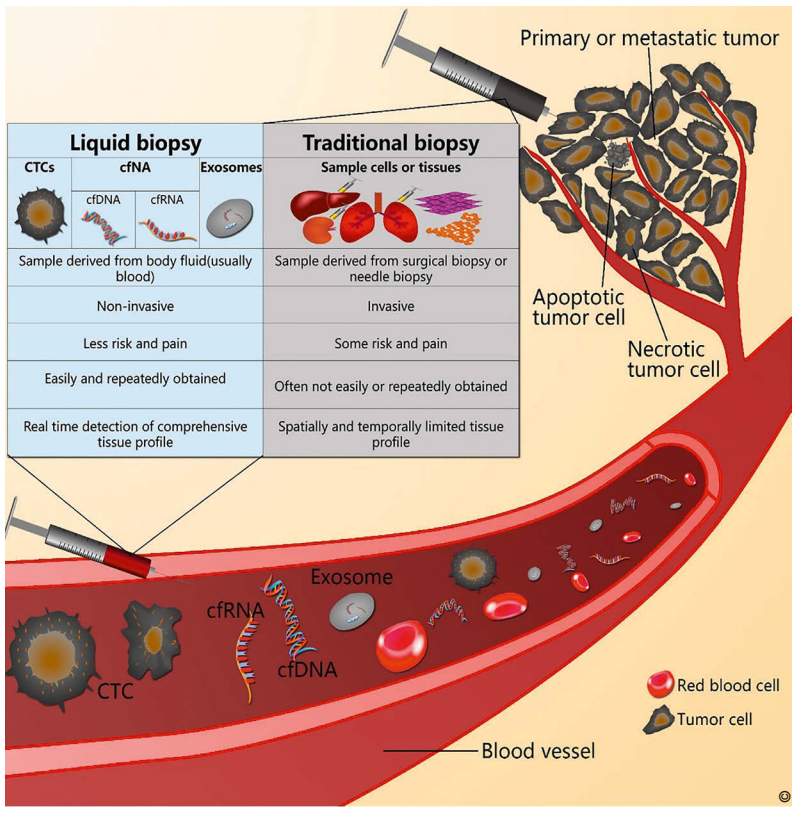
Frédérique Penault-Llorca is professor of Pathology at the University of Clermont-Ferrand and CEO of the Comprehensive Regional Cancer Institute Centre Jean PERRIN, Clermont-Ferrand. A member of the European Society for Medical Oncology (ESMO) and the French Society of Pathology, her main area of interest is female cancers, quality assurance and molecular pathology.

Giorgio Stanta is Professor of Pathology at the University of Trieste and the first to develop reproducible technologies for RNA extraction from clinical tissues. He is chairman of the OECI Biobanking and Molecular Pathobiology Working Group and vice-chairman of the ESP Molecular Pathology Working Group.

Kurt Zatloukal is Professor of Pathology and head of the Diagnostics and Research Center for Molecular Biomedicine at the Medical University Graz in Austria. His research focuses on the molecular pathology of metabolic liver diseases and cancer as well as molecular diagnostics and machine learning approaches for digital pathology.

Pros and cons of diagnostic techniques

Liquid biopsy vs. tissue biopsy: Getting the best of both worlds



Tissue biopsy and liquid biopsy can increasingly be used as complementary or alternative approaches, with advantages and limitations to each. While speakers at the recent 35th European Congress of Pathology in Dublin were quick to highlight that liquid biopsy was not about to replace tissue biopsy, the focus looked at the benefits and challenges of each through the lens of four expert speakers.

For his presentation, Professor Paul Hofman focused on the advantages and limitations of liquid biopsy versus tissue biopsy in thoracic oncology. In looking at how both biopsy techniques can be complementary, the Professor of Pathology and Head of the Laboratory of Clinical and Experimental Pathology at the Pasteur Hospital and Director of the IHU RespirERA, Nice, examined the landscape in thoracic oncology therapeutic decision making. Hofman further explored emerging biomarkers and molecular testing in thoracic oncology, provided insights on when and how to use tissue biopsy and liquid biopsy, and outlined recent developments of cf-DNA testing.

With more and more targeted genome alterations in thoracic cancer, looking for disease is a growing challenge, Hofman said. He emphasised the need to use NGS (next-generation sequencing) to address this. 'We also need to consider what is not targeted; there is at least 40% of patients in Western countries without any genomic alteration with an associated drug, which is much too high.' He underlined the importance of following ESMO (European Society for Medical Oncology) recommendations and guidelines but also noted that with some differences in US guidelines, there was a pressing need for global harmonization.

Emerging biomarkers call for complimentary approach

The benefits of using both liquid and tissue biopsy become evident in the context of emerging biomarkers, Hofman pointed out. Some of these markers are not detectable on liquid biopsy and may only be detected on tissue biopsy. 'This is particularly true for an increased number of proteins, including some targets of antibody drug conjugates, which can be detectable and quantified only on tissue biopsy.'

With future and current biomarkers for non-small cell lung cancers (NSCLC), he advocated seeing tissue and liquid biopsies as complementary. 'For our patients, we need to be sure about the right sample, so this is why now we need to think about the integration of liquid biopsy. Because sometimes it is a complementary approach but not an alternative approach if tissue biopsy is not available.' While he pointed out that in the US, liquid biopsy was a first line approach, he suggested Europe was not yet at that stage.

Mix and match to suit clinical needs

When dealing with lung cancer and the use of small tissue specimens, he felt blood specimens should be integrated into the process. 'By tissue biopsy, we can see some mechanisms of resistance that we cannot see in liquid biopsy. For example, we know that expressions of some proteins are only on the tissue.

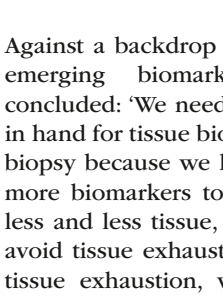
'In tissue biopsy, gene amplification and detection of large gene deletion is probably higher than in liquid biopsy, but there are advantages of doing liquid biopsy, such as we do not need hospitalisation.'

He further pointed to technical, logistical, and biological issues and limitations that come with both approaches. Liquid biopsy is non-invasive, repeatable, can be done as an outpatient, and is cost effective but with no histological evaluation and cancer diagnosis. Turnaround time for tissue biopsy is always longer, creates the need for hospitalisation and is invasive, but offers histological evaluation, standardisation of workflow and sensitivity for fusions/amplification. 'The best strategy is to match tissue and liquid biopsy at the same time,' said Hofman.

Use cases and challenges in lung cancer

For advanced lung cancer, doing tissue and liquid biopsy provides an opportunity to increase detection of actual genomic alterations and create global molecular portraits of the tumours. This can increase the number of target possibilities, though he pointed out concordance was around 70%. 'If we have negative results on tissue, then we have to look at the liquid biopsy results and vice versa,' he added.

Additional challenges for integration of liquid biopsy in thoracic oncology include screening and the detection of minimal residual disease and when post-surgery to take the blood sample, but there is still a gap in introducing that into daily practice, the expert reported.



Paul Hofman

Paul Hofman is a Professor of Pathology and Head of the Laboratory of Clinical and Experimental Pathology at Pasteur Hospital, and Director of the IHU RespiraERA, Nice, France. His research focuses on lung cancer, including molecular pathology, biomarkers, and diagnostics. He is also investigating next-generation sequencing approaches to link personalised medicine and molecular biology.

Tissue exhaustion becomes a growing challenge

To avoid tissue exhaustion, he said NGS should be performed in-house as sending samples outside the lab will not be sustainable in the near future.

Against a backdrop of current and emerging biomarkers, Hofman concluded: 'We need to work hand in hand for tissue biopsy and liquid biopsy because we have more and more biomarkers to look for with less and less tissue, so we need to avoid tissue exhaustion. If there is tissue exhaustion, we can switch rapidly to liquid biopsy.' However, he warned that as the next generation of pathology emerges, there is a need to be aware of false negative results in liquid biopsy. ■

Author: Mark Nicholls

Assistive mobility system to reduce strain on care staff

An easier way to transport hospital beds

The most important resource of a company – including hospitals – is its staff. This is reason enough to think about optimising working conditions. The two companies Linak and Tente have done just that and are presenting an innovative solution for patient transport at the hospital bedside at the Medica tradefair in Düsseldorf.

The joint project, called WeAssist, is designed to take the ergonomics of transport with a hospital bed to a new level. This assistive mobility system "understands" what the user wants to do. In this way, helping the user with every manoeuvre, for example, when negotiating a ramp. The intuitive and

self-explanatory design approach makes it possible to operate the system without any training, the companies state.

The new solution also aims to reduce the immense cost pressure on hospitals. The option of retrofitting existing beds reduces acquisition costs. While this is even easier if a Tente and Linak system is already installed in the beds, the companies point out that the upgrade can be retrofitted inexpensively in just a few minutes. New bed projects do not require large resources either, as the use of WeAssist can be realised with little effort and at a favourable price.

The assistive system is designed to offer the support that a second person would also provide when pushing the bed. This means that the bed transport can be carried out by just one person. This person is noticeably relieved, while the second person has time to take care of other important tasks. The system also significantly improves the ergonomics of bed transport, the companies report, as the strain on the spine, muscles and joints is reduced. Moving the bed is intuitive and requires less effort, with the effect being comparable to using an e-bike instead of a regular bicicle.

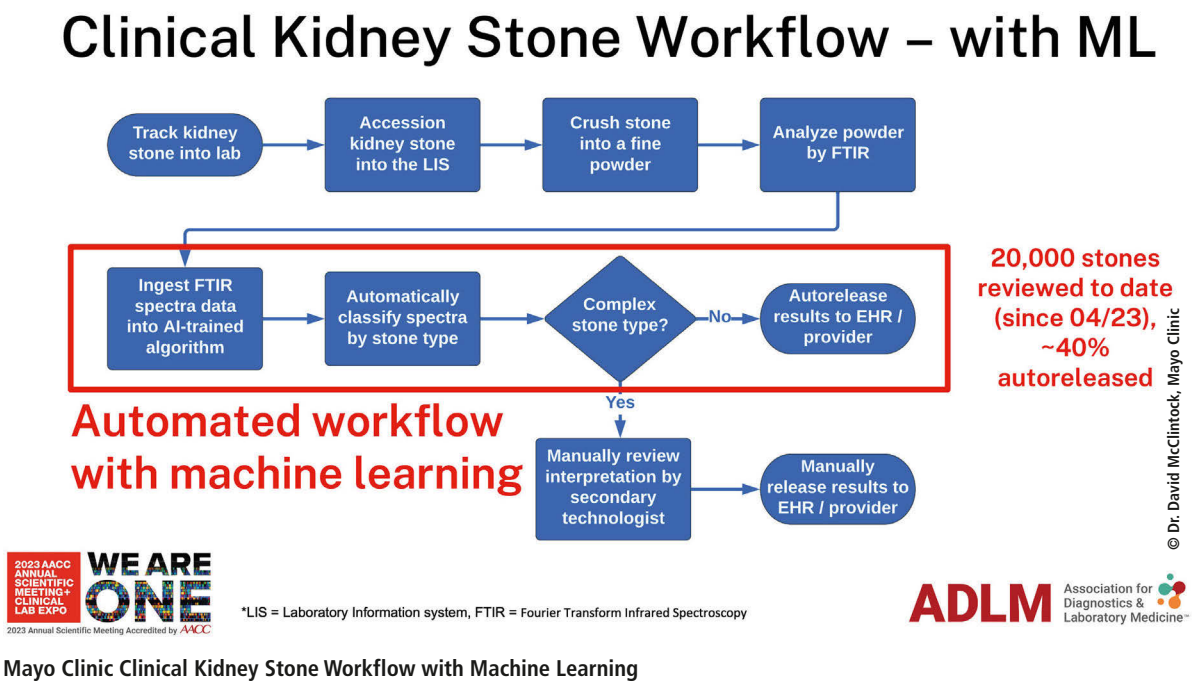
The companies point out that thanks to its health-promoting effects, the WeAssist system counteracts the increase in absenteeism in healthcare professionals, as the back no longer has to be bent excessively when transporting beds. This leads to reduced strain on joints, muscles and the spine, so medical care staff feel the relief immediately and benefit from significantly improved working conditions and less effort.

Visitors to Medica will have the opportunity to experience the WeAssist system live on a bed and drive it themselves.

Hall 12 / B53

Improving quality and efficiency

Preparing for AI in clinical laboratories



Mayo Clinic Clinical Kidney Stone Workflow with Machine Learning

Some year in this decade, AI tools will become ubiquitous within clinical laboratories. AI has the potential to increase the accuracy of laboratory testing and improve the quality and efficiency of operations and service of testing labs.

Clinical laboratorians must prepare to help lead this initiative, for their knowledge will be the key to successful implementation. They need to learn how AI algorithms are developed and validated, how to justify and analyze impact from the perspective of clinical laboratory medicine, and how to implement them to best benefit the patient and the hospital. Several scientific sessions at the Association for Diagnostics and Laboratory Medicine (formerly the AACC) Annual Scientific Meeting focused on this topic.

AI is in its naissance in medical lab development, and this was very apparent in the technical exhibition of the ADLM/AACC meeting. David McClintock, MD, Chair of the Division of Computational Pathology and AI in the Department of Laboratory Medicine and Pathology of Mayo Clinic, pointed out that only 30 out of the 941 exhibitors at the meeting included the terms ‚artificial intelligence' (AI) and/or „machine learning" (ML) in their product/company descriptions on the AACC exhibitor website. Ten companies included „analytics" in their description, but only four were separate analytics-based companies selling clinical lab AI/ML software. ‚This is an emerging space, just as radiology PACS was 30 years ago,' McClintock said. ‚Now is the time to learn about it or perhaps even start to developing models that can benefit your lab.'

Uses of AI/ML in the lab

There are numerous ways that both simple and complex AI tools can aid a clinical laboratory. These include:

- Automated spectroscopic data analysis and disease detection; multivariate analysis of disease conditions; test interpretation;
- Digital image analysis for microbiology, haematopathology, immunology, and forensics;
- Data entry automation for specific tasks and processes;
- Creating standardised reports for lab test results and automated entry into Laboratory Information System (LIS);
- Minimising laboratory testing for inappropriate test orders, predicting test results from other available data on patient chart, and reducing redundancy and duplication of lab tests, based on prior type and date of tests already performed;
- Data analytics for laboratory operations planning, such as predicting volume workflow, employee staffing requirements, etc.;
- Identifying and alerting for abnormal test results;
- Auto-verification of test results for quality control.

Automating spectral analysis for kidney stones and fecal analysis

Mayo Clinic spent six years developing an AI model to automate the spectral analysis of stones passed by patients. It is based on the classification of 708 unique kidney stone types. In the first 90 days of implementation, commencing April 2023, 20,000 stones have been reviewed, 40% of which were newly able to be bulk auto-released to patients' medical records.

Before the model was implemented, the conventional workflow began with cleaning and drying the stone, after which it was ground into a fine powder and manually analyzed with FTIR spectroscopy. A technician manually entered the results into a LIS, followed by a second technician reviewing the interpretation. Only then are results uploaded to a patient's electronic medical record (EHR).

AI tool to automate multiple processes

After evaluating how AI could improve workflow, reduce costs, and increase efficiency, the Kidney Stone lab at Mayo Clinic Rochester, in conjunction with an innovative AI team from Mayo Clinic Florida, created an AI tool to automate multiple processes following FTIR spectra analysis. The AI model was trained on 70,000 kidney stone spectra and validated with 16,491 kidney stone spectra. Quality assurance required 81,517 kidney stone spectra.

‚This is a lot of data, which took a lot of work, and a lot of computing time,' commented McClintock. ‚But now the process is automated and is achieving our expectations. If a stone is not complex, the AI system classifies it and then the information is automatically entered into the LIS and subsequently released to the patient's EHR. When it identifies a stone as complex, the results produced are manually flagged for review by a technician. The lab is now saving a lot of time, which equates to tangible cost savings and opportunities for laboratory staff work reduction/redirection.'

Other applications of AI in the clinical labs also exist, such as commercially developed AI tools in clinical microbiology to detect fecal ova and parasites (O&P). For most labs, up to 95% of O&P cases can be negative, and thus the process of reading slides can be monotonous. The investigational AI-assisted screening tool (Techcyte, Orem, UT) uses a convolutional neural network to identify and count parasite cysts and trophozoites, yeast, and red and white blood cells and groups them by class. Techcyte claims the tool is five times more sensitive than manual examination, with a sensitivity of 98.9%. It produces findings within 30 seconds instead of the average five minutes, automatically uploading negative findings to a LIS. Positive samples are flagged for technologist review and assessment. At Mayo Clinic, this test has just been implemented, with initial impressions positive by laboratory staff who can now comfortably remotely review slides.

What clinical lab managers need to think about

‚Don't get enamoured with AI for your lab,' McClintock cautioned. ‚Always remember a clinical lab's primary objective: to deliver the right information to the right person at the right place and right time in the right way. No system today can integrate all potential outputs of AI tools,' he emphasized. ‚LIS, EHR, and middleware solutions take considerable effort to integrate with any AI tool without encumbering the pathologist, laboratorian, or clinician. For starters, you need to think about data governance, data pipelines, regulatory guidelines, ethical review, custom programming and coding, computational computing power, either locally or in the cloud, cybersecurity, and risk management.

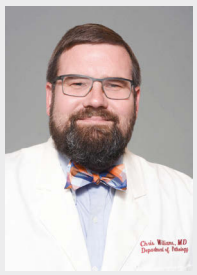
'Don't forget the cost and availability of AI maintenance, support and quality control, which all require new IT support skills. There are also AI specific tools, such as algorithm drift. And then, in the end, will the AI tool save you enough money or at some point be reimbursable so that it can pay for itself?'

Experts recommend that lab managers need to focus on generating clinical evidence for AI benefits and understand the barriers and challenges to implementation when they select a tool. New training on AI is essential. In general, experts recommend implementing the new tool while still keeping the existing system functioning, to give practitioners time to learn and get comfortable with AI while maintaining the status quo as back-up.

McClintock also described a new framework for clinical AI life cycle implementation, from idea generation to final validation, go-live, and system maintenance. By adopting a similar AI lifecycle, he encouraged attendees to embrace the potential of AI in their labs.

Co-presenter Christopher Lee Williams, MD, Assistant Professor of Pathology at the University of Oklahoma Health Sciences Center, concurs. ‚Will AI be replacing staff in labs?' he asked rhetorically. ‚Probably not. The practice of laboratory medicine has been constantly evolving, often due to increasing automation. I think that AI will be another tool in our tool bag, to aid in efficiency and quality control. With a steady increase in an aging population in the United States, we are going to need all the help we can get.' ■

Report: Cynthia E. Keen



Christopher Lee Williams

Christopher Lee Williams, MD, is the Director of Informatics in the Department of Pathology at the University of Oklahoma Health Sciences Center in Oklahoma City, where he also serves as an Assistant Professor. Dr Williams' current research interests include how to operationalise AI tools for analysis and reporting in the laboratory setting, and in optimizing UI/UX design for laboratory workflows.

David McClintock

David McClintock, MD, is the Chair of the Division of Computational Pathology and Artificial Intelligence within the Department of Laboratory Medicine and Pathology at Mayo Clinic in Rochester, Minnesota, USA. His primary clinical interests include clinical informatics, laboratory workflow optimisation, digital pathology implementation, analytics, and clinical ML/AI model deployment. His research interests include understanding the role and effects of digital pathology within the clinical laboratories and the use of AI and ML for improved diagnostics, more efficient workflows, and better patient outcomes.

Advertisement

Latest developments in contrast media utilisation

Striking the balance between diagnostic efficacy and patient safety remains critical when utilising iodinated contrast media to deliver the best imaging outcomes. Currently, 300 million CT exams are conducted across the world every year, with 40% contrast-enhanced exam. While playing a crucial role in diagnosis and treatment of disease, CT expert Efthimios Agadakos believes the medical profession has a duty to do its utmost to minimize patient risk from contrast media.

A session at ECR 2024 in Vienna heard about latest developments, trends and breakthroughs in contrast media utilisation in CT, MRI and ultrasound imaging, and explored the question of how dosage may be further lowered using modern protocols. Focussing on CT imaging, Agadakos offered insights into approaches he feels can contribute to enhanced patient safety and better-informed clinical decisions.

As Chief Radiographer at Laiko General Hospital in Athens, he highlighted the role of imaging in modern clinical practice, offering invaluable diagnostic information across a wide spectrum of medical specialities. 'It can improve visualisation of anatomy and pathology, enhance lesion detection and vasculature, identify ischemic conditions, enhance surgical planning and guidance as well as monitoring treatment response,' he said. 'But it is imperative to acknowledge the associated risk of iodine in contrast media.'

Why a lower dose matters

Risks from radiation levels and adverse reactions mean that optimal iodine delivery is pivotal in yielding precise and reliable diagnosis, while maintaining patient safety and healthcare efficiency. Agadakos said that lower iodine dose can reduce risk of allergic reactions and contrast-induced nephropathy, decrease vascular complications, enhance patient comfort and experience, minimise radiation exposure, and optimise resource utilisation. Protocols can also be adapted for children, the elderly and for patients that need repeat CT scans.

The expert went into detail on a range of options that can be applied to help reduce iodine dose when using CT. These include tube voltage selection (automated or manual), iterative reconstruction algorithms, cinematic rendering, Dual Energy CT, AI applications, Photon-counting CT, personalized protocols and smart injection systems. 'Iterative reconstruction algorithms enable the use of lower tube currents or voltages, driving lower iodine doses without diagnosing compromising diagnostic accuracy,' he told delegates.

One study using a low KV and low iodine dose with abdominopelvic CT achieved a 40% iodine dose reduction and 50% radiation dose reduction. 'Meanwhile, dual-energy CT allows for better iodine contrast enhancement at lower doses, thus reducing the total iodine load on the patients,' added Agadakos.

Perfect timing

Artificial Intelligence applications assist in reducing need for IVCM (intravenous contrast media) by analysing patient data such as weight, age, renal function and medical history to tailor personalized contrast doses for optimal imaging, and minimise the contrast-induced risks.

Machine learning algorithms can predict the required iodine dose and flow weight, select low KV or dual-energy CT scanning based on individual patient characteristics. When using personalized protocols, he said bolus triggering is a "must" with contrast-enhanced CT as it facilitates 'perfect timing for contrast enhancement, produces accurate imaging and reduces the need for higher iodine concentrations.' Meanwhile, photon counting CTA facilitates lower iodine dose by enhancing the detection of contrast media, particularly in small vessels, he added.

Finally, advanced contrast injectors equipped with intelligent technologies offer precise management of contrast administration. Agadakos said the aim is to strike a balance between diagnostic efficacy, image quality and patient safety and comfort. 'By embracing the latest advancements in CT technology and adopting tailored strategies for iodine dose reduction, we can push the boundaries of diagnostic excellence while prioritizing patient safety,' he continued.

'But we must continue to collaborate, innovate, and elevate the standard of patient-centred care in medical imaging, ensuring that every patient receives the highest quality of care and a positive and reassuring experience in the CT department.'

The session also heard from Peter Murphy, Unit Manager, MRI, PET CT & DXA, Alliance Diagnostic Medical Imaging Ireland and Cork University Hospital about current issues with Gadolinium-Based agents with MRI, and Barbara Kraus from Wolkersdorf, Austria, speaking on indications and protocols for ultrasound contrast agent administration. ■

Efthimios Agadakos

Efthimios Agadakos chief radiographer of the Medical Imaging Department at Laiko General Hospital, Athens, Regional Director Europe ISRRT (International Society of Radiographers and Radiological Technologists) and President of the Panhellenic Society of Radiological Technologists Greece. His areas of interest are in CT, radiation protection and patient safety. Awarded a MSc in Health Services Management from the National School of Public Health in Athens, he is currently completing his PhD thesis in Medicine at the University of Athens on low radiation dose protocols in CT.

New PET technique reveals pancreas tumors

A new PET scan reliably detects benign tumors in the pancreas, according to research led by Radboud university medical center.

The study in adults was published in the Journal of Nuclear Medicine. Earlier results from pediatric patients were also published in this journal.

Current scans often fail to detect these insulinomas, even though they cause symptoms due to low blood sugar levels. Once the tumor is found, surgery is possible.

The pancreas contains cells that produce insulin, beta cells. Insulin helps the body absorb sugar from the blood and store it in places like muscle cells. This regulates blood sugar levels. In rare cases, the beta cells malfunction, resulting in a benign tumor called an insulinoma. This almost never spreads, but it still causes problems due to excessive insulin production, leading to low blood sugar. 'People with this condition have little energy due to low blood sugar and often faint', explains Marti Boss, first author of the study. 'It's a very challenging disease. It often takes a long time before patients get a diagnosis. We can perform blood tests, but they can't confirm if a tumor is the cause or where it's located. Various scans like CT, MRI, and PET are available, but don't always show the insulinomas.'

Removing the tumor surgically resolves the problem, but first, the tumor's location must be known. Martin Gotthardt, professor of Nuclear Medicine at Radboudumc, explains: 'In the past, surgeons would start cutting away portions of the pancreas until they found the tumor. If it was at the end, the entire pancreas would be gone. You can live without a pancreas, but you'd struggle with severe diabetes and would constantly have to manage your blood sugar. So, a better scan was urgently needed.'

Gotthardt and his team developed a completely new scan, the so-called Exendin-PET scan, which allows for the precise localization of insulinomas. They previously published results from a study in children, where the insulinoma is congenital. Now, they present findings from a study in adults, where the insulinoma developed gradually.

In the study, 69 adult patients with suspected insulinoma participated. The Exendin-PET scan detected tumors in 95% of the patients, compared to 65% with the current PET scan. When combined with CT and MRI, the current PET scan usually detected the tumor, but in 13% of cases, the insulinoma was only visible on the new scan. Boss adds: 'We believe the new scan can replace all other scans. All the insulinomas we found with the new scan were removed, and all those patients were completely cured after surgery, even though some had been sick for decades.'

The new scan is based on a substance found in the saliva of the Gila monster, a type of lizard native to desert areas in the United States. Gotthardt explains: 'We knew this substance specifically binds to a molecule on these tumors, the GLP1 receptor. The substance from the saliva wasn't very stable in the human body, so we created a more chemically stable version, called Exendin. We then attached a radioactive substance to it, so it could be visible on a PET scan. Now, this mildly radioactive Exendin appears to perfectly detect insulinomas.'

The next step is to introduce the Exendin-PET scan into clinics as the standard scan for people suspected of having an insulinoma. Researchers will now assess how the scan improves patients' quality of life and how much money can be saved if other scans, like CT and MRI, are no longer needed. In addition, Gotthardt's team is investigating the potential use of Exendin for the treatment of insulinomas in a new research project called LightCure. ■

Source: Radboudumc

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Healing wounds faster with the power of AI

Swift Medical, a pioneer in digital wound care, has unveiled the new Skin & Wound 2 platform.

As the gold standard for the digital wound care segment which it helped to create, Swift's award-winning platform has been used for over 50 million patient assessments in home health, ambulatory, acute, and skilled nursing settings. With over 22 peer-reviewed publications, the company has stayed true to its commitment to clinically validate its groundbreaking innovations and has proven outcomes in accuracy, equitable AI and improved healing rates.

"Skin & Wound 2 demonstrates our continued commitment to empowering clinicians with the most advanced tools available, enabling the delivery of superior wound care outcomes," said the company's CEO, Dwayne Sansone. "For nearly a decade, Swift Medical has been committed to delivering an inclusive, unbiased approach to digital wound care. We see it as our moral responsibility to harness the power of generative AI to revolutionize patient diagnostics, ensuring highly accurate results for every skin tone. Our mission is to heal our world faster by leveraging AI to ensure that every patient, regardless of their background, receives the most precise and equitable care possible."

Skin & Wound 2 is built with the advancements of the healthcare landscape in mind and to take further advantage of Swift's patented AI technologies. The new platform incorporates the latest FHIR standard, along with the best-in-class imaging and documentation in the market, which is tightly integrated with premier EMR platforms like Homecare Homebase. It features a seamless modern user interface allowing for expedited evaluations and sub-millimeter accuracy.

"Homecare Homebase has been the leader in integrating the most advanced and reliable patient-focused technologies. Our deeply collaborative partnership with Swift provides our customers with the best digital wound care solution in the market to help patients heal faster," said Scott Pattillo, Chief Strategy Officer.

In 2024, Swift surpassed 600,000 wound care evaluations in a month by over 21,000 clinicians of all types. Swift's dedication to enterprise scalability without compromising quality has been the driving force for the advent of Skin & Wound 2. The new platform will enable rapid deployment of new features, including several additional ground-breaking capabilities planned in the next year. ■

Source: Swift Medica, Inc.

Soldering wounds with light and nano thermometers

Not every wound can be closed with needle and thread. Empa researchers have developed a soldering process with nanoparticles that gently fuses tissue.

The soldering technique is expected to prevent wound healing disorders and life-threatening complications from leaking sutures. The team recently published the promising method in the journal Small Methods and applied for a patent.

The idea of suturing a wound with a needle and thread dates back more than 5,000 years. Since then, this surgical principle has not changed much: Depending on the skill level of the person performing the operation and the equipment, cuts or tears in the tissue can be joined together more or less perfectly. Once both sides of a wound are neatly fixed to each other, the body can begin to close the tissue gap permanently in a natural way. However, the suture does not always achieve what it is supposed to: In very soft tissues, the thread can cut through the tissue and cause additional injury. And if the wound closure does not seal on internal organs, permeable sutures can pose a life-threatening problem. Researchers at Empa and ETH Zurich have now found a way to solder wounds using lasers.

Soldering usually involves joining materials together by means of heat via a melting bonding agent. This thermal reaction must remain within narrow limits for biological materials, at the same time, the temperature is difficult to measure in a non-invasive way. This has been a problem for the application of soldering processes in medicine. The team led by Oscar Cipolato and Inge Herrmann from the Particles Biology Interactions laboratory at Empa in St. Gallen and the Nanoparticle Systems Engineering Laboratory at ETH Zurich therefore tinkered with a smart wound closure system in which laser soldering can be controlled gently and efficiently. For this purpose, they developed a bonding agent with metallic and ceramic nanoparticles and used nanothermometry to control the temperature.

The elegance of the new soldering process is also based on the interaction of the two types of nanoparticles in the bonding protein-gelatin paste. While the paste is irradiated by laser, titanium nitride nanoparticles convert the light into heat. The specially synthesized bismuth vanadate particles in the paste, on the other hand, act as tiny fluorescent nano thermometers: They emit light of a specific wavelength in a temperature-dependent manner, allowing extremely precise temperature regulation in real time. This makes the method particularly suitable for use in minimally invasive surgery, as it does not require stirring and determines temperature differences with extremely fine spatial resolution in superficial and deep wounds.

Once the team had optimized the conditions for „iSoldering" (intelligent soldering) via mathematical modeling in silico, the researchers were able to investigate the performance of the composite material. Together with surgeons from the University Hospital Zurich, the Cleveland Clinic (USA) and the Czech Charles University, the team achieved fast, stable and biocompatible bonding of wounds on organs such as the pancreas or liver in laboratory tests with various tissue samples. Equally successful and gentle was the sealing of particularly challenging pieces of tissue, such as the urethra, fallopian tube or intestine, using iSoldering. A patent application has now been filed for the nanoparticle composite material.

But the researchers didn't stop there: They succeeded in replacing the laser light source with gentler infrared (IR) light. This brings the soldering technology another step closer to be used in hospitals: „If medically approved IR lamps were applied, the innovative soldering technology could be used in conventional operating rooms without additional laser protection measures," says Inge Herrmann. ■

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Soldering wounds with a nanoparticle paste and light: Oscar Cipolato and Inge Herrmann in Empa's Particles-Biology Interactions laboratory in St. Gallen.

Source: Empa

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Technology applications in diagnostic imaging

How digital twins will support the radiologist of the future

Digital twin technology can transform clinical practice by aiding patient-specific prediction and supporting personalized treatment models. Expert speakers at an ECR2024 session in Vienna focussed on how radiology will play a leading role in the advance through data acquisition via a range of imaging modalities.

The session was chaired by radiologist Professor Valeria Panebianco from the Sapienza University of Rome, who also outlined her department's work with digital twin technology.

To set the stage, she provided a rough definition of what a digital twin can be:

- an evolving digital profile that helps optimise digital performance;
- a dynamic digital representation; or
- a virtual representation of a physical object or system across its lifecycle.

The key concepts are that the two systems – physical and digital – should exist side by side on a real time basis.

Panebianco said; 'As simulation models, digital twins will transform clinical practice as they will provide patient-specific prediction for the prevention, screening and disease diagnosis as well as personalization and assessment of response to therapy.'

Bridging the human-digital divide

The expert delivered insights on the future development of digital twins in radiology through clinical, computational, digital and virtual pathways, noting that it is 'where the real clinical world meets digital'. However, the complexity and prognostic heterogeneity of diseases make it necessary to apply computational tools and precision medicine.

'The data for digital twins' development can be derived from many different medical specialities,' she continued. 'However, radiology stands out for multiple factors as radiologists make diagnoses and assess therapy response, which are the main predictive clinical questions to which digital twins have to reply.'

Radiology produces large amounts of data from different modalities such as CT, MRI and ultrasound, providing a rich foundation for quantitative and functional information. To achieve the goal of making viable predictions, the data fed to the digital twins must be accurate as well, Panebianco said.

She pointed to current examples of digital twin applications, such as in cardiology to inform on clinical decisions, in orthopaedics to maintain musculoskeletal health of soldiers, and in multiple sclerosis for simulation models for treatment outcomes.

Outlining the work to develop digital twin technology at the University of Sapienza, she said her focus is on validating wearables, liquid biopsy and imaging biomarkers in prospective studies to construct the digital twin.

She concluded: 'Radiology is able to provide a bridge between the human being and the digital twin by shortening the gap and enhancing the development of this innovative digital solution.'

Efficiency, personalization, research

Meanwhile, Huan Xuan Nguyen, Professor of digital communication in engineering at Middlesex University in London and Director of the London Digital Twin Research Centre, went into more detail on what he called the "three pillars" of digital twins in healthcare:

- models developed for healthcare facilities and organizations, designed to improve efficiency of hospital or departments;
- digital twins of the human body for personalized diagnosis, treatment planning, treatments and interventions; and
- models geared towards disease research, medicine and device development.

However, he cautioned that implementation of digital twins in healthcare come with high deployment and maintenance costs, with significant investment needed in technology platforms to achieve viable results.

Nguyen also outlined technical challenges, with notable issues around data collection and integration, computational resources, model accuracy and validation, as well as privacy and security concerns. The effort needed to overcome these challenges might still be worth it, he added: 'The benefit in healthcare and radiology is that you can have greater predictive accuracy with a digital twin, treatment plan optimisation and can test scenarios without interfering with real patients.

'It can also be used for research and training and to familiarise patients with equipment. Finally, personal care and treatment is one of the most important potential benefits of the digital twin.'

Need for a regulatory framework

Dr Ilena Rapisarda, a private law researcher from the Department of Law at the University of Catania in Sicily, explored ethical and legal issues of digital twin technology.

While the technology's development might still be in its infancy, the field is rapidly evolving, she said: 'Clinicians will be able to simulate aspects of treatments on patient digital twins and determine which option is likely to be the most effective.

'Digital twin technology offers great opportunities to revolutionize healthcare systems, and ethical issues should not prevent development of such technologies but should integrate with it.'

However, the expert warned that conflicts of interest must be regulated by adopting an ethical approach, with the new technologies governed by the law. She said it was necessary to adopt an appropriate regulatory framework, especially regarding the allocation of responsibilities between the different actors involved in the production and use of digital twins. The framework should also introduce ethical principles of autonomy, responsibility and transparency in codes of conduct and training courses for engineers, computer scientists and developers, with particular reference to ethics in the design of technologies. ■

Author: Mark Nicholls

Huan Xuan Nguyen

Huan Xuan Nguyen Professor of digital communication in engineering at Middlesex University in London and Director of London Digital Twin Research Centre, with research interests include that include digital twin modelling, digital transformation and machine learning.

Valeria Panebianco

Valeria Panebianco Full Professor of Radiology at the Sapienza University of Rome with a specialist interest in diagnostic imaging focused on GU, screening programmes and precision medicine. She is scientific co-ordinator of a range of projects on digital medicine applications in healthcare.

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