

The inaccurate resolution of contemporary digital angiography, but not the anatomic complexity itself, primarily impairs the invasive evaluation of ostial coronary lesions

Ograniczona wartość rozdzielczości obrazowania współczesnej angiografii cyfrowej, a nie sama złożoność anatomii, sprawia, że angiograficzna ocena stopnia zwężenia ujść naczyń wieńcowych jest stale niedoskonała

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The quantitative evaluation of the severity of coronary stenosis is done in an angiographic view, in which the identified lesion makes the lumenogram narrowest. The degree of severity of the selected lesion (% diameter stenosis [%DS]) is assessed as the relative reduction of minimal lumen diameter (MLD) measured at the narrowest site of the identified lesion in relation to the diameter of the adjacent segment in which the lumen diameter is considered to be normal (reference site). A 70% lumen diameter reduction, corresponding to a 90% narrowing of its cross-sectional area, excludes the possibility of increasing the blood flow above its resting value. In real-life, everyday clinical practice a visual assessment of %DS is used, with the average difference between the two evaluations done by the same physician being 20%. Even after all workshop conditions of optimal coronary angiography are fulfilled, and using high-resolution angiographs (1024 × 10124 pixels) with dedicated digital callipers, in a substantial number of cases (~40%), physicians assess %DS in an ambiguous way (being unable to determine it precisely) and judge its value in the range ≥ 40% to < 70% (borderline lesion). The resolution describes the ability of an imaging system to distinguish objects that are close together. The Line-Pair Resolution Test Phantom consists of parallel lead strips separated by a distance equal to the width of the strips. The resolution quantifies how close the lines can be to each other and still be visibly distinguishable. The common practice is to describe the line width and separation distance in terms of line pairs (LP) per unit distance (mm). An imaging system is evaluated by imaging the test object and observing the minimum separation at which the separation of the lines is visible. Using the Line-Pair Resolution Test Phantom we quantified the actual resolution of the AXIOM Artis Siemens™ with a flat panel detector 1024 × 1024 pixels in size, showing the distinguishability of details being 2.8 LP/mm, signifying that the objects < 0.35 mm (350 μm) in size are undistinguishable (Fig. 1A). Furthermore, in a patient with borderline angiographic lesion of left anterior descending artery (LAD) ostium, two experienced interventionists measured MLDs at the same vessel location in the corresponding two orthogonal views and in the three following frames. It appeared that the relative variations in measured MLDs were as much as 36% (Fig. 2B). Only intravascular ultrasound (Galaxy™², 40 Mhz Atlantis SR Pro) gave a unique insight into the anatomy of the LAD ostium (Fig. 1C). The limited visual resolution of contemporary angiographs, but not the anatomic complexity itself, primarily impairs the invasive evaluation of ostial coronary lesions.

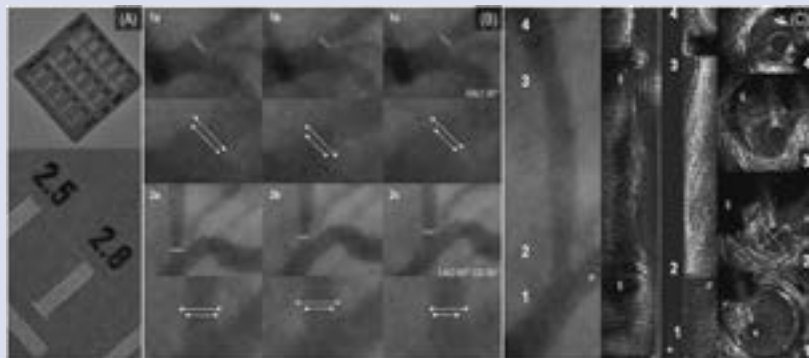


Figure 1. Radiopaque numbers indicate the resolution of each group in line pairs/mm (A). Minimal lumen diameter measurements done in borderline lesion of left anterior descending artery (LAD) ostium assessed with two orthogonal projections (RAO 30°, LAO 60°, CD 30°), displayed are the three following frames taken at the speed of 15 frames/s, selected within the narrowest lumenogram (1a-c, 2a-c, respectively) (B). An intravascular ultrasound (IVUS) (Galaxy™², 40 Mhz Atlantis SR Pro) allowed precise LAD ostium evaluation (C). Displayed angiographies are recorded in 1024 × 1024 resolution (B, C); * — IVUS transducer; & — atherosclerotic plaque (double tipped arrows indicate min & max lumen diameters); # — left circumflex artery take-off

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