

## The autopsy as the cornerstone for education and research in cardiology

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In the era of advanced techniques of medical imaging, it is becoming increasingly difficult to support the role of the traditional autopsy in the diagnosis of diseases, including those of the cardiovascular system.

But for those devoted to the study of cardiovascular pathology there is no doubt about the quantity and quality of information that autopsies can provide other than the gross evaluation of the heart and vessels.

Two examples of such important contribution became evident from the analysis of two cases published in the current issue of *Autopsy & Case Reports*.<sup>1,2</sup> The two of them had an inflammatory commitment of the myocardium as the main condition leading to death. One case probably represents a viral myocarditis in a child and the other a complication of drug intake in the form of hypersensitivity myocarditis. On both occasions, the careful gross and histological postmortem examinations of the heart were fundamental to the understanding of the patients' evolution and correlation with the clinical findings. They brought also relevant contribution to the education of the clinical teams about the possible recognition of the primary myocardial diseases prior to death and on how to manage the patients.

Presently, there is no substitute for autopsy when we consider the precise sampling of lesions, especially in the heart, which topographic anatomy requires full understanding of the intrinsic morphology of subsystems like valves, coronary arterial system and specialized tissues for the conduction of the

electrical stimulus. Regardless of the high resolution of cardiovascular imaging and even the possibility of 3-dimensional printing of hearts from the magnetic resonance or computerized tomography images, the direct examination of the anatomical specimens is still the gold standard.

While, nowadays, virtual histology is just a promising method of image analysis, new conditions and diseases are continuously being described based on the detailed microscopic examination of vessel walls and the myocardium. A good example of such discovery is the recent recognition of medium-sized and large vessels involvement in the so-called IgG4 related diseases. A careful study of an obstructed coronary artery in a case originally attributed to ordinary coronary atherosclerosis, gives the perspective of a systemic disease to be looked for in selected cases as described by Gutierrez et al.<sup>3</sup>

The impact of autopsy in education deserves to be discussed in detail. Not just the immediate correlation obtained from the cases clinically studied, but also the analysis of stored specimens is essential in the education of clinicians, surgeons, imaging professionals and pathologists.

In a tertiary Cardiology center and University hospital, a study aimed at analyzing the discrepancy between clinical and autopsy diagnoses<sup>4</sup> depicted a concordance rate of 71.1% for acute myocardial infarction, 75% for aortic dissection, 73.1% for infective endocarditis and 35.2% for pulmonary embolism.

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Considering a previously published categorization,<sup>5</sup> major discrepancies that were not clinically identified and having potential adverse effect on survival were found in 30% of the cases. It is unequivocal the value of such findings when we consider that residents and doctors in training were able to learn from the discrepancies detected.

Another study investigated the role of the autopsy in the modern undergraduate medical curriculum in the United Kingdom, based on interviews with medical educators. Along with the discussion about the pros and cons of autopsy during medical education, it was generally felt that students should be exposed to autopsies, but the interviewees provided alternatives such as video-conferences, demonstrations and the study of museum specimens.<sup>6</sup> In this regard, tribute has to be paid to the great pioneer of education in Cardiology, Dr. Maude Abbott, one of the first women to attend McGill University in Canada, who worked in the early 1900s. She devoted herself to the study and categorization of congenitally malformed hearts but, more importantly, organized in 1906 the International Association of Medical Museums.<sup>7</sup> Her demonstrations of malformed hearts together with her didactical drawings and efforts to correlate with the existing methods of diagnosis called the attention of the international community and inspired doctors to study the congenital heart defects. Since then, demonstration of anatomical specimens has been an essential tool in the education of pediatric cardiologists and cardiac surgeons.

In 2007, we tried to answer the question about the role of cardiac autopsy in the recent years and also the reasons for the decline in their numbers over the time.<sup>8</sup> We recognized that autopsy may be considered expensive and that hospital administrators must be convinced that information obtained from autopsies improves the quality of health care. Moreover, we acknowledged the value of the existing anatomical archives all over the world for the purpose of education and research in Cardiology. In fact, in a recent publication, the need to maintain and preserve such precious specimens through three-dimensional digital imaging was stressed by the International Society for Nomenclature of Paediatric and Congenital Heart Disease.<sup>9</sup> Using technologies of scanning and three-dimensional printing it is now possible to produce replicas of the original specimens. These

techniques are of course also available for the study of living patients, but the grounds for the understanding of heart morphology and of precise image processing, at this moment continue to come from the experience obtained with anatomical specimens.

It is impressive to recognize how the recent advances in imaging can allow us to observe structures of the heart which up to now were exclusively examined by histology. An example is the very recent publication by Shinohara et al, showing the structure and course of the cardiac conduction atrioventricular axis after the imaging of anatomical specimens by the technique of High-Resolution Phase-Contrast Computerized Tomography.<sup>10</sup> This new development has come a long way, but has farther yet to go, and surely will depend on the correlation with histological findings.

Finally, a word about the "minimally invasive autopsy",<sup>11</sup> a resource that combines imaging technologies with minimal histological sampling: it is probably the goal to be sought by both pathologists and imaging professionals. Perhaps for the cardiovascular system, especially for the heart as previously explained and based on its complex three-dimensional structure, this combination of techniques will not reach excellence as for the solid organs in a short period of time. But it will be certainly achieved, with the fundamental contribution of pathologists and the knowledge harvested from autopsies.

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