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Commentary

As diagnostic imaging becomes the single largest source of manmade radiation exposure to humans, (contributing more than all the nuclear power plants and atomic weapon tests put together) it is important for us radiologists to understand the implications of this exposure and to try and limit the potential harm that may come from it. Mulvihill et al review the available data on risk of subsequent cancer development after childhood exposure to diagnostic ionizing radiation. The data so far seems to suggest that the risk is small but the quality of the data is questionable and further work is needed to refine our understanding of this. They suggest strategies to limit this exposure in the highest risk areas.

On a similar note Kithara et al followed over a 100,000 radiographers over almost a 30 year period to determine the incidence of malignant brain tumours in this cohort. Despite absorbed doses as high as 290mGy the risk of malignant brain neoplasm was similar to the general population. This is reassuring to the professionals for whom this is an occupational hazard.

Jia et al report the findings of the meta analysis of Radio Frequency Abalation (RFA) vs surgical resection for hepatocellular carcinoma. Their findings that RFA has similar outcomes to surgical resection for the operators in Pakistan given the burden of viral hepatitis and the incidence of HCC in the country. With the increasing awareness there is anecdotal evidence that more tumours are being picked up at an early stage because of the surveillance strategies. RFA is increasingly becoming available throughout the country and is proving to be cost effective, safe and efficacious in this scenario.

Another common scenario in every day radiology is an incidentally found complex renal cyst. As soon as Bosniak grade of III or higher is assigned to them there is a tendency among urologists to excise them. Mousassian et al's findings seem to suggest that this may not be entirely justified. In their series although the majority of the excised lesion were malignant, they were low grade lesions with a longitudinal stability during the follow up period. It may be justified to just watch these lesions with periodic scans rather than offering surgery upfront.

Artificial Intelligence (AI) and Machine Learning (ML) are set to revolutionise radiology like no other technology has done in the past. AI and ML have the potential of being truly disruptive technologies hen it comes to image interpretation. This has led to pessimism regarding the future of radiologists in some circles. I am of the belief that used appropriately AI will make radiologists better and more capable rather than redundant. Dreyer and Geis also broadly agree with this view of the future. AI and ML are here. Radiology needs to embrace them rather than be afraid of them.

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David J. Mulvihill, Sachin Jhawar, John B. Kostis, Sharad Goyal

Diagnostic Medical Imaging in Pediatric Patients and Subsequent Cancer Risk

The use of diagnostic medical imaging is becoming increasingly more commonplace in the pediatric setting. However, many medical imaging modalities expose pediatric patients to ionizing radiation, which has been shown to increase the risk of cancer development in later life. This review article provides a comprehensive overview of the available data regarding the risk of cancer development following exposure to ionizing radiation from diagnostic medical imaging. Attention is paid to modalities such as computed tomography scans and fluoroscopic procedures that can expose children to radiation doses orders of magnitude higher than standard diagnostic x-rays. Ongoing studies that seek to more precisely determine the relationship of diagnostic medical radiation in children and subsequent cancer development are discussed, as well as modern strategies to better quantify this risk. Finally, as cardiovascular imaging and intervention contribute substantially to medical radiation exposure, we discuss strategies to enhance radiation safety in these areas.

American Journal of Roentgenology 2017; 208: 1278-84

Cari M. Kitahara, Martha S. Linet, Stephen Balter, Donald L. Miller, Preetha Rajaraman, Elizabeth K. Cahoon, Raquel Velazquez-Kronen, Steven L. Simon, et. al.

Occupational Radiation Exposure and Deaths From Malignant Intracranial Neoplasms of the Brain and CNS in U.S. Radiologic Technologists, 1983–2012

OBJECTIVE: Childhood exposure to acute, high-dose radiation has consistently been associated with risk of benign and malignant intracranial tumors of the brain and CNS, but data on risks of adulthood exposure to protracted, low-to-moderate doses of radiation are limited. In a large cohort of radiologic technologists, we quantified the association between protracted, low-to-moderate doses of radiation and malignant intracranial tumor mortality.

MATERIALS AND METHODS: The study population included 83,655 female and 26,642 male U.S. radiologic technologists who were certified for at least 2 years as of 1982. The cohort was followed from the completion date of the first or second survey (1983–1989 or 1994–1998) to the date of death, loss to follow-up, or December 31, 2012, whichever was earliest. Occupational brain doses through 1997 were based on work history, historical data, and, for most years after the mid 1970s, individual film badge measurements. Radiation-related excess relative risks (ERRs) and 95% CIs were estimated from Poisson regression models adjusted for attained age and sex.

RESULTS: Cumulative mean absorbed brain dose was 12 mGy (range, 0–290 mGy). During follow-up (median, 26.7 years), 193 technologists died of a malignant intracranial neoplasm. Based on models incorporating a 5-year lagged cumulative brain dose, cumulative brain dose was not associated with malignant intracranial tumor mortality (overall ERR per 100 mGy, 0.1; 95% CI, < -0.3 to 1.5). No effect modification was observed by sex or birth cohort.

CONCLUSION: In this nationwide cohort of radiologic technologists, cumulative occupational radiation exposure to the brain was not associated with malignant intracranial tumor mortality.

Clinical Radiology 2017; 72(12): 1066-75

J.B. Jia, D. Zhang, J.M. Ludwig and H.S. Kim

Radiofrequency ablation versus resection for hepatocellular carcinoma in patients with Child–Pugh A liver cirrhosis: a meta-analysis

AIM: To evaluate whether radiofrequency ablation (RFA) or surgical resection (RES) has superior overall survival (OS) and disease-free survival (DFS) in patients with hepatocellular carcinoma and Child-Pugh class A liver cirrhosis.

MATERIALS AND METHODS: Meta-analysis was used to compare 1-, 3-, and 5-year OS and DFS between RFA and RES. Those studies meeting inclusion criteria and published prior to 1 June 2015 were included. The odds ratio (OR) was used as the treatment effect measure. A priori defined sensitivity analyses of study subgroups was performed.

RESULTS: Fifteen studies were included in this analysis. Subgroup analyses based on predetermined patient characteristics were performed to minimise bias. No difference in 1-year OS, 3-year OS, and 3-year DFS was found in analyses limited to studies where patients were equally eligible for both therapies. There was also not a significant difference in OS and DFS between RFA and RES when studies were limited to those with only solitary tumours or tumours <3 cm.

CONCLUSION: The data suggest the equivalence of RFA and RES in patients with solitary tumours <3 cm and good liver status based on Child–Pugh score.

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Pedro N. Mousessian, Fernando I. Yamauchi, Thais C. Mussi and Ronaldo H. Baroni

Malignancy Rate, Histologic Grade, and Progression of Bosniak Category III and IV Complex Renal Cystic Lesions

OBJECTIVE: The primary purpose of this study is to determine the malignancy rate, histologic grade, and initial stage of surgically treated complex renal cysts classified as Bosniak category III or IV. For nonsurgical lesions, a secondary objective was to evaluate lesion progression on follow-up examinations.

MATERIALS AND METHODS: We searched our database for cystic lesions classified as Bosniak III or IV category on CT or MRI from January 2008 to April 2016. Surgically resected lesions, per category, were correlated with information on pathologic reports to obtain malignancy rates. For malignant lesions, histologic grade and initial stage were evaluated. Imaging follow-up of at least 2 years was used to evaluate progression of clinically followed lesions.

RESULTS: We included 86 lesions in 85 patients in the final analysis. Of the 60 surgically resected lesions (70%), 46 (77%) were malignant and 14 (23%) were benign. Malignancy rates were 72% for Bosniak category III lesions and 86% for Bosniak category IV lesions. Most malignant cysts were early-stage (pT1) cysts with low histologic grades (89% of Bosniak III lesions and 91% of Bosniak IV lesions). Follow-up studies of the surgically resected lesions did not show local recurrence, metastasis, or lymph node enlargement. Among patients with lesions managed by watchful waiting (n = 26), all lesions remained unchanged in terms of size and complexity after at least 2-years of follow-up.

CONCLUSION: Although high malignancy rates were

observed for both Bosniak category III and IV lesions, our results suggest that such malignant cysts are usually early-stage tumors with a low histologic grade. Lesions that underwent follow-up remained unchanged on control examinations. These findings may indicate low aggressiveness of these lesions, supporting the idea that more conservative approaches may be used

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Keith J. Dreyer and J. Raymond Geis

When Machines Think: Radiology's Next Frontier

Artificial intelligence (AI), machine learning, and deep learning are terms now seen frequently, all of which refer to computer algorithms that change as they are exposed to more data. Many of these algorithms are surprisingly good at recognizing objects in images. The combination of large amounts of machine-consumable digital data, increased and cheaper computing power, and increasingly sophisticated statistical models combine to enable machines to find patterns in data in ways that are not only cost-effective but also potentially beyond humans' abilities. Building an AI algorithm can be surprisingly easy. Understanding the associated data structures and statistics, on the other hand, is often difficult and obscure. Converting the algorithm into a sophisticated product that works consistently in broad, general clinical use is complex and incompletely understood. To show how these AI products reduce costs and improve outcomes will require clinical translation and industrial-grade integration into routine workflow. Radiology has the chance to leverage AI to become a center of intelligently aggregated, quantitative, diagnostic information. Centaur radiologists, formed as a synergy of human plus computer, will provide interpretations using data extracted from images by humans and image-analysis computer algorithms, as well as the electronic health record, genomics, and other disparate sources. These interpretations will form the foundation of precision health care, or care customized to an individual patient.