Laminar Pattern of Mineral Calcium-Phosphorus Deposits in a Human Carotid Plaque
Nanoscale Ultrastructure and Elemental Analysis

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Atherosclerotic calcifications are related to poor prognosis and all-cause mortality in large population studies.1 Moreover, vascular calcifications are inversely associated with the potential reduction of plaque volume in regression studies during statin treatment, which suggests that more calcified lesions are less likely to undergo positive remodeling.2

Recently, it has been suggested that calcification is a tightly regulated process of mineralization akin to bone formation.3 In plaques, the deposits consist of a nonhomogeneous composite that contains hydroxyapatite mineral nanocrystals embedded in a collagenuous organic matrix, whereas at a nanoscale level, apatite crystals interact with cholesterol crystals. In this context, mineralization may result from a correspondence of calcium and phosphorus to laminar deposition. The presence of carbon, related to residual organic material, is displayed in different places with respect to the laminar deposits of calcifications. Thus, coupling at a nanoscale level the morphological images and elemental analysis in a human carotid plaque shows the deposition pattern of calcium and phosphorus and their relationship with lamination sheets.

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Disclosures
None.

References

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Figure 1. A, Longitudinal section of the carotid specimen visualized by scanning electron microscopy. The figure shows 2 areas of plaque formation within a thickened media layer. The arrow indicates the area shown at higher magnifications in panel B. B, Sheetlike deposits are visible within the media layer. Details are shown in the insets.

Figure 2. Section of atheromatous plaque showing laminar deposition of calcium phosphate microcrystal layers, with residual partially folded organic sheets.
Figure 3. Detail of laminar deposition of mineralization and corresponding energy-dispersive x-ray analysis maps of elemental analysis clearly shows colocalization of calcium (Ca) and phosphorus (P) within the laminations. Diffuse presence of carbon (C) indicates residual organic material displayed in different places with respect to the laminar deposition of calcifications.
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