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Radiological Pathology

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Short commentary

Pathology and radiology have become pivotal in the clinical practice of daily medicine. Diagnostic radiology and pathology are indeed indispensable wheels of medical practice. Clinicians achieve tentative diagnoses based on laboratory data and medical images in addition to their physical findings and patient medical history. Based on all available findings and on patient characteristics, clinicians finally decide on further therapeutic management strategies, including medical and surgical therapies. Medical images are interpreted and reported by radiologists, yet with current hospital-wide image distribution and viewing systems (PACS) images are immediately and largely available for second reading and interpretation by clinicians. The majority of clinicians consider pathology as the ultimate reference for final diagnosis of many diseases. Radiologists will admit that pathology correlation allows quality control and peer review, and that correlation improves radiology training and expertise. This explains why articles on radiological pathological correlation still remain very popular in medical journals.

Communication between interventional radiologists and pathologists is essential for appropriate handling of biopsy specimens to obtain 'more' information from 'less' material [1,2]. Radiological imaging studies are essential in many instances for visualization of morphological and functional abnormalities and largely contribute to tailored (personalized) patient management. Some examples will illustrate this statement. In a patient with multisegmental liver metastases, partial resection is not indicated and an alternative treatment option is required. In this case radiological diagnosis is crucial and plays an essential role not only for accurate diagnosis and staging of this potentially multisegmental liver pathology. Imaging methods of detection and characterization of focal liver lesions including liver metastases are rapidly progressing due to the marked development of diagnostic imaging tools, equipment and contrast media. For decades CT was the preferred diagnostic modality for diagnosis of liver metastasis. At present, however, MRI (Magnetic Resonance Imaging) has even stronger capabilities with new sequences (i.e. diffusion weighted imaging) and newer contrast media to reliably detect and characterize focal liver lesions, even including subtypes of hepatocellular carcinoma [3,4]. It must be clear that the scanning procedure largely depends on the clinical indication and the radiological question to be answered. Some MR contrast media are better suited for the examination of neurologic disorders and gynecological disease processes. It is likely that this evolution will be largely influenced by hybrid imaging techniques where functional and molecular imaging is fused with simultaneous acquisition of high-quality MR images (PET-MRI).

It is true that in many cases the final diagnosis of a disease is made by pathologists by analysis of a biopsy or surgical specimen. Autopsy is the ultimate tool for pathologists to reveal unexpected disease processes. Virtual autopsy (Autopsy imaging) based on whole-body CT may guide the pathologist in targeted autopsy or, in some instances, can avoid autopsy. For some subsets of diseases, pathologists correlate their findings with radiological imaging studies. Dahlin, for example, edited a textbook on pathology of bone tumors, with comprehensive correlation with radiological imaging studies [5].

During my residency training, I learned that in a number of cases the radiological diagnosis largely approached the final pathological diagnosis or pathophysiology, yet a final histological diagnosis was still required for confirmation. A few examples will illustrate this.

Good et al. reported in 1953 that about 50% of resected pulmonary nodules without calcification on plain chest x-ray films were malignant by correlating the cases with pathology [6]. This increased to 55% if adenomas (28%) were added to bronchogenic carcinomas, metastases and fibrosarcomas. The rest of the lesions were benign, although the authors did not exclude rare cases of calcified nodules harboring malignancy. Based on these correlations of chest x-rays and pathology, Good et al. concluded that a pulmonary nodule with calcification or an unresectable nodule without calcification should be followed up [6,7].

The absence of calcification in pulmonary nodules as a predictor of malignancy was further studied by Siegelman using CT [8], showing a strong suspicion of malignancy of a pulmonary nodule with attenuation numbers less than 164 Hounsfield units. CT attenuation numbers of more than 164 Hounsfield units suggested benign lesions.

Pugh had already in 1951 observed that loss of lamina dura in dental roentgenograms was an additional finding to subperiosteal resorption of bone in the phalanges in case of primary or secondary hyperparathyroidism [9]. He stressed the importance of both findings and concluded that they were pathognomonic of these two diseases. This is an example of radiological findings reflecting pathophysiology.

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Even back in 1910, Schwarz clarified the shadow around the heart on chest x-rays as the fat pad surrounding the pericardium (epipericardial fat pad) by correlating the chest x-rays with autopsy findings [10].

Personally, I had strong interest in correlation of medical images including x-ray films, ultrasonography, CT, angiograms and MRI with pathology. Correlation with pathology of fibro-osseous lesions of the jaw on roentgenograms were demonstrated [11]. Collaboration with a pathologist resulted in an article on correlation of the pathology and imaging of Thorotrast deposition in tissues [12].

With newer imaging modalities and software packages, quantification of imaging data becomes feasible with standardized reporting. Correlation of these parametric studies with pathology (and genetics) in big data bases would allow physicians to predict the final histological diagnosis based on imaging studies, which will be useful in patients where tissue specimens are difficult to obtain (brain tumors, small lung nodules, …) or in follow up (so called radiomics) [13-16]. Likewise, with digitation of pathology, images of gross pathology and microscopic specimens will become available hospital wide and, as for radiology, images will be separated from the report. Many clinicians now subspecialists in interpretation of radiological imaging studies, will gain experience and expertise in pathology interpretation too.

In summary, collaboration between radiologists and pathologists is of mutual interest and ultimately beneficial for improvement of patient care.

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