11. Pathological Basis for Percutaneous Catheter and Balloon Revascularization

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Five years ago I histologically examined ten occluded segments of the superficial femoral artery, taken during saphenous vein bypass operation after application of percutaneous transluminal angioplasty (PTA) [2]. I have already indicated the dilating effect of PTA, which should become more evident using the balloon catheter. In order to demonstrate this, after application of the balloon catheter we examined ten additional segments of the superficial femoral artery, taken at autopsies on subjects of various ages and with different degrees of atherosclerosis.

We endeavored to answer the following questions:
1. Is any dilating effect apparent in microscopic sections after postmortem balloon catheter application?
2. Are there similar alterations of the vessel wall throughout life which are not to be attributed to the effect of PTA?
3. Are fibrous plaques and atheromas compressible by PTA?
4. Does PTA cause destruction of the vessel wall (mainly of the intima) which might lead to thrombosis in live patients?

In our 1978 publication a bulging effect of PTA, combined with a thinning of the media and forming of clefts between the layers of the intima or between intima and media, was shown [2]. Similarly, in these postmortem cases dilation of the lumen, thinning of the media, and cleavage of fibrous intima or cleavage between intima and media could be seen (Fig. 1). Dilation and cleavage were only missing in fibrous and rigid areas of several stenosed segments (Fig. 2). Atheromatous parts of the plaques were not compressible by PTA (Fig. 3). In this point I agree with Hempel [1], but I cannot confirm the findings of Leu and Grünstig [3]. Moreover, fibrous plaques also seem not to be compressible.

Thinning of the tunica media is a frequent finding resulting from loss of elasticity. It is apparent in advanced age and also beneath atherosclerotic plaques. It should not be mistaken in histopathological examinations for a stretch effect due to the balloon catheter.

In the cases presented here, no ruptures of the intima were seen which could have produced thrombosis during life. The clefts do not communicate with the lumen (Figs. 1 and 3). Thus these ruptures should not be regarded as an effect of PTA. Only in one case is a deeper tear of intima and media seen, and this was probably caused by application of the balloon catheter (Fig. 4). But this tear does not communicate with the lumen.
**Fig. 1.** Postmortem PTA by balloon catheter of the superficial femoral artery: dilation of the lumen, thinning of the media, clefts in the intima. A 76-year-old man. Elastica, × 14

**Fig. 2.** Postmortem PTA by balloon catheter of another segment of the same artery as Fig. 1, severely stenosed by a fibrous rigid plaque. No dilation of the lumen, no thinning of the media, no clefts in the intima. Elastica, × 14