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TECHNICAL NOTE

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The UV hand lamp as a helpful instrument for macroscopic visualisation of myocardial fibrosis during autopsy

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Abstract The application of ultraviolet light in forensic practice is a well-tested method to visualise traces or skin alterations. When viewing myocardial sections under UV light at autopsy, bluish-white fluorescent areas became visible that could not be detected in the seemingly homogenous myocardium in daylight. A systematic comparison of the macroscopic cardiac findings and the pertinent histological sections showed that in all cases with a positive UV fluorescence myocardial fibrosis or lipomatosis could be confirmed by histological methods. The examination for UV fluorescence of the myocardium seems to be a simple and rapid method improving the macroscopic perceptibility of fibrotic changes and minor scars.

Key words Ultraviolet light · UV fluorescence · Myocardium · Autopsy

Introduction

According to the literature, between 15 and 55% of cases undergoing forensic autopsy can be categorised as sudden and unexpected deaths from natural internal causes. In up to 80% of these cases death is found to have been caused by diseases of the cardiovascular system, mostly coronary artery disease [1, 2, 3]. Morphological signs pointing to a chronic myocardial ischemia may be stenosis of the coronary arteries, but also fibrosis of the myocardium. Whereas coarse patches of myocardial fibrosis or scars resulting from infarction can be easily detected by macroscopic inspection, minor degrees of interstitial fibrosis may be indiscernible to the naked eye and can often be diagnosed only by histological examination.

When inspecting the section of a heart with an extensive infarction scar under ultraviolet light, a bluish-white fluorescence with sharp demarcations could be distinguished from the unchanged myocardium (Fig. 1). This observation induced us to perform systematic studies in order to determine whether UV fluorescence tests could be suitable as a screening method for the detection of myocardial fibrosis.

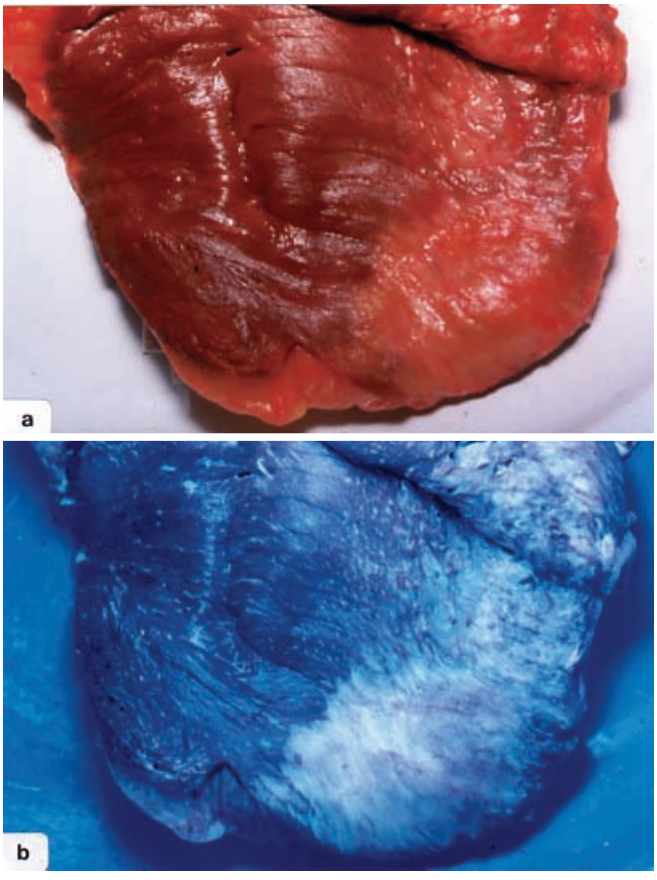

Fig. 1 Intramural section of a heart with a scar after extensive myocardial infarction, as visible under illumination with **a** daylight and **b** longwave ultraviolet radiation

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Material and methods

UV fluorescence tests were performed on the hearts of 30 individuals who had died from cardiac causes (16 males and 14 females aged between 25 and 87 years) and on a control group of 50 unnatural deaths (30 males and 20 females aged between 18 and 86 years).

After making intramural cuts through the myocardium of the left ventricle the sections were evaluated firstly under normal light and the macroscopically visible alterations were described. Then the autopsy room was darkened and the myocardium was inspected under UV light (UV hand lamp, 2 × 4 W, wave range 320–400 nm, Roth, Karlsruhe, Germany). Where fluorescent areas became visible, these were described as to their localisation, shape and density and documented by photographs. Tissue samples of the myocardium were removed from sites with positive fluorescence, for histological examination and stained with haematoxylin-eosin (HE) and chromotrop aniline blue (CAB).

Results

In 26 out of the 80 cases (33%) the myocardial sections did not show any pathological findings when viewed in daylight, whereas under UV light bluish-white fluorescent areas became visible (Fig. 2). In a further 31 cases fibrosis could be detected with the naked eye. The fibrotic changes were also discernible under UV light but with sharper demarcations from the surrounding myocardium (Fig. 1). In the remaining 23 cases macroscopic inspection did not reveal any pathological findings of the myocardium either in daylight or under UV light.

In all cases in which fluorescent areas could be detected under UV light in the myocardium, these correlated with connective tissue and/or fatty tissue on histological examination. In seven cases (9%) microscopic examination showed small patches of myocardial fibrosis, which had not been visible under UV light. The localisation of the connective tissue was primarily perivascular and partly very thin, streaky or net-shaped.

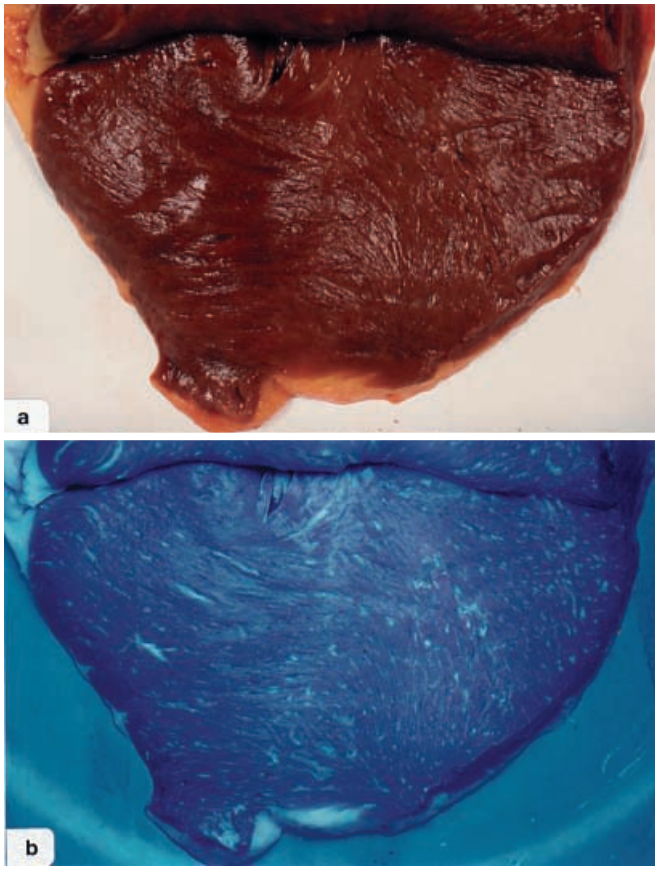

Fig. 2 **a** Intramural cut showing a homogeneous myocardium with no obvious signs of fibrosis (illuminated by daylight). **b** Same area with numerous small bluish-white fluorescent areas visible under illumination with ultraviolet radiation indicating punctiform perivascular fibrosis

Discussion

UV fluorescence has been well known for a long time and is used for various forensic applications such as detection of semen or saliva, approximate dating of skeletal remains and visualisation of latent fingerprints [1, 4, 5, 6, 7]. In our study it was found that in all cases in which connective or fatty tissue could be detected in the myocardium even in daylight, these findings became more intensive under UV light. In addition fluorescent areas could be identified in the myocardium that had not been visible in daylight in approximately one-third of the cases. Histologically these areas correlated with myocardial fibrosis and/or lipomatosis. While there were no false positive fluorescence results, histologically confirmed myocardial fibrosis was found in about 9% of the cases, which had not been discernible either in daylight or under UV light. Acute myocardial infarctions, which were characterised by a demarcated area yellowish in colour, did not become more intensive under ultraviolet light.

At the Freiburg Institute of Legal Medicine every autopsy now includes the examination of the myocardium for UV fluorescence on a routine basis. We consider it a simple and rapid method supplementing the macroscopical examination. The occurrence of false negative results shows, however, that the demonstration of UV fluorescence is only a screening method and cannot replace a thorough histological examination of the myocardium.

References

1. Knight B (1996) Forensic pathology, 2nd edn. Arnold, London Sydney Auckland, pp 47–49, 128–130, 487–504
2. Ramos V, Valenzuela A, Villanueva E, Miranda MT (1997) Antioxidant-related enzymes in myocardial zones and human pericardial fluid in relation to the cause of death. Int J Legal Med 110: 1–4
3. Osuna E, Pérez-Cárceles MD, Alvarez MV, Noguera J, Luna A (1998) Cardiac troponin I (cTn I) and the postmortem diagnosis of myocardial infarction. Int J Legal Med 111: 173–176
4. Stoilovic M (1991) Detection of semen and blood stains using polilight as a light source. Forensic Sci Int 51: 289–296
5. Springer E, Almog J, Frank A, Ziv Z, Bergman P, Gui Qiang W (1994) Detection of dry body fluids by inherent short wavelength UV luminescence: preliminary results. Forensic Sci Int 66: 89–94
6. Lynnerup N, Hjalgrim H (1995) Routine use of ultraviolet light in medicolegal examinations to evaluate stains and skin trauma. Med Sci Law 35: 165–168
7. Bramble SK, Creer KE, Wang GC (1993) Ultraviolet luminescence from latent fingerprints. Forensic Sci Int 59: 3–14