HealthManagement.org
The Journal
LEADERSHIP • CROSS-COLLABORATION • WINNING PRACTICES
VOLUME 20 • ISSUE 2 • 2020 • € 22
ISSN = 1377-7629

GE HEALTHCARE
SPECIAL SUPPLEMENT

Cover Story:

The Future is Digital

Heart Failure – Noninvasive Hemodynamic Monitoring on the Rise

Heart Failure (HF) is a major and public health problem as it affects at least 26 million people worldwide and will dramatically increase with an ageing population. Currently 5.7 million people suffer from HF in the US with an expected 46% increase in prevalence by 2030.[1] This is an alarming number especially when accounting for increasing health care cost. In the US around $31 billion, (10% of the total healthcare expenditure for cardiovascular diseases) is related to HF treatment and therapy and is expected to increase 127% by 2030.[1]

The risk factors for Heart Failure are multifactorial and complex[1] and therefore a significant prognosis is essential for an efficient treatment or medication.
Hypertension is reported to be the most prevalent HF risk in the developed world and the ESC guidelines recommend monitoring of continuous blood pressure and heart rate as standard for this patient group.[2,3] Further, decreased cardiac output has been documented as a central problem in HF patients, followed by an increased preload and lower systolic blood pressure.[4]

Standard assessment of heart failure patients is invasive in most cases and the measurement of right ventricular, right atrial, and pulmonary artery pressures and cardiac output determination remains an invasive gold standard in hemodynamic assessment of severe systolic HF during right heart catheterization.[5]
Since technological advances have enabled reliable noninvasive and continuous hemodynamic monitoring devices to become available on the market, the assessment of HF risk factors to support an efficient prognosis has become much easier and less risky.

A study by Fernandes Serôdio et al. with the noninvasive Task Force® Monitor investigated the role of baroreceptor sensitivity (BRS) in HF patients and concluded that baroreflex function is also an independent marker for heart failure prognosis. HF patients show depressed arterial baroreflex function, which correlates closely with other clinical HF parameters.[6]

Related to the medication of the patients, they reported significant evidence that noninvasive methods provide similar results to those obtained through the phenylephrine technique and might even avoid the use of vasoactive drugs.[6]

There are also composite parameters, which are based on

noninvasive readings and which "may provide equally accurate prognosis as the invasive examination"[5], as reported by Gilewski et al.

Nygaard et al. confirm "that a set of non-invasively determined parameters provides similar accuracy of prognosis as in the case of invasive parameters".[7]

The assessment of noninvasive hemodynamic parameters in critically ill heart failure, stroke and sepsis patients in the Emergency Department might even help to distinguish one disease state from another.[8]

Another study by Wagner et al. shows that apart from being a helpful tool for diagnostics, noninvasive and continuous BP and CO monitoring is also a benefit for HF patients in the challenging perioperative field.[9]

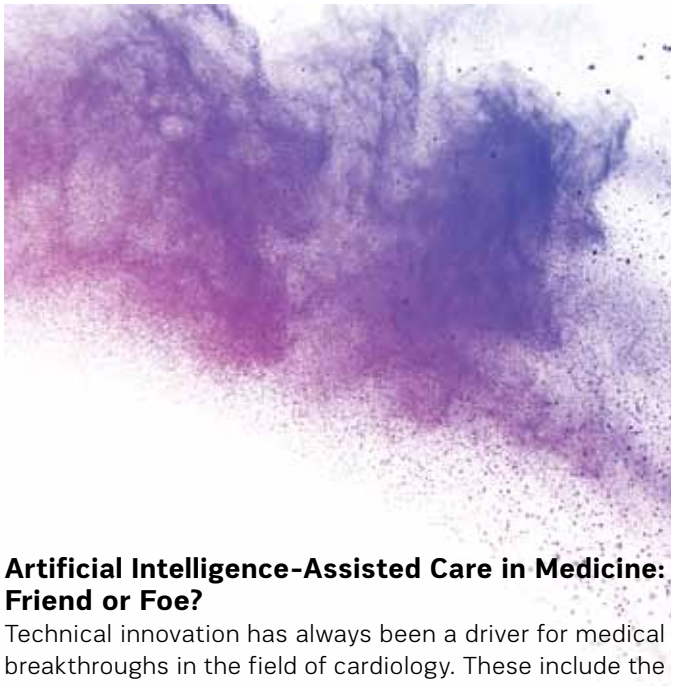
Noninvasive hemodynamic assessment contributes to decreased cost as well as risk by providing enhanced diagnosis, and enables the development of early and individualized treatment strategies for HF patients in order to avoid heart transplants as the very last consequence.

"If given optimal therapy guided by HD monitoring it might be possible to drive down hospital length of stay and 30-day readmission rates (25%) in this patient population."[8] ■

Author: **Dr. Jürgen Fortin**
CEO & Chief Scientific Officer | CNSystems| **Austria**
fortin@cnsystems.com | www.cnsystems.com

REFERENCES

For full references please email edito@healthmanagement.org



Artificial Intelligence-Assisted Care in Medicine: Friend or Foe?

Technical innovation has always been a driver for medical breakthroughs in the field of cardiology. These include the Laennec's stethoscope, the electro- and echocardiogram, percutaneous coronary interventions, transcatheter structural heart interventions, open-heart surgery, ventricular assist, and implantable electronic devices.

However, while we see many examples of such technologies, many have not translated to routine clinical care so far. Artificial Intelligence is one such example. It is important to note that AI is not a specific technology per se and it does not have any artificial features. It is actually machine intelligence (MI) and so far, MI has seen more disappointments than success. The expectations associated with AI/MI seem to over-inflated as far as cardiology is concerned.

There could be multiple reasons for this including a hospital's infrastructure and regulations. Hospitals are still in the process of transitioning to functioning as digitalised units, and data harmonisation is still a challenge for most hospitals. Also, with the introduction of the new EU Medical Device Regulation (MDR) in 2017, which is to become effective in 2020, several software are now considered medical products and have time-consuming and costly requirements for certification.

Machine intelligence is here to stay, but its application still poses a challenge for most hospitals. These can be overcome by using statistical models and by combining knowledge-based approaches with deep learning. MI has the potential to disrupt healthcare systems and clinical care. Computers can process large quantities of data and structured representation of knowledge in just a short time without loss of information. Both digitisation and desire for personalised medicine are likely to establish new clinical domains that will focus on computer-assisted medicine. It's just that both hospital management and clinicians have to keep up with this rapidly developing technology.

German Doctors to Prescribe Health Apps in 'World First'

The German healthcare system is undergoing several digital upgrades in 2020 in order to improve the service.

One of the key features of the plan is that, for the first time, doctors will be able to prescribe healthcare apps to patients.

Expected to pass into law this year, the policy means that health insurance companies will provide health services digitally on tablets, computers and smartphones. An example of such an app would be one specially designed for diabetes monitoring and care.

German Federal Minister of Health, Jens Spahn described the move as a "world first."

There have been some reservations however. The Green Party has criticised the government for implementing new procedures with apps having proven their benefit.

Addressing this, the Federal Institute for Drugs and Medical Devices is set to examine app quality and safety, after which the developer must prove that the product better scare.

Other digital upgrades to the German healthcare service this year include provision of online doctor consultations, digital prescriptions and digital sick notes.

Promising Technology for Managing Pulmonary Diseases

A new non-invasive technology developed by Monash University (Australia) researchers can be used to diagnose, treat and manage respiratory lung diseases, such as cystic fibrosis, asthma and lung cancer.

Existing technology, eg 3D CT scans, cannot capture the spatial distribution of lung function in a breathing lung, which hampers early diagnosis and monitoring. New four-dimensional X-ray velocity (XV Technology) imaging provides high-definition images at 30 frames per second, allowing to see the movement of air in real-time and assess functional airflow in healthy and diseased lungs in live organisms, as was demonstrated by the research on mice. A comparison of a cystic fibrosis mouse model against a healthy control mouse allowed researchers to pinpoint localised areas of deficiency in a lung.

The study led by Dr Rhiannon Murrie from the Department of Mechanical and Aerospace Engineering at Monash University and published in Scientific Reports in January 2020, shows the potential application of this technology in respiratory disease detection, monitoring and treatment through non-invasive and non-terminal means. Another promising direction is assessment of how effective early interventions may be for respiratory illnesses.

The technology, commercialised by an Australian med-tech company 4Dx Limited, is being tested in human clinical trials in the USA, with Phase I already completed successfully.

ACC, HeartHero to Advance Out-of-Hospital Cardiac Arrest Treatment

The American College of Cardiology (ACC) has partnered up with HeartHero to form an alliance to combat sudden cardiac death (SCD) and improve survival rates. For many years, the ACC has been on a mission to improve cardiac care. Now it aims to improve survival with the help of HeartHero's portable defibrillator.

SCD is a leading cause of mortality in the USA, claiming about 360,000 lives every year. A large majority of these patients die before they reach a healthcare facility. Also, a significant number of sudden cardiac death episodes occur in the home (65%), followed by a public setting (21%) and nursing homes (11%). About 37% of cardiac arrest is witnessed by a bystander and 12% by an EMS provider. Among the patients managed by EMS, about 20% have an initial rhythm (ventricular tachycardia or ventricular fibrillation) that is shockable by an external defibrillator. Today, external defibrillators can be found in most public places including airports, hotels, government buildings, airplanes, cinemas, etc.

HeartHero's AED was the recipient of the Innovative Challenge award in New Orleans. It is small, portable, and user-friendly. The miniature size means that individuals at risk for sudden cardiac death can now store the device in their car, carry it home, and even have it in the office, ensuring instant access. The HeartHero AED has a visual indicator that guides the user through the resuscitation process. It also has auditory and visual aids that guide the user through the resuscitation process.

World Economic Forum Promotes AI Toolkit

While about 29 countries have established national AI policies to address potential risks, very few companies have followed suit.

To address this challenge, the World Economic Forum (WEF) has worked with more than 100 companies in six countries and experts in the field of technology to develop the Empowering AI Toolkit.

The kit has been designed with the structure of a board meeting in mind. It aligns 12 learning modules with traditional board committees and working groups. The objective is to support companies in making informed decisions on AI solutions for protection of customers and shareholders.

WEF said that AI was a tool in a corporate board's toolkit and that boards need to know when to deploy it and how it aligns with a company's overall strategy.

The Empowering AI Toolkit was created by the World Economic Forum with Centre for the Fourth Industrial Revolution Network Fellows from Accenture, BBVA, IBM and Suntory Holdings. Among the many others who contributed to its development were AI4All, Australian Institute of Company Directors, Best Practice AI, Latham & Watkins, Saudi Aramco and Splunk.

Machine Learning and Early Diagnosis of CVD

Despite significant advances in the diagnosis and management of cardiac disease, cardiovascular disease continues to have high morbidity and mortality. In some cases, the diagnosis is delayed, while in others, the diagnosis is mistaken for another disorder. Advanced technology and machine learning have opened up new opportunities to evaluate image-based data.

Currently, image analysis is completely reliant on observer visual assessment and using crude quantitative measures to assess cardiac function and structure. Clinicians agree that there is a need for more advanced analytical techniques that can allow for more refined quantification of imaging phenotypes. That is why machine learning is slowly creeping into mainstream medicine, especially cardiology. Machine learning approaches to image-based analysis/diagnosis rely on models/algorithms that learn from past clinical cases through the identification of complex and hidden imaging patterns.

Preliminary data show the superiority of image-based cardiovascular diagnosis with machine learning for cardiac disorders like heart failure and coronary artery disease. The vastly superior diagnostic performance of artificial intelligence-based image analysis may help lower the burden of certain cardiac disorders by facilitating earlier and more accurate diagnostic decision making.

However, we are still in the early stage of machine learning, and researchers have systematically started to add the different case scenarios for each cardiac disorder with all the possible permutations and combinations. The more data is entered into the system, the more likely it is that the performance of the model will improve. Also, machine learning requires accurate output diagnostic labels and a suitable application to predict the right cardiac diagnosis based on the imaging data. But in any case, it is an effective tool and can help improve early diagnosis of cardiovascular disease.

Author: HealthManagement.org Editorial Team
HealthManagement.org | Limassol, Cyprus
HealthManagement.org | edito@healthmanagement.org | @ehealthmgmt