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Library Current Awareness Bulletin Radiology – August 2021

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News

Radiography journal announces Editors' Choice Paper for 2020
The Society of Radiographers
June 2021
[Each year, the Radiography journal presents an award for the 'Editors' Choice' paper, selected from the previous year's five issues, writes Editor in Chief Professor Julie Nightingale.]

Role of scout or localiser images during CT or MRI in diagnostic radiology
The Society of Radiographers
July 2021
[Position statement from the Clinical Imaging Board]

The SCoR questions European position statement on ultrasound
The Society of Radiographers
July 2021
[The SCoR has questioned a European position statement on best practice in ultrasound for failing to mention the role of radiographers and sonographers.]

Reports

Clinical oncology UK workforce census 2020 report
The Royal College of Radiologists
July 2021
[The RCR collected data from the UK's 62 cancer centres in December 2020 to find out staff numbers and issues among clinical oncologists – the expert doctors who treat cancer with all non-surgical means, including radiotherapy, chemotherapy and immunotherapy. The report highlights a shortage of clinical oncologists in the NHS.]

Unlocking Solutions in Imaging: working together to learn from failings in the NHS
Parliamentary and Health Service Ombudsman
July 2021
[This report highlights recurrent failings in the way X-rays and scans are reported on and followed up across NHS services. It recommends a system-wide programme of improvements for more effective and timely management of X-rays and scans]

Statistics

Diagnostic imaging dataset for March 2021
NHS England
June 2021
[The Diagnostic Imaging Dataset (DID) is a central collection of detailed information about diagnostic imaging tests carried out on NHS patients, extracted from local Radiology Information Systems (RISs) and submitted monthly.]

Artificial Intelligence

Chest x-ray automated triage: A semiologic approach designed for clinical implementation, exploiting different types of labels through a combination of four Deep Learning architectures.
Mosquera C., Diaz F.N., Binder F., Rabellino J.M., Benitez S.E., Beresñak A.D., Seehaus A., Ducrey G. et al
Computer Methods and Programs in Biomedicine, vol. 206
July 2021
[**Background and objectives**: The multiple chest x-ray datasets released in the last years have ground-truth labels intended for different computer vision tasks, suggesting that performance in automated chest x-ray interpretation might improve by using a method that can exploit diverse types of annotations. This work presents a Deep Learning method based on the late fusion of different convolutional architectures, that allows training with heterogeneous data with a simple implementation, and evaluates its performance on independent test data. We focused on obtaining a clinically useful tool that could be successfully integrated into a hospital workflow. **Materials and methods**: Based on expert opinion, we selected four target chest x-ray findings, namely lung opacities, fractures, pneumothorax and pleural effusion. For each finding we defined the most suitable type of ground-truth label, and built four training datasets combining images from public chest x-ray datasets and our institutional archive. We trained four different Deep Learning architectures and combined their outputs with a late fusion strategy, obtaining a unified tool. The performance was measured on two test datasets: an external openly-available dataset, and a retrospective institutional dataset, to estimate performance on the local population. **Results:** The external and local test sets had 4,376 and 1,064 images, respectively, for which the model showed an area under the Receiver Operating Characteristics curve of 0.75 (95%CI: 0.74-0.76) and 0.87 (95%CI: 0.86-0.89) in the detection of abnormal chest x-rays. For the local population, a sensitivity of 86% (95%CI: 84-90), and a specificity of 88% (95%CI: 86-90) were obtained, with no significant differences between demographic subgroups. We present examples of heatmaps to show the accomplished level of interpretability, examining true and false positives. **Conclusion**: This study presents a new approach for exploiting heterogeneous labels from different chest x-ray datasets, by choosing Deep Learning architectures according to the radiological characteristics of each pathological finding. We estimated the tool's performance on the local population, obtaining results comparable to state-of-the-art metrics. We believe this approach is closer to the actual reading process of chest x-rays by professionals, and therefore more likely to be successful in a real clinical setting.]

Interventional Radiology ex-machina: impact of Artificial Intelligence on practice.
Gurgitano M., Angileri S.A., Rodà, Giovanni M., Liguori A., Pandolfi M., Ierardi A.M., Wood B.J., and Carrafiello, G.
La Radiologia medica, vol. 126(7) pp. 998-1006
Jul 2021
[Artificial intelligence (AI) is a branch of Informatics that uses algorithms to tirelessly process data, understand its meaning and provide the desired outcome, continuously redefining its logic. AI was mainly introduced via artificial neural networks, developed in the early 1950s, and with its evolution into "computational learning models." Machine Learning analyzes and extracts features in larger data after exposure to examples; Deep Learning uses neural networks in order to extract meaningful patterns from imaging data, even deciphering that which would otherwise be beyond human perception. Thus, AI has the potential to revolutionize the healthcare systems and clinical practice of doctors all over the world. This is especially true for radiologists, who are integral to diagnostic medicine, helping to customize treatments and triage resources with maximum effectiveness. Related in spirit to Artificial intelligence are Augmented Reality, mixed reality, or Virtual Reality, which are able to enhance accuracy of minimally invasive treatments in image guided therapies by Interventional Radiologists. The potential applications of AI in IR go beyond computer vision and diagnosis, to include screening and modeling of patient selection, predictive tools for treatment planning and navigation, and training tools. Although no new technology is widely embraced, AI may provide opportunities to enhance radiology service and improve patient care, if studied, validated, and applied appropriately.]

Biological Imaging

Transformational Role of Medical Imaging in (Radiation) Oncology.
Coolens C., Gwilliam M.N., Alcaide-Leon P., de Freitas Faria I.M., and Ynoe de Moraes F.
Cancers, vol. 13(11)
June 2021
[**Simple Summary**: Onboard, imaging techniques have brought about a huge transformation in the ability to deliver targeted radiation therapies. Each generation of these technologies enables us to better visualize where to deliver lethal doses of radiation and thus allows the shrinking of necessary geometric margins leading to reduced toxicities. Alongside improvements in treatment delivery, advances in medical imaging have also allowed us to better define the volumes we wish to target. The development of imaging techniques that can capture aspects of the tumor's biology before, during and after therapy is transforming how treatment can be delivered. Technological changes have further made these biological imaging techniques available in real-time providing the opportunity to monitor a patient's response to treatment closely and often before any volume changes are visible on conventional radiological images. Here we discuss the development of robust quantitative imaging biomarkers and how they can personalize therapy towards meaningful clinical endpoints. Onboard, real-time, imaging techniques, from the original megavoltage planar imaging devices, to the emerging combined MRI-Linear Accelerators, have brought a huge transformation in the ability to deliver targeted radiation therapies. Each generation of these technologies enables lethal doses of radiation to be delivered to target volumes with progressively more accuracy and thus allows shrinking of necessary geometric margins, leading to reduced toxicities. Alongside these improvements in treatment delivery, advances in medical imaging, e.g., PET, and MRI, have also allowed target volumes themselves to be better defined. The development of functional and molecular imaging is now driving a conceptually larger step transformation to both better understand the cancer target and disease to be treated, as well as how tumors respond to treatment. A biological description of the tumor microenvironment is now accepted as an essential component of how to personalize and adapt treatment. This applies not only to radiation oncology but extends widely in cancer management from surgical oncology planning and interventional radiology, to evaluation of targeted drug delivery efficacy in medical oncology/immunotherapy. Here, we will discuss the role and requirements of functional and metabolic imaging techniques in the context of brain tumors and metastases to reliably provide multi-parametric imaging biomarkers of the tumor microenvironment.]

COVID-19: Impact on Radiology Services

Imaging Appropriateness in Pediatric Radiology during COVID-19 Pandemic: A Retrospective Comparison with No COVID-19 Period.

Bottari G., Stellacci G., Ferorelli D., Dell'Erba A., Aricò M., Benevento M., Palladino G., and Solarino B.

Children, vol. 8(6) pp. 1-6

Jun 2021

[During the COVID-19 pandemic, the number of accesses to the Pediatric Emergency Department (pED) in Italy sharply decreased by 30%. The purpose of this study is to evaluate how this novel setting impacted on management of children with trauma, and the use and appropriateness of imaging studies in such patients at the pED. All imaging studies performed in patients with trauma at the pED of a tertiary children's Hospital during the first wave of the COVID-19 pandemic (between March and May 2020) were reviewed, in comparison with a control time interval (March to May 2019). In the pre-COVID control era, 669 imaging studies documented bone fractures in 145/568 children (25.5%). In the COVID-era, 79/177 (44.6%) pediatric patients showed bone fractures on 193 imaging studies. Comparative analysis shows a 71% decrease in imaging studies, and the proportion of negative imaging studies (with no evidence of bone fractures) dropped in 2020 by 19% compared to the 2019 control era ($p < 0.001$). The sharp decrease of negative studies suggests that the rate of appropriateness was higher during COVID-era, suggesting some attitude toward defensive medicine in the previous control year, as a result of some degree of imaging inappropriateness. The impact of a pandemic on emergency medicine may offer a unique opportunity to revisit diagnostic and therapeutic protocols in pediatrics.]

Impact of the COVID-19 pandemic on interventional radiology services across the world.

Xu Y., Mandal I., Lam S., Troumpoukis N., Uberoi R., Sabharwal T., Makris G.C., and Trompoukis N.

Clinical Radiology, vol. 76 (8) pp. 621-625

August 2021

[**Aim**: To review data on the impact of the COVID-19 pandemic on interventional radiology (IR) services. **Materials and Methods**: A systematic review of the available studies was performed according to the PRISMA guidelines. **Results**: A total of 14 studies met the inclusion criteria. IR caseload reduced between 16.8-80%, with elective activity affected more than emergency work. Trainees also experienced a 11-51.9% reduction in case volumes and many were redeployed to critical care. IR departments re-organised operations and personnel, and many continued to offer 24/7 services and support critical care areas through redeployment of staff. The majority of studies report no significant issues with the availability of personal protective equipment and that local or national governing body or radiology society guidelines were followed. **Conclusion**: The COVID-19 pandemic reduced case volumes and training opportunities. IR departments showed flexibility in service delivery. The lessons learned offer novel insights into how services and training can be reorganised to ensure that IR continues to thrive.]

Diagnostic Radiology

Workload of diagnostic radiologists in the foreseeable future based on recent scientific advances: growth expectations and role of artificial intelligence

Kwee T.C. and Kwee R.M.

Insights into Imaging, vol. 12(1)

Dec 2021

Objective: To determine the anticipated contribution of recently published medical imaging literature, including artificial intelligence (AI), on the workload of diagnostic radiologists. **Method(s)**: This study included a random sample of 440 medical imaging studies published in 2019. The direct contribution of each study to patient care and its effect on the workload of diagnostic radiologists (i.e., number of examinations performed per time unit) was assessed. Separate analyses were done for an academic tertiary care center and a non-academic general teaching hospital. **Result(s)**: In the academic tertiary care center setting, 65.0% (286/440) of studies could directly contribute

to patient care, of which 48.3% (138/286) would increase workload, 46.2% (132/286) would not change workload, 4.5% (13/286) would decrease workload, and 1.0% (3/286) had an unclear effect on workload. In the non-academic general teaching hospital setting, 63.0% (277/240) of studies could directly contribute to patient care, of which 48.7% (135/277) would increase workload, 46.2% (128/277) would not change workload, 4.3% (12/277) would decrease workload, and 0.7% (2/277) had an unclear effect on workload. Studies with AI as primary research area were significantly associated with an increased workload ($p < 0.001$), with an odds ratio (OR) of 10.64 (95% confidence interval (CI) 3.25-34.80) in the academic tertiary care center setting and an OR of 10.45 (95% CI 3.19-34.21) in the non-academic general teaching hospital setting. **Conclusion(s)**: Recently published medical imaging studies often add value to radiological patient care. However, they likely increase the overall workload of diagnostic radiologists, and this particularly applies to AI studies.]

Education, Training and Workforce Development

CIRSE Clinical Practice Manual.
Mahnken A.H., Boullosa Seoanne E., Cannavale A., de Haan, M.W., Dezman R., Kloeckner R., O'Sullivan G. et al
Cardiovascular and Interventional Radiology
July 2021
Background: Interventional radiology (IR) has come a long way to a nowadays UEMS-CESMA endorsed clinical specialty. Over the last decades IR became an essential part of modern medicine, delivering minimally invasive patient-focused care. **Purpose**: To provide principles for delivering high quality of care in IR. **Methods**: Systematic description of clinical skills, principles of practice, organizational standards and infrastructure needed for the provision of professional IR services. **Results**: There are IR procedures for almost all body parts and organs, covering a broad range of medical conditions. In many cases IR procedures are the mainstay of therapy, e.g. in the treatment of hepatocellular carcinoma. In parallel the specialty moved from the delivery of a procedure towards taking care for a patient's condition with the interventional radiologists taking ultimate responsibility for the patient's outcomes. **Conclusions**: The evolution from a technical specialty to a clinical specialty goes along with changing demands on how clinical care in IR is provided. The CIRSE Clinical Practice Manual provides interventional radiologist with a starting point for developing his or her IR practice as a clinician.

Professional Development Needs of Non-Radiology Nurses: An Exploration of Nurses' Experiences Caring for Interventional Radiology Patients.
Carley A., Melrose S., Rempel G., Diehl-Jones W., and Schwarz B.A.
Journal of Radiology Nursing, vol. 40(2) pp. 146-151
June 2021
[Nursing in interventional radiology is diverse and multifaceted. This area of specialty nursing has not yet been acknowledged as such or embraced in Canada. Professional development for interventional radiology nurses is lacking with even fewer educational opportunities for non-radiology nurses who care for interventional radiology patients throughout the hospital to develop needed interventional radiology knowledge and related skills. This qualitative descriptive study explored the experiences non-radiology nurses have caring for interventional radiology patients. Interviews with ten non-radiology nurses in a Canadian hospital provided rich data for analysis. Thematic analysis revealed that these nurses did not receive formal IR education in their nursing curriculum, acquired their knowledge through self-teaching, lacked knowledge about imaging modalities and IR procedures, were impeded to build trusting nurse-patient relationships, and felt ineffective communication disrupted the continuity of care they provided. Addressing professional development needs related to creating interventional radiology education, increasing awareness of the specialty of interventional radiology nursing, and enhancing clinical collaboration is a key recommendation. • Non-radiology nurses acquire most of their knowledge through self-teaching. • IR knowledge gap impedes non-radiology nurses from providing safe and holistic care. • Non-radiology nurses' professional development needs center on a lack of resources. • Addressing these needs involves education, awareness, and collaboration.]

Interventional Radiology

Ambulatory Care in IR: Time to Engage.
Lee M.J. and Binkert C.A.
CardioVascular & Interventional Radiology, vol. 44(7) pp. 1003-1004
July 2021
[In summary, elective IR procedures are ideally suited to ambulatory care and as interventional radiologists become more involved in ambulatory care, we believe that in the future, a paradigm shift will occur in that day case IR will be considered the norm for most elective IR procedures. Healthcare expenditure in Europe is increasing on a yearly basis with the average healthcare expenditure among European nations amounting to 9.9% of GDP (gross domestic product) in 2018 [[1]]. Interventional radiology (IR) is a minimally invasive procedural specialty that does not require the services of anesthesiology for the vast majority of procedures which simplifies the transition to day care IR.]

The Application of Interventional Radiology in Living-Donor Liver Transplantation.
Ko G.Y., Sung K.B., and Gwon D.I.
Korean Journal of Radiology, vol. 22(7) pp. 1110-1123
July 2021
[Owing to improvements in surgical techniques and medical care, living-donor liver transplantation has become an established treatment modality in patients with end-stage liver disease. However, various vascular or non-vascular complications may occur during or after transplantation. Herein, we review how interventional radiologic techniques can be used to treat these complications.]

Radiation Exposure

Prenatal radiation exposure in diagnostic and interventional radiology.
Fiebich M., Block A., Borowski M., Geworski L., Happel C., Kamp A., Lenzen H., Mahnken A.H. et al
RoFo, vol. 193(7) pp. 778-786
July 2021
[**Background**: The exposure of a pregnant woman to X-rays is an event that can cause uncertainty for all concerned. This review provides guidance on how to assess such a situation and how to determine the dose to the unborn child. In general, the use of X-rays in pregnant women in radiology should be avoided. If possible, alternatives should be used, or examinations postponed to a time after the pregnancy. This review gives a summary of the procedure for determining the radiation exposure of a pregnant woman. **Method**: Based on the previous report of 2002 and the literature on prenatal radiation exposure published thereafter, the DGMP/DRG report on the procedure for the assessment of prenatal radiation exposure was adapted to the current state of science and technology. **Results:** Typically, only relatively low radiation exposures of less than 20 mSv occur for the unborn child in X-ray diagnostics in the vast majority of cases. At these dose level the additional risk of damage to the embryo or fetus caused by the radiation is low and therefore only a rough conservative estimate using tabulated values are made. Only in a few types of examination (CT and interventional radiology) higher doses values might occur in the uterus. Instead of dose estimates (step 1 in the two-step model) in these cases the calculation of dose (step 2) are required and further action by the physician may be necessary. **Conclusions:** During the assessment, it is useful to initially use simple conservative estimation procedures to quickly determine whether a case falls into this large group less than 20 mSv, where there is a very low risk to the unborn child. If this is the case, the pregnant woman should be informed immediately by the doctor who performed the examination/treatment. This avoids a psychological burden on the patient. The DGMP/DRG report suggests a relatively simple, clearly structured procedure with advantages for all parties involved (physician, medical physics experts, MTRA and patient). **Key points** · The DGMP/DRG report on prenatal radiation exposure describes the procedure for calculating radiation exposures and the associated risks for the unborn child. · Using the two-step model, only a simple assessment based on the first step is necessary for most prenatal radiation exposures. · With the given tables it is possible to estimate individual risks for the unborn child taking into account the radiation exposure. · Only in the rare case that the first estimate results in a uterine dose larger 20 mSv a more accurate calculation is necessary.]

Recommendations for the use of active personal dosemeters (APDs) in interventional workplaces in hospitals.
O'Connor U., Carinou E., Clairand I., Ciraj-Bjelac O., De Monte F., Domienik-Andrzejewska J., Ferrari, P. et al
Physica Medica, vol. 87 pp. 131-135
July 2021
[Occupational radiation doses from interventional procedures have the potential to be relatively high. The requirement to optimise these doses encourages the use of electronic or active personal dosimeters (APDs) which are now increasingly used in hospitals. They are typically used in tandem with a routine passive dosimetry monitoring programme, with APDs used for real-time readings, for training purposes and when new imaging technology is introduced. However, there are limitations when using APDs. A survey in hospitals to identify issues related to the use of APDs was recently completed, along with an extensive series of APD tests by the EURADOS Working Group 12 on Dosimetry for Medical Imaging. The aim of this review paper is to summarise the state of the art regarding the use of APDs. We also used the results of our survey and our tests to develop a set of recommendations for the use of APDs in the clinical interventional radiology/cardiology settings, and draw attention to some of the current challenges.]

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