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Omnia Health Magazine: Radiology Special

Insights from the January/February edition

- Conducting research in radiology
- Compression Sonography: Revealing the unseen

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Conducting research in radiography

The radiograph profession must contribute to its body of knowledge by engaging in research in order to evolve and maintain high standards.

By Francis Zarb

Radiographers are the link between technology and the patient.

Radiography is a relatively young profession that started with W.C. Röntgen's discovery of X-rays in 1895. The profession has greatly evolved over a short span of years, with knowledge about x-rays contributing to the use of different radiographic techniques, design and development of new technologies, image interpretation, and patient care, amongst others.

For the radiography profession to move forward, and maintain high radiographic standards, it must contribute to its body of knowledge by engaging in research. The future of the radiography profession is based on research and evidence-based practice. Research is the systematic investigation or inquiry for the acquisition of knowledge, where the ultimate goal of the research is to develop and expand this body of knowledge.

Radiographers are increasing their role in actively performing research to keep abreast with the changes occurring at a fast pace in medical imaging and radiotherapy, such as developments in digital imaging, patient administration systems, the introduction of hybrid imaging, and the use of artificial intelligence. Radiographers are the link between technology and the patient.

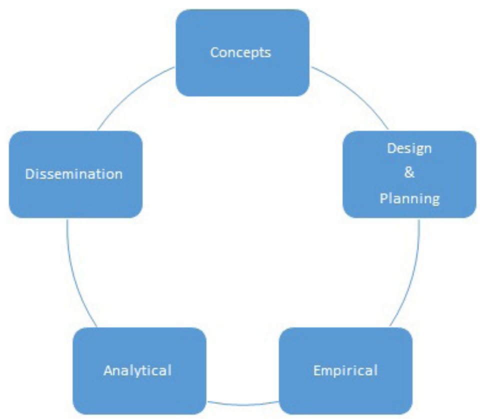
Radiographers cannot just shadow technical developments but must be proactive and conduct their own research in healthcare and technology and include the perspective of the patient. This implies a role transition from a clinical radiographer to one being a researcher.

The aim of this article is to provide an overview of the research processes. The research process outlines the steps required from generating the initial idea to disseminating the final outcome or findings of the research.

The research process

The way research is conducted depends on the methodology to be used in answering the research question. The type of research will then follow a particular model or paradigm. The main models are referred to as the Naturalistic (qualitative) or Positive (quantitative) models, or a mixed model (including both qualitative and quantitative) approach.

Focusing more on a quantitative approach to research, this follows a tight process before commencing of data collection. The steps involved in a quantitative research design include the following:



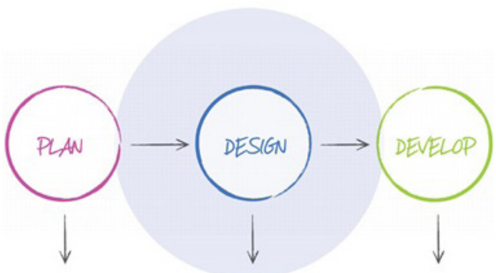
Conceptual phase

The first step of the research process is to think (or conceptualise) the area of study. Reviewing existing literature on the subject area helps in identifying gaps in the knowledge that lead to the development of the research question. The review of the literature together with undertaking clinical fieldwork assist in the definition of conceptual definitions and formulation of hypothesis for the research to be undertaken.

The design and planning phase

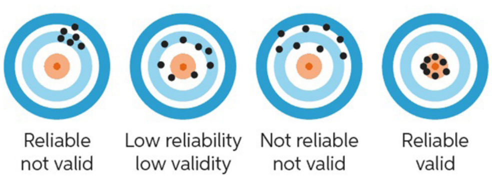
Once the research question or hypothesis is formulated, the next step is the selection of the appropriate research design to address and achieve the research aims. The target and accessible population are identified from which a sample is selected. For this purpose, a sampling plan is designed to select a sample that is representative of the population for which the findings of the study are to be generalised.

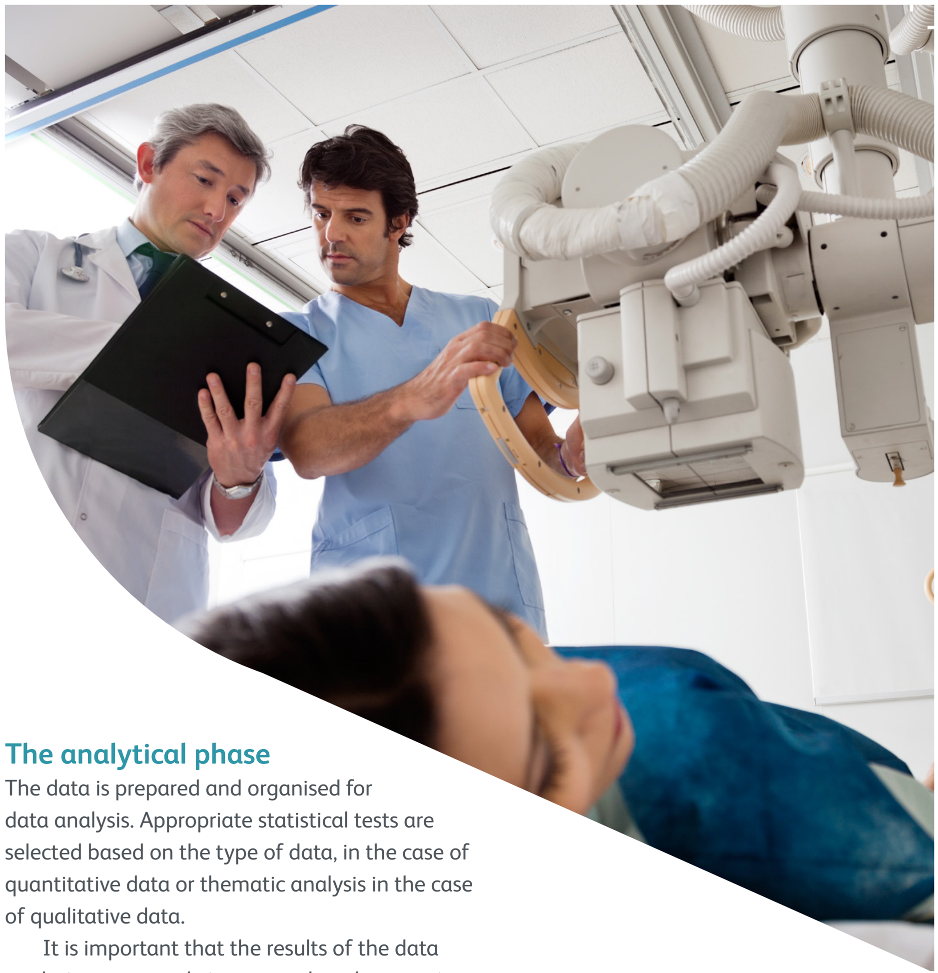
Data collection protocols are developed, which will be followed for data collection. These include specific methods used to measure the variables being studied. In the case of human participants, ethical issues are to be considered. Once the method of data collection is agreed upon, it is put on trial during a pilot study. The pilot study tests the feasibility of the method and provides an opportunity to highlight any issues that are addressed prior to the main data collection process.



The empirical phase

For the empirical phase or data collection, the data collection tools are developed and tested for validity and reliability. Validity refers to the accuracy of a measure, and whether the tools really collect the data that they are supposed to collect. While reliability refers to the consistency of the data collected, and whether the results obtained from the data can be reproduced under the same conditions.





The analytical phase

The data is prepared and organised for data analysis. Appropriate statistical tests are selected based on the type of data, in the case of quantitative data or thematic analysis in the case of qualitative data.

It is important that the results of the data analysis are correctly interpreted, and comparisons made to findings from similar research.

The dissemination phase

The research is not complete unless the results of the research are communicated with others so that the findings can be implemented as recommended. Research is useless if findings are not shared and implemented.

Conclusion

Research findings, to be effective, require dissemination to be used in practice. Translating research findings and other evidence-based practices into routine practice is essential to improve the quality and effectiveness of radiographic services.

References available on request.

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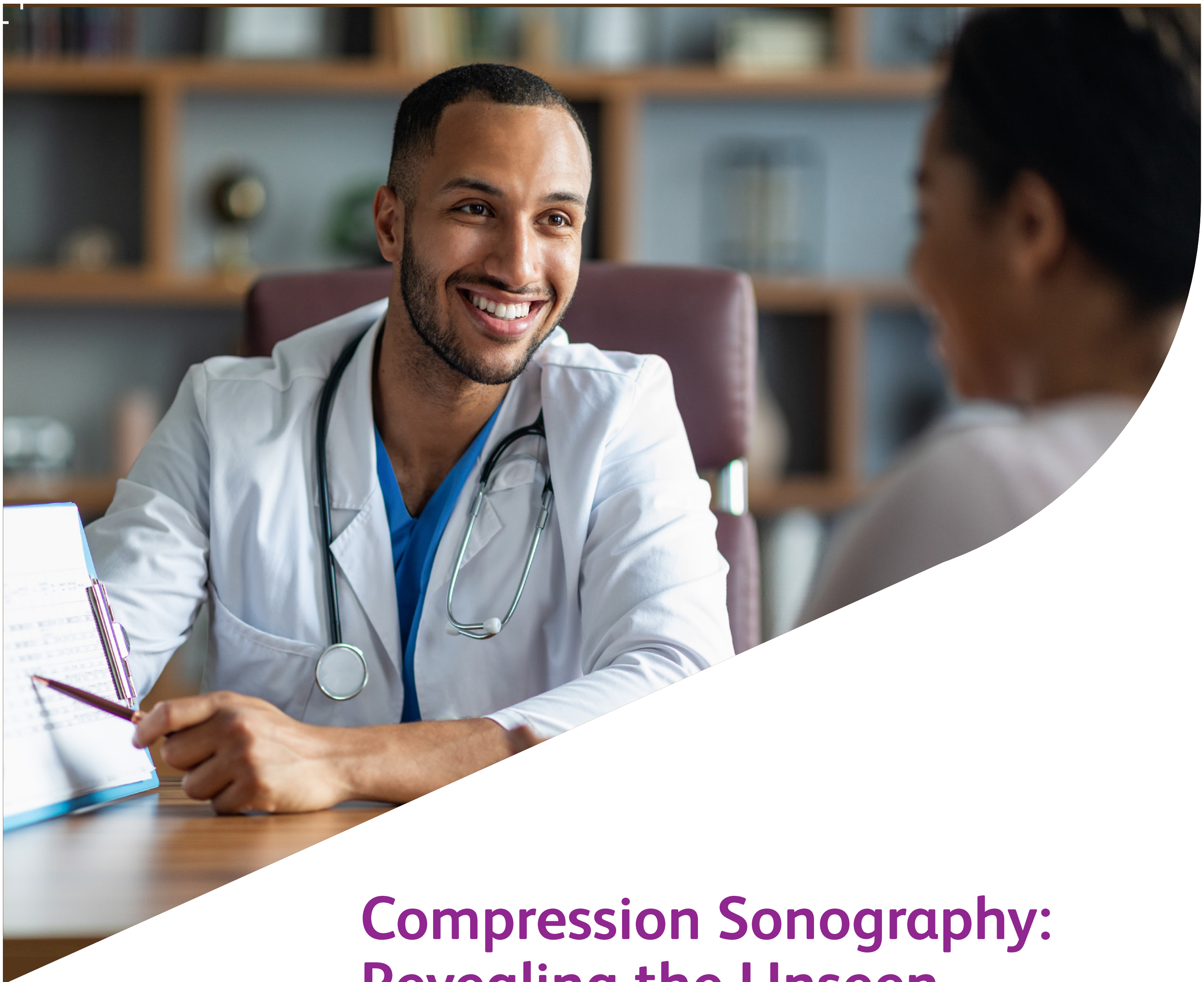


Compression Sonography: Revealing the Unseen

Graded compression sonography technique can be of great value when assessing the relation between two relatively adjacent structures.

By Omer Abdelmageed Mahmoud

One of the most common differential diagnoses for appendicitis in paediatric patients is an inflamed mesenteric lymph node.

Compression sonography is a technique that uses the sonographer's physical power to apply a pressure effect on the targeted site or organ, it would thus be defined as "Applying gentle or hard pressure on the site of interest during ultrasound examination using handheld ultrasound transducer".

Since its introduction in 1986 by pioneer Puylaert JB to diagnose patients with suspected appendicitis, many studies were conducted using the same concept of compression, but in other clinical ultrasound examinations of various body parts.

Compression ultrasonography, compression ultrasound sonography, compression ultrasound technique, and graded compression ultrasound are synonymous terms and can be used interchangeably. A sonographer or radiologist is advised to avoid using the compression technique unless they are sure that it would help them reach the required diagnosis, as this is an unpleasant technique used in patients only when necessary.

You are required to explain the intention and process to the patient in simple terms during or before the scan, as once the compression starts, it is a challenge to keep an eye on the screen and the patient's expression at the same time to monitor his tolerance to the pain.

Graded compression sonography in gastrointestinal tract

In the gastrointestinal tract, graded compression sonography can be to diagnose acute appendicitis. As described by Puylaert JB, patients with peritoneal irritation or local tenderness can tolerate the slow, gentle increase in pressure of compression sonography, however, they show a marked painful response if rapid, uneven scanning is performed as the normal gut is found to be compressible opposite to the obstructed or thick wall gut (see figure 1).

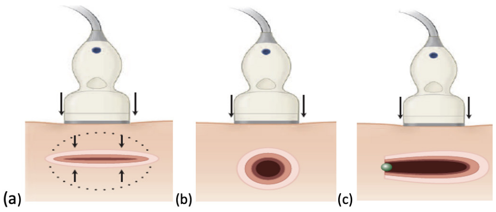


Figure 1: Normal compressible gut (a), abnormally non-compressible thickened gut (b), and obstructed loop (c).

Graded compression is used to identify the inflamed appendix by displacing gaseous bowel loops, visualisation of iliac vessels and psoas muscle. Visualisation of the ascending colon, cecum, and terminal ileum assess appendix compressibility.

In figure 2, identifying the blinded end tubular structure is crucial to confirm the structure seen as appendix, using graded compression sonography.

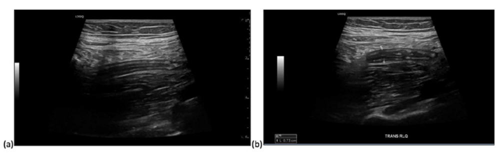


Figure 2: This 17-year-old surgically proven retrocecal appendicitis showed an unclear appendix tip in (a) to confirm appendix, while with graded compression, the tip was correctly identified.

In paediatric patients, one of the most common differential diagnoses for appendicitis is an inflamed mesenteric lymph node for various reasons. Therefore, the graded compression technique should be used for paediatric patients with vague abdominal pain or suspicion of appendicitis in order to identify the cause by displacing the overlapping bowel gas. In figure 3, a five-year-old child with abdominal pain for one week and fever in the last two days showed multiple enlarged mesenteric lymph nodes when the compression technique was used.

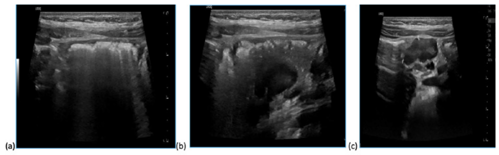


Figure 3: Graded compression sonography revealed enlarged multiple mesenteric lymph nodes, the largest is in figure (c). It is very clear how bowel gas was displaced from a-c when using grade compression sonography.

Graded compression sonography should also be used when performing an ultrasound examination on a patient with excessive bowel gas to the level of maximum tolerance from the patient. Incidental intraabdominal masses are uncommon but identifying them is essential to start up a management plan or recommend further diagnostic investigations or imaging for the patient (figure 4).

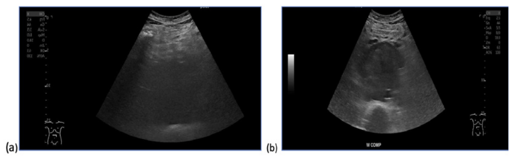


Figure 4: Graded compression on a 44-year-old male who was referred from emergency revealed an intraabdominal solid mass that was later on confirmed on CT scan as a nodal mass, along with multiple hepatic solid masses. This demonstrates how unclear this was in (a), while with compression, the mass was successfully identified after bowel displacement and reducing the distance from the skin surface in (b).

Graded compression sonography in assessing hernias

Compression sonography is essential when assessing the reducibility of hernias. The referring physician or surgeon would want to exclude any features of obstruction and strangulation as result, diagnosing the herniated sac as being completely or partially reducible could be carried out using compression technique (figure 5).

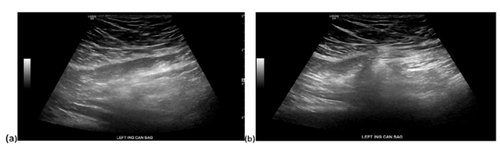


Figure 5: The scan of a 45-year-old male with left groin pain and intermittent swelling revealed a fat-containing inguinal hernia (a) that was shown to be completely reducible when using compression technique (b). Images are in the sagittal plan.

Compression transvaginal sonography can help assess the relative mobility of adnexal ectopic pregnancy relative to the ipsilateral ovary.

Graded compression sonography technique can be of great value when assessing the relation between two relatively adjacent structures as in the case of a 36-year-old female with lower abdominal pain. After being referred for ultrasound from the emergency department, the non-contrast CT scan revealed a suspicious lower abdominal mass that was suspected to be uterine in origin. Hence, the radiologist recommended an ultrasound of the pelvis that showed that the mass is completely separable from the uterus when the compression technique was used and was right adnexal in origin, which after surgery confirmed to be right ovarian Dysgerminoma (figure 6).

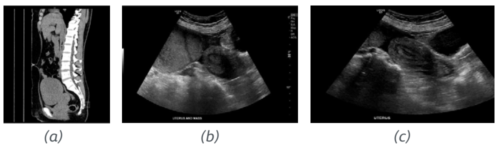


Figure 6: Non-contrast CT scan image showed the mass originating from the uterus. (b) A transabdominal ultrasound scan showed the being pedunculated from the uterine fundus. (c) Applying compression revealed the mass as being completely separable from the uterus.

Compression transvaginal sonography with the same principle of push-pull movement as described earlier in 1988 by Timor – Tritch which was known as "sliding sign" can also be used to assess the relative mobility of adnexal ectopic pregnancy relative to the ipsilateral ovary.

Figure 7 shows how using the sliding sign can confirm the origin of the adnexal ectopic pregnancy as being tubal or ovarian in the absence of possible underlying adhesions. As well as differentiating an adnexal mass e.g. donut sign of ectopic pregnancy from an ovarian lesion e.g. corpus luteum.

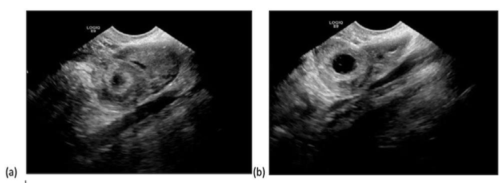


Figure 7: A 21-year-old female with acute pelvic pain, abnormal uterine and vaginal bleeding, and quantitative B HCG of 8,700. The left ovarian-like cystic lesion was identified using TVS (a). Applying pressure on the lesion confirmed that it is separately moving from the ovary (b) which was confirmed as being left tubal ectopic on surgery.

Light hand technique is usually applicable when imaging superficial structures.

One of the most known applications of compression sonography is to assess for vascular patency, which is in this case is by applying hard compression if needed. In patients with suspected deep vein thrombosis, it is a common practice to use compression to assess for the presence or absence of a thrombus (figure 8).

As this technique was found to be useful as well when assessing the compressibility of the superficial temporal artery in suspected cases of giant cell arteritis, which had shown sensitivity of 77 per cent to 79 per cent and a specificity of 100 per cent. Aschwanden M. et al (figure 9).

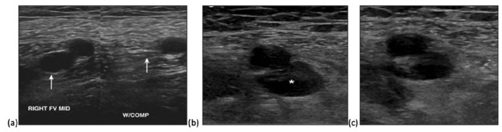


Figure 8: Completely compressible femoral vein (a). Femoral vein with intraluminal thrombus (b) which is non-compressible (c).

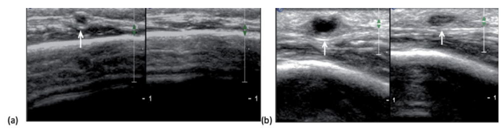


Figure 9: Normal superficial temporal artery which is completely compressible (a) and partially compressible superficial temporal artery in a patient with giant cell arteritis due to intimal thickening.

When to void compression sonography or heavy hand practice

Light hand technique is a term used to describe the opposite technique to heavy hand practice. The latter is described as the normal pressure applied during the routine scan, either by applying a light pressure when using the probe or by applying stand-off technique with the use of a gel pad between the probe and skin surface. The light hand technique is usually applicable when imaging superficial structures.

Heavy hand practice (technique) tends to hide critical sonographic information. In some situations, it might alter a measurable quantitative value, increasing the risk of complicating patients' conditions, and might deform anatomical structure (figures 10- 13).

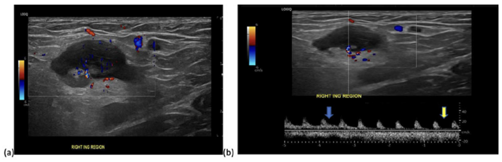


Figure 11: This 31-year-old patient who was referred to ultrasound because of right inguinal pain and swelling revealed an enlarged inguinal lymph node with preserved fatty hilum (a). Spectral Doppler interrogation of the artery at hilum for educational purposes was done to show the effect of compression on the spectral waveform, in which diastolic component (blue arrow in b) is reduced when heavy hand technique is used (yellow arrow in b) hence the Doppler indices is affected by the change in diastolic component.

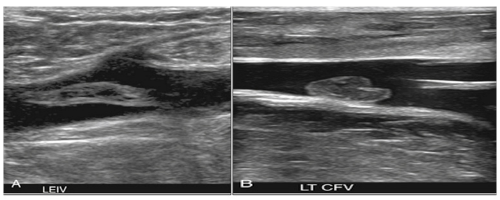


Figure 12: Free floating thrombus in deep veins, rises the alert to avoid using compression technique to assess for patency of the vein. Color Doppler filling should be used instead of direct compression by the probe since there is a risk of dislodging part of the thrombus causing emboli and PE as consequence.

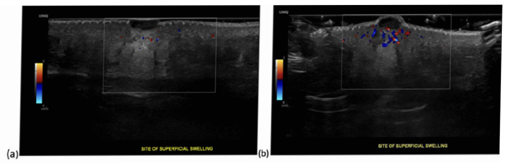


Figure 10: A patient with a right knee painful lump revealed a subdermal collection. Diffuse subcutaneous edema seen with equivocal probe compression with minimal vascularity (a). Hyperemic flow is noted when using light hand technique with enough gel amount that acts as a gel pad and thus minimizing compression on the skin surface (b) which is suggestive of inflamed subdermal collection.

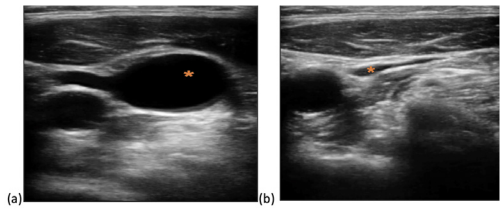


Figure 13: Deforming anatomical structure. Left internal jugular vein seen completely distended when reasonable probe compression is used during the scan (a). Complete compression of the same vein when in adequate heavy hand technique is used to scan structures rather than internal jugular veins itself (b).

Omer Abdelmageed Mahmoud is a Senior Sonographer at Sheikh Shakhbout Medical City in partnership with Mayo Clinic

Malaffi adds radiology images as part of the centralised patient records in Abu Dhabi

HIE innovations in sharing health data will be a crucial component for enabling the future of healthcare.

By Dr Sanji de Sylva

Multiple countries across the globe have built Health Information Exchanges (HIEs) to centralise and mobilise patient records and drive better quality of care and improved patient outcomes. Enshrined by World Health Organisation's eHealth Resolution "to foster exchange of data and information for the promotion of health, health systems and training of healthcare workers," countries see HIEs as an important tool to strengthen patient services and experiences to improve care and evolve in line with the strong healthcare trends towards preventive and value-based care.

In the Middle East, The Department of Health - Abu Dhabi (DOH) is leading the charge, having commissioned the Abu Dhabi Health Information Exchange Platform, Malaffi, in 2018 and empowering Healthcare Professionals (HCPs) to make well-informed decisions using available patient data from all previous appointments, regardless of the facility.

The availability of radiology images in patient records ensures that time-poor healthcare providers now gain a holistic view of patients' records.

The challenges of sharing radiology images outside of one organisation

As diagnostics play a critical role in patients' journeys, radiology images become essential to holistic electronic medical records (EMR). The burden of retrieving radiology and diagnostic images from disparate systems for patients and healthcare providers is significant. Not having easy access to images from previous appointments with different providers may lead to duplication and over utilisation or diagnostic services, delays in treatment, poor treatment outcomes, and a poor experience for clinicians and patients.

Nevertheless, sharing radiology images across different healthcare organisations is challenging due to the large file size and interoperability issues. Only select HIEs globally have implemented an image exchange solution within the providers' portal.

Malaffi introduces an Image Exchange Solution

Malaffi's recent launch of the Image Exchange Solution now allows healthcare providers across the Emirate of Abu Dhabi using Malaffi to have access to radiology studies. This latest Malaffi enhancement again positions Abu Dhabi at the forefront of using innovative digital health technologies to drive better patient outcomes.

Malaffi's user survey revealed that 90 per cent of clinicians felt it very important to have access to the historical radiology images for their patients. It is anticipated that those who will benefit the most from such a solution are surgeons, gynaecologists and obstetricians, internal medicine specialists and cancer care teams, and multidisciplinary teams.

Delays in waiting to receive images – such as X-Rays, CT scans, MRIs and ultrasound images, for example - from disparate systems can be frustrating for the care teams and add to stressful situations for patients. Ultimately, in Abu Dhabi, the burden of patients needing to take hard copy scans or CDs of scans to appointments will be eliminated once 60 facilities are connected to Image Exchange, removing the reliance on the patient and for the HCPs to have more timely access to additional clinical information.

The availability of radiology images in patient records ensures that time-poor healthcare providers now gain a holistic view of patients' records and can review and compare images from different visits and timeframes. Image access reduces the need to duplicate expensive and invasive radiology investigations, which also safeguards patients from unnecessary radiation and reduces time and cost. A recent study found that the duplication of diagnostic images in clinical settings after implementing an image exchange decreased by more than 20 per cent.

Another study found that nearly two-thirds (61 per cent) of radiologists suffer from burnout, up from 36 per cent in 2013 to 49 per cent in 2017. Reducing the duplication of multiple and sometimes unnecessary scans can help to alleviate this issue.

Likewise, there are many use cases for sharing images across organisations. Consider, for example, a scenario where a patient undergoes a CT scan at a hospital trauma centre and is then transferred to a tertiary hospital. Studies have found considerable duplication of CTs in these cases, in addition to the fact that valuable time is lost when the patient needs to be treated urgently.

Abu Dhabi at the forefront of digital health technology

As healthcare professionals become increasingly time-poor, technology can solve many of the issues they face. According to Persistence Market Research, medical image exchange systems are expected to be adopted globally at a significant pace over the coming years due to the growing adoption of advanced technologies in the healthcare industry.

For Malaffi, delivering an image exchange solution was the natural next step to continue adding value for the clinical users, especially given the fragmented healthcare landscape in the emirate and the need to deliver a single, seamless and secure source of important clinical information. Ultimately, following a phased approach, two million radiology images from over 60 healthcare sites across Abu Dhabi will be available through the exchange. The first facilities to join include NMC Healthcare, Reem Hospital, Burjeel Holdings and HealthPoint.

As part of the global HIE community, Malaffi has been recognised for its achievements as one the fastest-implemented platforms globally. Alongside the image exchange, in 2022, Malaffi released several functionalities such as patients' appointments, risk profile and a Health Portal, cementing its position among the most advanced HIEs. The organisation continues its journey with a commitment to seek new solutions to improve the quality of healthcare and enhance HCPs' ability to deliver this in Abu Dhabi.

And now, as the world embraces the emerging healthcare trends moving from sick care to preventive care and the ultimate target of practicing value-based care, HIE innovations in sharing health data will be a crucial component for enabling the future of healthcare. Being able to combine diagnostic images with other clinical data and biomarkers for patients, creates a platform and foundation for AI-enabled tools (which combine clinical and imaging data) to be implemented to drive more targeted and personalised care.

References available on request

Dr Sanji de Sylva is VP Clinical Engagement and Informatics at Malaffi.

Big wins in the medical imaging industry amid high hospital demands

The medical imaging market is projected to cross US$59 billion in annual revenue by 2030, according to Global Market Insights Inc.

By Shreya Bhute

The rising burden of multiple diseases and the growing rate of mortality in recent times has amplified the increase in healthcare spending to cater to the surging requirement for early diagnosis. According to the Centers for Medicare & Medicaid Services (CMS) in 2021, healthcare spending in the US grew 9.7 per cent in 2020, reaching US$12,530 per person.

In view of the growing disease penetration worldwide, the demand for several new technologies and equipment for effective treatment has grown widely in a variety of medical settings as well as at all major levels of healthcare. To that end, the growth of the medical imaging industry is anticipated to remain positive in the coming years considering its soaring popularity for supporting diagnosis, monitoring, and treating different medical conditions. This diagnostic service is recording a significant preference for its rising essentiality in confirming, assessing as well as documenting the course of multiple diseases and response to treatment.

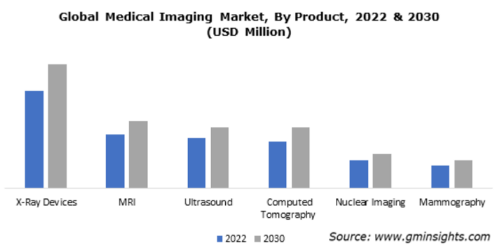
Medical imaging mainly encompasses different technologies deployed for viewing the human body and delivering information about several parts to aid the physician in understanding the complications and enabling them to take better decisions. The procedures are increasingly favoured as they are non-invasive, completely painless, and most times do not require any special preparation.

The widening stream of technological enhancements in imaging equipment are playing a key role in the expansion of the industry.

The widening stream of technological enhancements along with the rising integration of artificial intelligence (AI) and digital solutions in imaging equipment by market players are playing a key role in the expansion of the medical imaging industry for enhancing patient care and transforming clinical outcomes. Stating an example, GE Healthcare joined forces with Intel for advancing the use of AI in medical imaging by developing an algorithm to assist the medical staff in triaging potentially life-threatening cases faster.

Breakthroughs in X-ray technology to augment the medical imaging market share

In recent times, the interest in medical X-ray imaging has significantly evolved considering their rising popularity as valuable medical tools in a wide variety of procedures and examinations for noninvasively helping in diagnosing diseases and monitoring therapy. These products have an upper hand over other imaging technologies as they not only support medical and surgical treatment planning, but also guide medical personnel in inserting catheters, and stents inside the body.



X-ray devices hold paramount importance in the field of radiology given their assistance in diagnosing tumours and removing blood clots or other blockages. To reduce the stress and strain on the radiology staff, the need for designing advanced mobile X-Ray technology is depicting a rise for improved workflow and usability, further influencing the medical imaging market growth. To illustrate, in July 2022, Siemens Healthineers launched its newest mobile X-ray system, Mobilett Impact. The new system is affordable and comes with full digital integration, combining the benefits of mobile X-ray imaging at a patient's bedside.

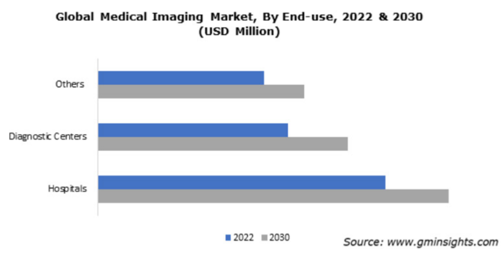
Several groundbreaking technologies have also been introduced by top contenders in the medical imaging business sphere to meet the rising need for X-ray imaging outcomes for effective medical diagnosis. For instance, in May 2021, Carestream Health released groundbreaking AI-driven technology, Smart Noise Cancellation (SNC) for improving image quality and producing images that are relatively clearer than with standard processing. Of late, the increasing number of research activities on spectroscopic X-ray imaging has been instrumental in amplifying their deployment from labs to clinics.

Shreya Bhute

Demand for medical imaging depicts a significant rise in hospitals

There is an increasing number of investments aimed at deploying cutting-edge technologies for producing faster and enhanced image quality, leading to quicker diagnoses as well as treatment for patients will support the medical imaging industry demand in hospitals. In October 2019, NYC Health + Hospitals announced to invest US$224 million over 10 years to upgrade the medical imaging technology system-wide.

The regular requirement for performing rapid imaging exams in various complex situations at the patient's bedside has steered the adoption of medical imaging solutions in hospitals. To illustrate, Canon Medical Systems USA Inc., in August 2020, rolled out Soltus 500, its all-new Mobile Digital X-ray technology to offer these healthcare settings access to systems with enhancements. It also helped them to streamline bedside exams for improved workflow and productivity.



The rising shift to digitisation in hospital settings has also prompted the increasing deployment of cloud-based imaging solutions mainly in the post-pandemic era for the transition from traditional care delivery to a more decentralised model in hospital settings. For instance, in August 2022, GE Healthcare teamed up with AWS for the first Europe-based cloud deployment of well-known diagnostic imaging solution developed for radiologists, Edison True PACS at the Royal Orthopaedic Hospital NHS Foundation Trust.

The road ahead

In the years to follow, the increasing burden of heart diseases is expected to drive innovations in cardiac medical imaging for promoting early detection and intervention measures. In October 2022, Google Cloud announced a Medical Imaging Suite, its new initiative within the realm of healthcare, for creating an efficient, universally friendly, and value-providing platform, with interoperability and accessibility. This growing technological intervention along with the rising regulatory support, mainly from the U.S. FDA (Food and Drug Administration) for new product approvals will also influence the industry dynamics.

Deep learning-based systems aid radiographers in prediction, decision-making

Promising work is being performed in tissue classification and cancer staging, thanks to the advent of machine learning and other sophisticated models in diagnostic radiology.

By Asma Ali Zain

Rapid advancements in medical therapy necessitate the need for regular multimodality imaging.

Artificial intelligence, and deep learning in particular, has been used extensively for image classification and segmentation, including on medical images for diagnosis and prognosis prediction. However, the use of deep learning in radiotherapy prognostic modelling is still limited.

Deep learning is a subset of machine learning and artificial intelligence that has a deep neural network with a structure like the human neural system and has been trained using big data. Deep learning narrows the gap between data acquisition and meaningful interpretation without explicit programming. It has so far outperformed most classification and regression methods and can automatically learn data representations for specific tasks.

The application areas of deep learning in radiation oncology include image segmentation and detection, image phenotyping and radiomic signature discovery, clinical outcome prediction, image dose quantification, dose-response modeling, radiation adaption, and image generation.

An article published in Clinical Oncology analyses 10 studies on the subject noting that researchers suffer from the same issues that plagued early normal tissue complication probability modelling, including small, single-institutional patient cohorts, lack of external validation, poor data and model reporting, use of late toxicity data without taking time-to-event into account, and nearly exclusive focus on clinician-reported complications.

It adds that the studies, however, demonstrate how radiation dose, imaging and clinical data may be technically integrated in convolutional neural networks-based models; and some studies explore how deep learning may help better understand spatial variation in radiosensitivity. In general, there are several issues specific to the intersection of radiotherapy outcome modelling and deep learning, for example, the translation of model developments into treatment plan optimisation that will require an additional combined effort from the radiation oncology and artificial intelligence communities.

Hence, the use of machine learning and other sophisticated models to aid in prediction and decision-making has become widely popular across a breadth of disciplines. Within the greater diagnostic radiology, radiation oncology, and medical physics communities promising work is being performed in tissue classification and cancer staging, outcome prediction, automated segmentation, treatment planning, and quality assurance as well as other areas.

Envisioning the future of radiology

Dr. Ali Vahedi, Consultant Radiologist at Mubadala Healthcare, explains that AI has an important role to play in the current and future of radiology. At present, this is primarily in the form of helping clinicians improve efficiency and diagnostic capacity which is essential with the exponential increase of diagnostic tests conducted year-on-year. He adds that AI has the potential to rapidly evaluate a vast quantity of imaging data, helping to prioritise worklists and diagnoses, which will aid in reducing reporting time, improve the accuracy of reports as well as limit discrepancies. In addition, it will give radiologists more time for direct patient care and vital research.

A study published in the Progress in Medical Physics Journal highlights that high-quality simulated three-dimensional (3D) CT images are essential when creating radiation treatment plans because the electron density and anatomical information of tumours and OARs are required to calculate and optimise dose distributions.

Radiotherapy plays an increasingly dominant role in the comprehensive multidisciplinary management of cancer. As radiation therapy machines and treatment techniques become more advanced, the role of medical physicists that ensure patients' safety becomes more prominent. With the advancement of deep learning, its powerful optimisation capability has shown remarkable applicability in various fields. Its utility in radiation oncology and other medical physics areas has been discussed and verified in several research papers. These research fields range from radiation therapy processes to QA, super-resolution medical image, material decomposition, and 2D dose distribution deconvolution.

According to Dr. Vahedi, the global imaging market size is expected to grow, driven by numerous factors such as growth in the number of hospitals and clinics and rising demand for minimally invasive surgeries.

He adds that rapid advancements in medical therapy also necessitate the need for regular multimodality imaging. In addition, technological advancements in medical imaging equipment are also contributing to the growth, with manufacturers introducing new products that are more compact, more cost-effective, and produce less ionising radiation than their predecessors. This improved affordability will invariably improve patient access to imaging. it can be concluded that over the past few years there has been a significant increase in both the interest in as well as the performance of deep learning techniques in this field.

Promising results have been obtained that demonstrate how deep learning-based systems can aid clinicians in their daily work, be it by reducing the time required, or the variability in segmentation, or by helping to predict treatment outcomes and toxicities. It remains to be seen when these techniques will be employed in routine clinical practice, but it seems warranted to assume that we will see AI contribute to improving radiotherapy soon. In conclusion, the application of deep learning has great potential in radiation oncology.

Dr. Ali Vahedi, Consultant Radiologist, Mubadala Health Dubai

Dynamic SaaS platform eases workflow automation

Mahdi Keyhani, Senior Product Manager, RamSoft.

RamSoft's OmegaAI is an efficient cloud-native solution that enables the storage and sharing of medical images.

Quality and efficiency are highly prized in the fast-paced health industry, and RamSoft, a healthcare IT SaaS leader, acknowledges that while technology is embedded in every aspect, radiologists still face challenges in the management of medical imaging. Mahdi Keyhani, Senior Product Manager at RamSoft, explains more. Excerpts:

How has the medical imaging market changed since the pandemic?

Remote work finally became a valid and accepted method of working for various roles in radiology as well as healthcare practices around the world. Consequentially, this precipitated a major paradigm shift in healthcare, culminating in new opportunities for improving the performance of healthcare-related workflows.

While cloud computing has been a niche market in healthcare IT (or in some cases, hybrid cloud architectures marketed as cloud solutions), this technology has not seen its potential in other sectors such as big tech and finance. Therefore, this paradigm shift was not limited to healthcare workflows, and it created a more patient-centric approach to healthcare.

Consequentially, the current market has seen a renewed interest in patient-focused products such as patient portals, patient engagement apps, online booking, and access to health records.

How are you incorporating AI and VR into your products/solutions.

OmegaAI, as its name implies, is purpose-built with the mindset to incorporate AI in a variety of use cases including:

- Image processing that assist radiologists in improving their performance and empower and enhance the workflow by way of AI-driven assignment of studies.
- Resolving the key issue of patient matching. AI works to ensure prior studies are connected to current studies as well as enable prior results and clinical history is accessible at any time. This is crucial for patient safety and can help to optimise the effective use of resources, not to mention also reducing waste.
- VR applications are also considered in our cutting-edge patient engagement app, Blume (available in OmegaAI Marketplace, Google Play & Apple's App Store).

How are you adopting 3D radiography and digital radiography technologies?

OmegaAI's Image Viewer's design supports typical 3D applications like 3D multiplanar reconstruction and other technologies (e.g., MIP). Additionally, RamSoft is planning to provide further relevant capabilities such as 3D surface or body part reconstruction.

What solutions do you offer in medical image storage, and how are you helping to keep medical image data safe?

We store data using enterprise-level cloud storage. Cloud storage security can help to support the delivery of unique technologies as well as foster privacy and security policies towards keeping data safe from unauthorised access.

Common attacks such as malware, physical data breaches or leaks are rare and require a rare chain of human error to happen. Even in those cases, geographical redundancy and other built-in protection can prevent and help in successful disaster recovery.

How do you see the "Metaverse" being applied in medical imaging?

The main benefit of Metaverse in medical imaging could be its potential to enable telemedicine. In the practice of radiology, direct interaction of radiologists and patients is not a common necessity; however, collaboration and the ability to have a virtual session in which a group of healthcare providers can visually review medical images and collaborate is another potential for the utilisation of virtual reality in medical imaging.

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