



# Role of imaging in vascular calcifications evaluation in CKD patients

- *RENART project* -

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# Vascular disease in CKD

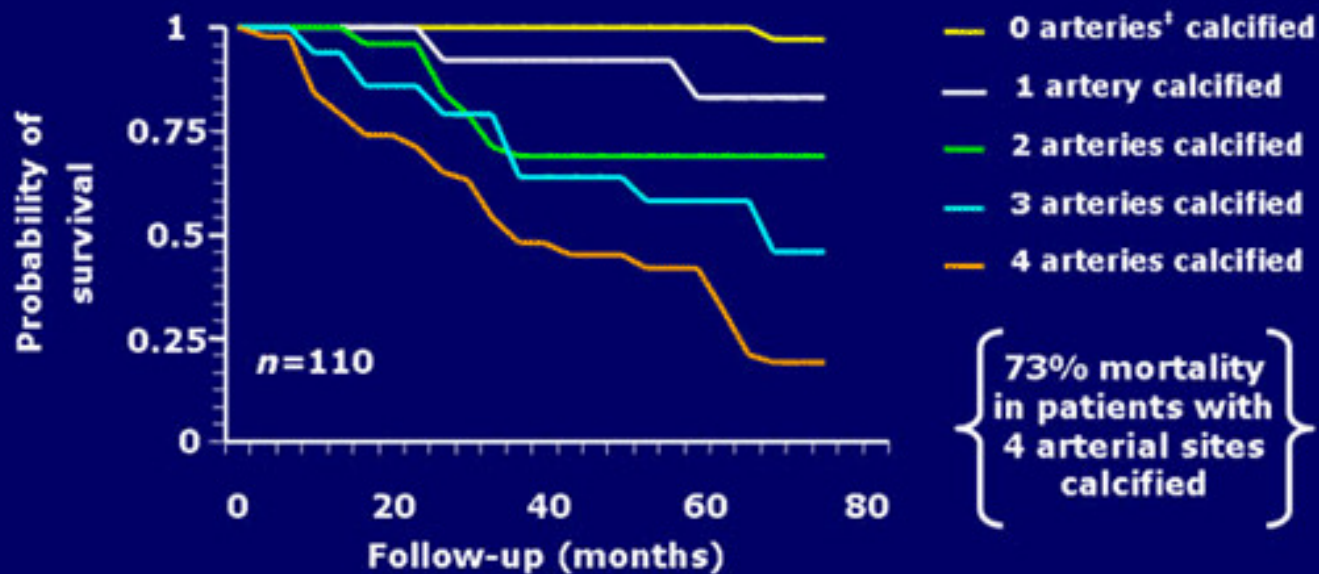
- **CKD-MBD syndrome**
  - biochemical disturbances
  - bone abnormalities
  - extraskeletal calcifications
- **Prevalence of vascular calcifications in CKD**
  - increases with progressively decreasing kidney function
  - is greater than that in the general population

## Vascular disease in CKD

- Detection of vascular calcification at baseline and vascular calcification progression can identify patients at risk of major adverse events and
- The presence of vascular/valvular calcification should be regarded as a complementary component to be incorporated into the decision making of how to individualize treatment of CKD-MBD syndrome

# Vascular disease in CKD

## Arterial Calcification<sup>†</sup> Increases Mortality Risk

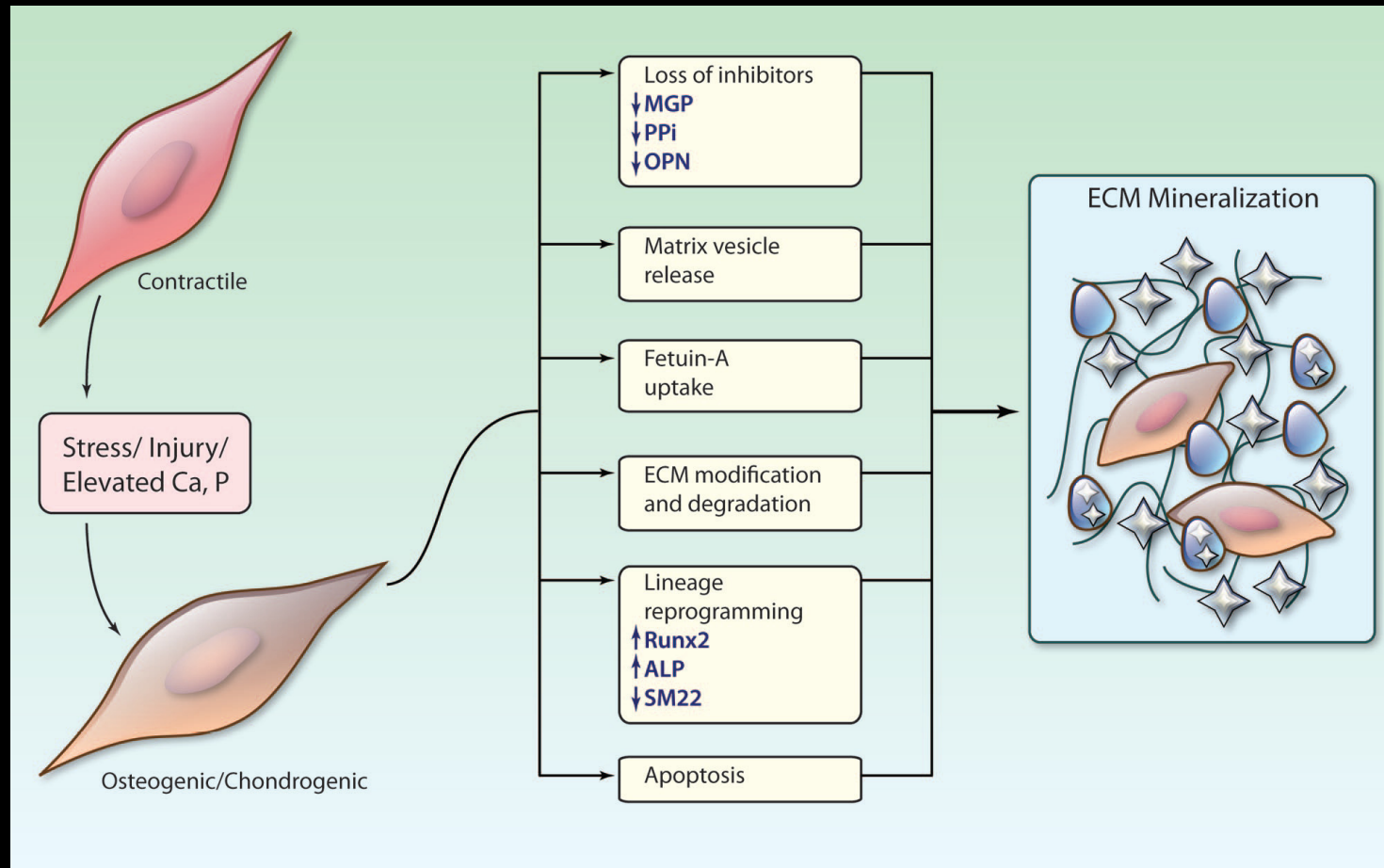


<sup>†</sup>Determined by ultrasonography

<sup>†</sup>Carotid artery, abdominal aorta, iliofemoral axis, and legs

$P < .0001$  for each increase in number of arteries calcified

# Pathogenesis of vascular disease in CKD



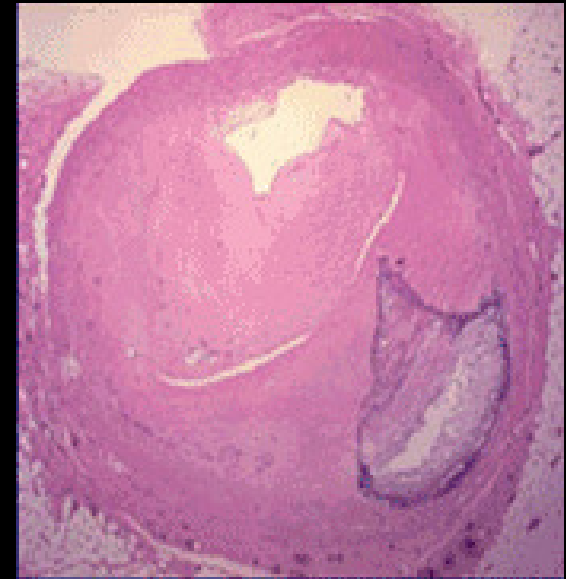
## Patterns of vascular disease in CKD

- Atherosclerosis
- Arteriosclerosis
- Calciphylaxis/calcific uremic arteriopathy (CUA)

## Patterns of vascular disease in CKD

- **Atherosclerosis**

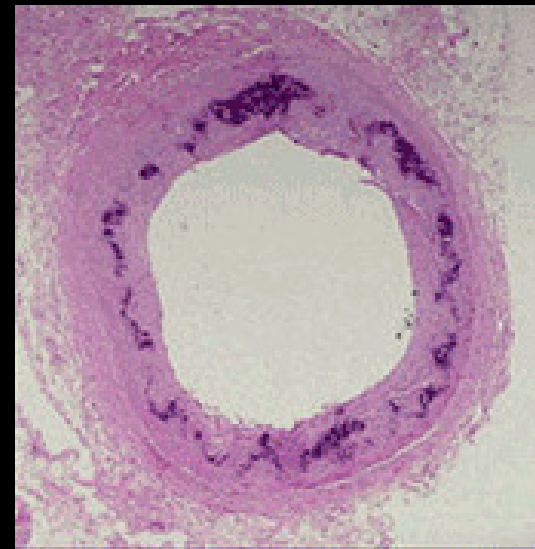
Intimal lesions, histologically classified as type I to type VI along a continuum of minimal changes to clinically significant lumen stenosis



## Patterns of vascular disease in CKD

- **Arteriosclerosis**

Reduced arterial compliance due to increased fibrosis, loss of elasticity, and vessel wall calcification affecting the media of large and middle-sized arteries

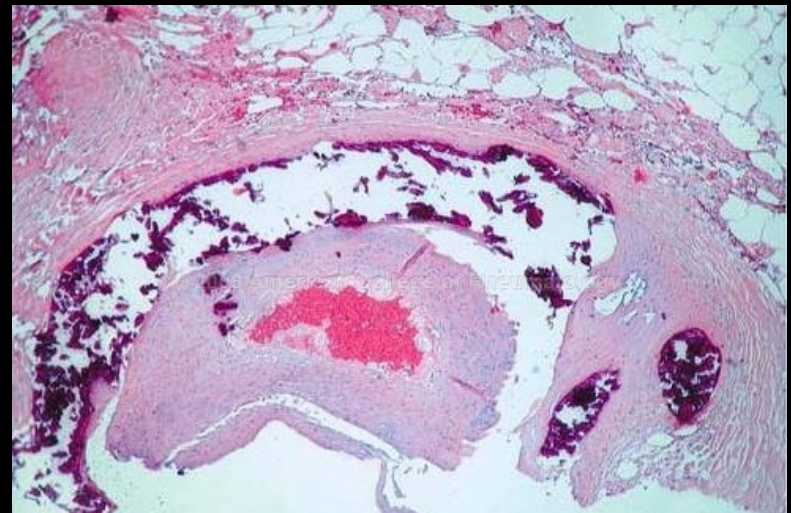
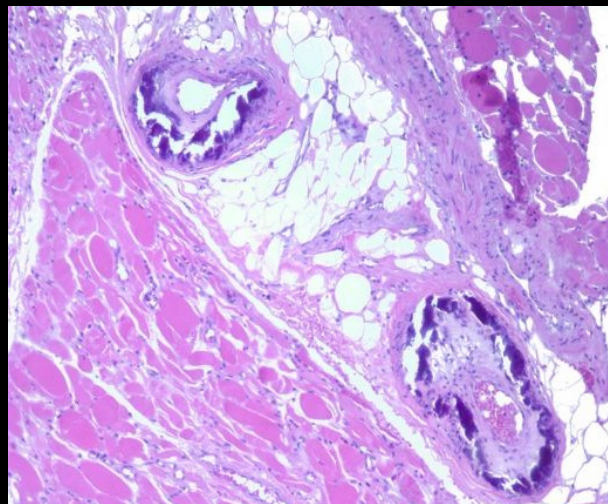




## Patterns of vascular disease in CKD

- **Calciophylaxis**

A potentially life-threatening calcification entity of ESRD, characterized by subcutaneous small vessel media calcification, panniculitis, tissue ischemia, dermal necrosis and ulcerating, painful wounds



## Imaging of vascular disease in CKD

- Plain X-ray
- Vascular ultrasound
- Computed tomography

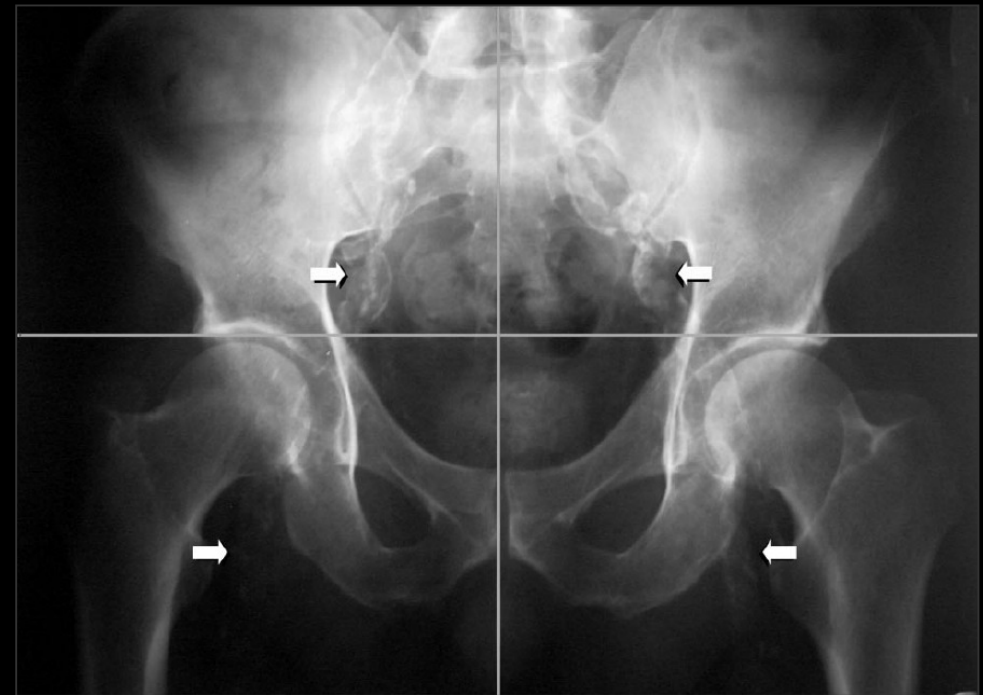
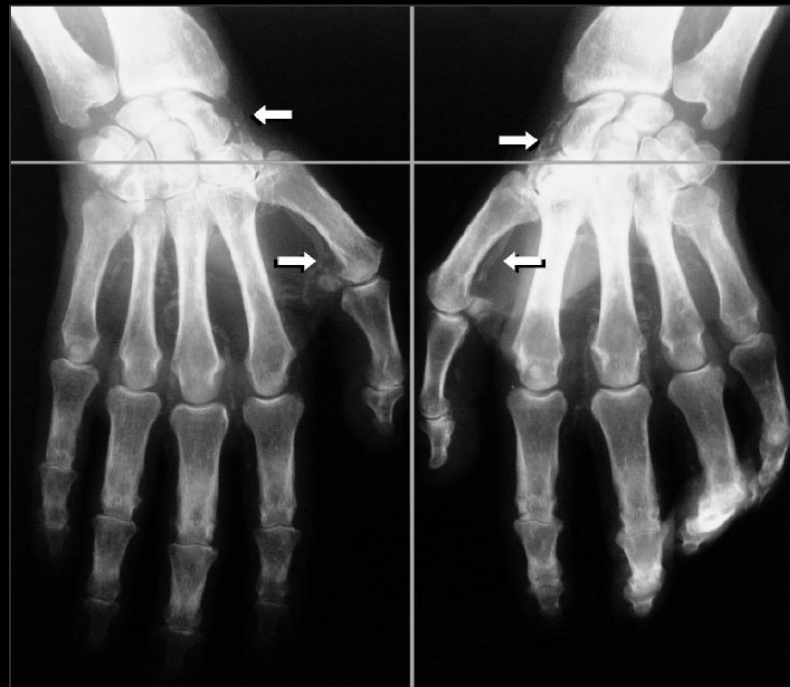
# Imaging of vascular disease in CKD

## Plain X-ray

- Radiographic films of the pelvis and hands were used to detect presence of linear calcification in the iliac, femoral, digital and radial arteries

# Imaging of vascular disease in CKD

## Plain X-ray



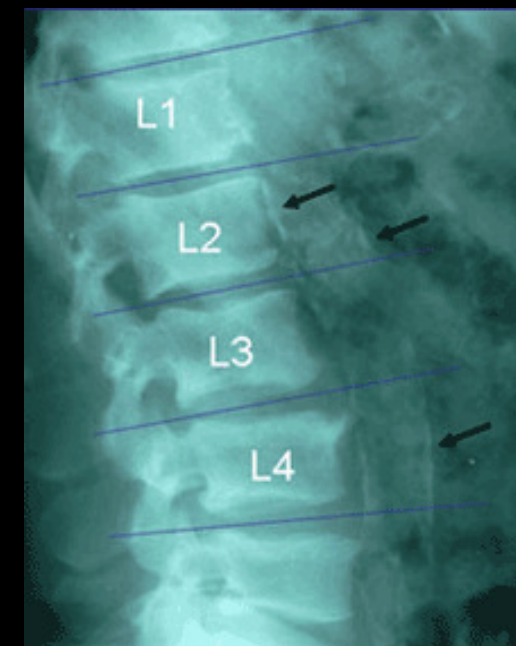
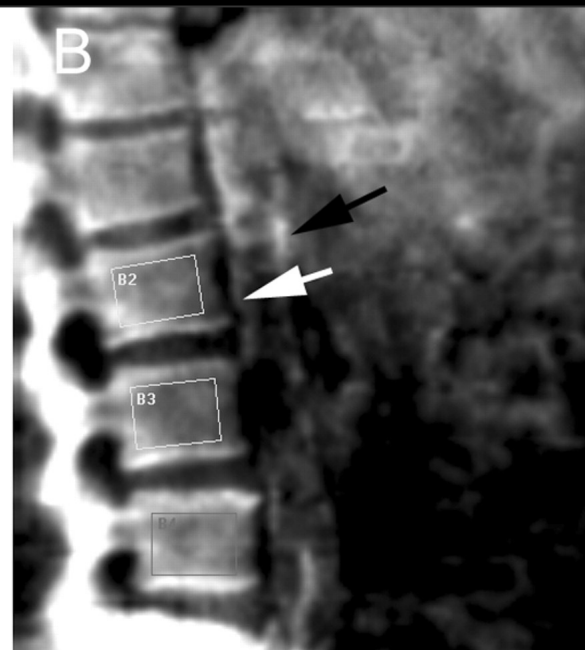
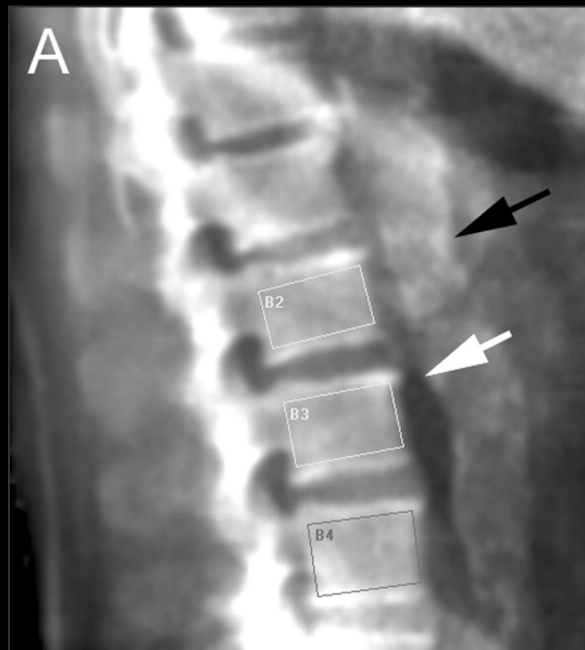
# Imaging of vascular disease in CKD

## Plain X-ray

- The 2009 KDIGO guidelines have endorsed the use of plain lateral abdominal X-ray films to detect aortic calcifications

# Imaging of vascular disease in CKD

## Plain X-ray



# Imaging of vascular disease in CKD

## Plain X-ray

- Medial calcification is usually characterized on plain radiographs as linear lesions visible along the course of an artery
- Intimal calcification is more characteristically identified by patchy and irregular radio-opaque lesion

# Imaging of vascular disease in CKD

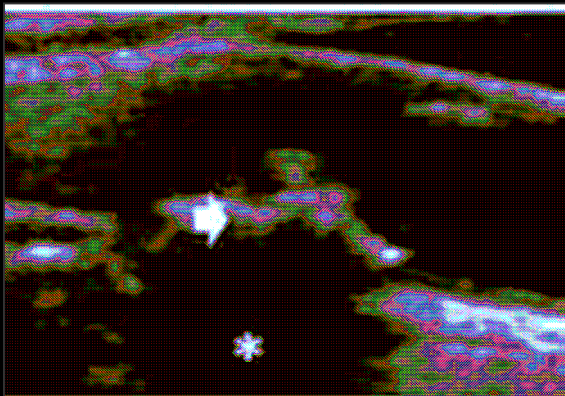
## Vascular ultrasound

- Evaluation of carotid arteries, ilio-femoral axis, leg arteries
- Provide only qualitative and semi-quantitative assessment of VC

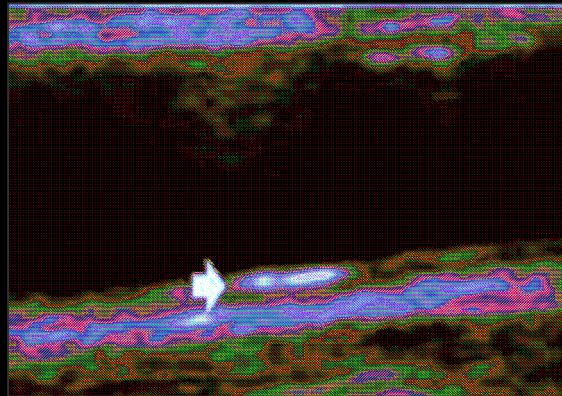


# Imaging of vascular disease in CKD

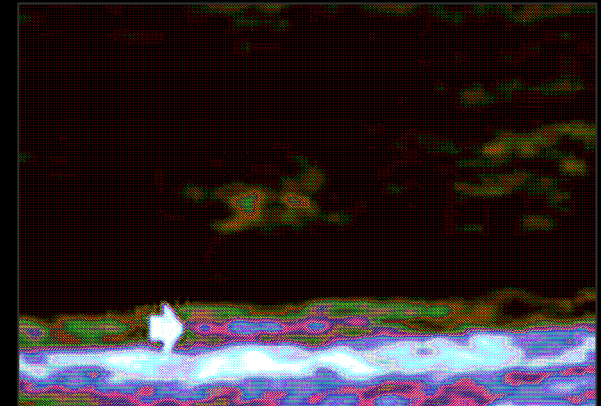
## Vascular ultrasound



highly-calcified plaque



intimal calcification



medial calcification

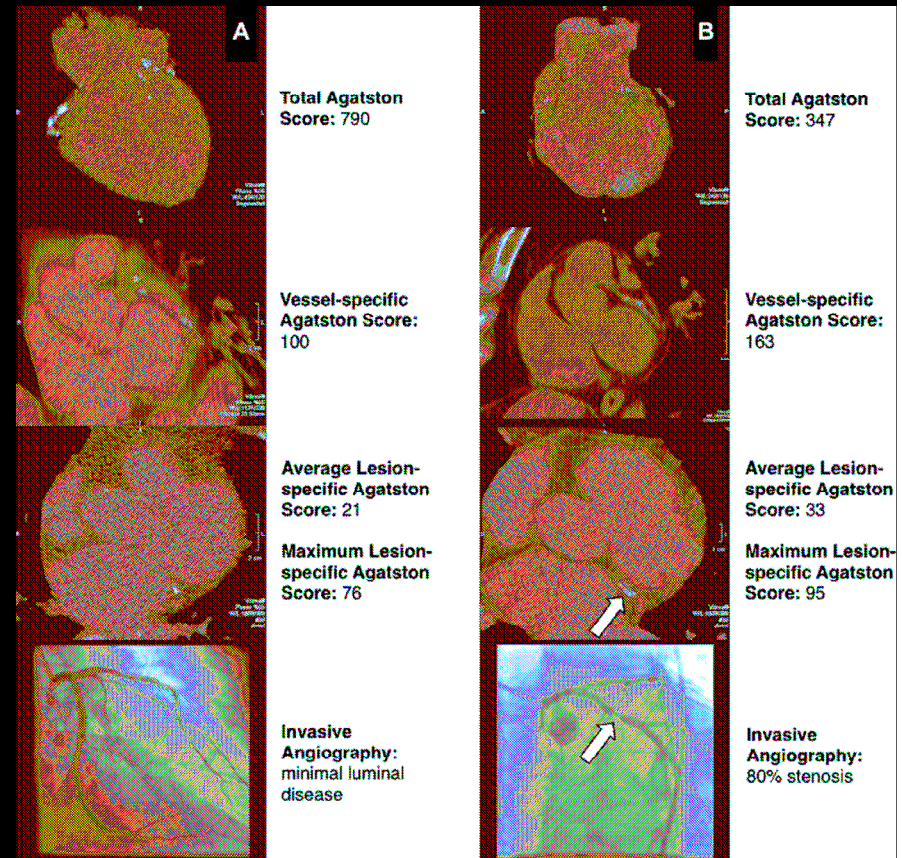
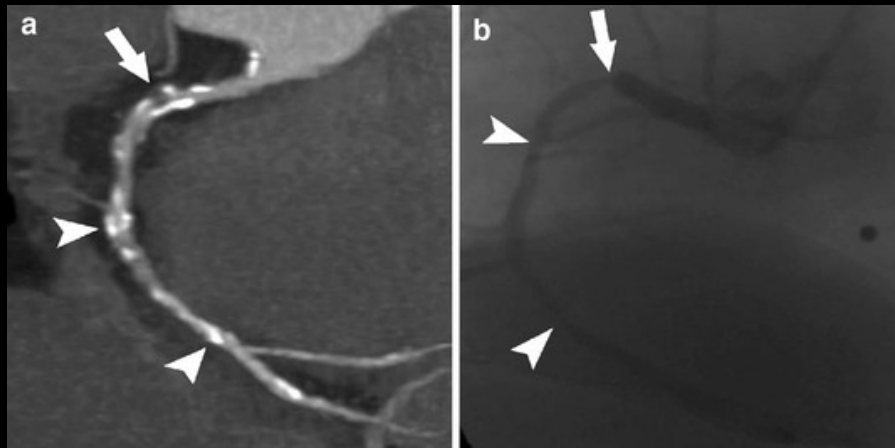
# Imaging of vascular disease in CKD

## Computed tomography

- The CT-based techniques (Electron Beam CT and Multi Slice CT) are currently regarded as the most sensitive methods for the detection and quantification of cardiovascular calcification.
- Agatston score - standardized scoring system to produce coronary artery calcium (CAC) scores

# Imaging of vascular disease in CKD

## Computed tomography



## RENART project

The aim of RENART study is to develop a computer assisted score for vascular calcification in chronic renal failure (ArterioTest), which will identify patients with severe vascular disease, and will serve to guide therapy and to monitor the treatment.

The presence and extension of vascular calcifications will be evaluated by means of vascular ultrasound examination, computer tomography, and arterial stiffness measurement.

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**Thank you!**