THE OPHTHALMOSCOPIC EVIDENCE OF DEATH

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It is not easy to be certain of death in a person immediately after the event. The usual advice is :—

1. To listen carefully with the stethoscope for at least five minutes all over the chest, especially in the region of the heart, for any sound of heart-beats.

2. Tie a finger with a ligature, being careful not to stop the circulation altogether and watch for the change and possible swelling of the peripheral part (Magnus's sign.)

3. Inject fluorescein and, if the circulation still persists, the neighbouring skin will stain deep yellow.

There are many other good suggestions to be found in text-books the best being to cut a small artery and to watch for a jerky flow of blood. In the fundi the usually described signs immediately after death are :—

- (a) The change of the usual yellowish-red colour to a yellowish-white ;

- (b) The emptiness of the vessels on the disc and near it in contrast with peripheral vessels still filled with blood ;

- (c) Pneumatosis (bubbles of air) in the veins of the retina.

During the last few years I have had several opportunities of seeing cases immediately or very soon after death. In the majority of these cases I was familiar with the appearance of the fundi during life, a few I had seen shortly before and again after death. The ophthalmoscopic examination of the eye after death is exceedingly simple.—The pupil is dilated, the media are clear. By gentle pressure on the eye-ball immediately after the circulation has ceased one can make the veins and then the arteries collapse on the retina near the disc, but, of course, in contrast to the living eye, no venous or arterial pulse appears. The same applies to the disc. And in my opinion it is an infallible and easily elicited sign of death.

In my experience, in persons *not suffering from aortic regurgitation*, within one or two minutes after death the disc becomes pale, but the retina remains rosy, the arteries are not changed, but the veins are somehow more flat. Arterio-venous compression is still preserved on the retina and the disc. Later, the disc grows dead-white, the retina more rosy ; the arteries become thinner and the

veins more blackish, but not tortuous (in the living increased blackness is usually accompanied by an increase in tortuosity) the vessels on the disc are nearly empty, but still visible. After that (15-20 minutes) the blood column in the arteries begins to break up, first of all on the retina near the disc and at the points of arterio-venous compression. The retina is paler, but still rosy. Still later (1-2 hours) the retina is white, the media become more hazy, but some of the large arteries are still visible on the retina as slightly dark-red lines, interrupted in places. The same applies to the veins, but they are less visible. I never saw early bubbles of air in the veins, contrary to the statement in many text-books.

The explanation of all these phenomena seems to me to be in the loss of muscular tonus of the arteries and of the heart. Supposing that the body is lying in the usual position—with the head and shoulders slightly raised on a pillow—the blood will collect in the venous cerebral sinuses, carotids, aorta and heart. The capillaries of the disc, supplied from behind the lamina cribrosa (partly perhaps), may be less collapsible because of their strong perivascular membrane and containing little blood—will be emptied first. The retinal vessels have to drain more blood (from all the retina) and the lamina cribrosa will not allow a very free outflow—they will be emptied much more slowly. But the main factor will be the state of the aortic valve of the heart. Even in a normal person after death this will be partly open and the blood will trickle from the aorta and collect in the ventricle. The post-mortem state of the aortic valve together with the degree of the rigidity of the large vessels will, in my opinion, decide the quickness with which changes in the fundi occur. Perhaps the following fact will verify to some degree all the foregoing theories.

I saw a boy, aged 19 years, with an advanced aortic insufficiency (endocarditis rheumatica) 1-2 hours before his death and then again approximately 10 minutes after his respiration ceased. His retina was completely white with some rosy thick arteries still visible in places. The cornea was hazy and altogether his fundi 10-15 minutes after death presented the appearance, usually only seen in 1-2 hours after death in a person dying from any other condition.