Should the autopsy be allowed to become obsolete?

Elena Ladich, Allen Burke and Renu Virmani

The rate of autopsy in the USA has fallen to less than 5% of hospital-based deaths. Many factors have contributed to this decline, including the confidence of physicians in new investigative tools for *in vivo* diagnosis and assessment of disease progression.

We believe that the autopsy remains a vital tool for quality control and for the assessment of new laboratory technologies, and fear that some of the justifications for the decline in autopsies are misguided. Let us take the example of coronary artery disease, for which autopsy remains a critical tool that cannot be replaced by *in vivo* studies. The majority of patients presenting with acute coronary events have plaque rupture. The *in vivo* identification of the precursor lesion, the vulnerable plaque, is not yet a reality. Detailed autopsy studies have identified the pathologic features of the vulnerable plaque, which include a large, lipid-rich, necrotic core and a thin fibrous cap (<65 μm) infiltrated by macrophages. High-resolution imaging of atherosclerotic plaque morphology is, therefore, essential for identifying coronary plaques that cause acute coronary events.

In the past few decades many imaging techniques beyond traditional angiography have emerged, but none has acquired the resolution necessary for identification of the thin-cap fibroatheroma. These modalities include intravascular ultrasonography (IVUS), coronary CT angiography, MRI and, most recently, optical coherence tomography (OCT). IVUS is an invasive technology for the imaging of coronary arteries, with a resolution close to 300 μm . This technology has the ability to resolve plaque characteristics, such as fibrous tissue, lipid core and calcium, but cannot identify the thin fibrous cap, macrophages or thrombus. Color coding of IVUS (i.e. virtual histology) is based on histologic characterization of human

We believe that the autopsy remains a vital tool for quality control and for the assessment of new laboratory technologies

plaque determined at autopsy, but the technique has yet to prove its usefulness. Multislice CT has emerged as an alternative to invasive angiography. Multislice CT has a high negative predictive value for clinically significant coronary artery disease, but is limited because of the constant motion of the heart and a resolution higher than 500 μm . MRI is useful for the detection of carotid atherosclerosis, but cardiac motion, tortuosity of small blood vessels and a resolution of 500–700 μm limit its use in severe coronary atherosclerosis.

OCT is touted for its high-resolution (<10 μm) images. Identification of the thin fibrous cap and macrophages that correlates with pathologic sections has been reported *in vitro*. The limitations of OCT, however, include the need for a blood-free imaging zone and a shallow axial penetration of 2 mm. Also, discrimination between necrotic core and calcification can be difficult.

Are we to conclude that autopsy has been rendered obsolete because new technologies such as OCT have shown resolution almost to the level of light microscopy? OCT, despite showing promise, is not yet ready for mainstream use because of its many limitations. Invasive and noninvasive technologies have insufficient resolution and are in need of a gold standard. At present, histology is the reference method, and is likely to remain so for the near future. None of these technologies has been able to distinguish ruptured plaque from erosions; the latter cause thrombosis in at least 30% of people with acute coronary syndromes. An over-reliance on imaging techniques alone will yield a limited view of coronary artery disease. Rather, ongoing communication between clinicians and pathologists must continue to maximize our understanding of deaths resulting from coronary artery disease.

E Ladich is a staff pathologist, A Burke is the Deputy Director and R Virmani is the Medical Director at CVPPath, International Registry of Pathology, Gaithersburg, MD, USA.

R Virmani is also an Advisory Board member of Nature Clinical Practice Cardiovascular Medicine.

Competing interests

The authors declared they have no competing interests.

www.nature.com/clinicalpractice
doi:10.1038/ncpcardio0581