Fracture Risk Assessment

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Why diagnosis of osteoporosis is important?

- The most common metabolic bone disease
  - 1/3 of women > 50
  - 1/5 of men > 50
- High Morbidity and Mortality

- Asymptomatic
  - 30-50% of vertebral fracture

OSTEOPOROSIS

- A skeletal Disorder:

    - Compromised Bone Strength

    - Increased Risk of Fracture

Adams, Nat Rev Endocrinol. 2013

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Risk of fracture in CKD

- CKD is associated with the development of:

    – Mineral bone disorder

    – Osteoporosis

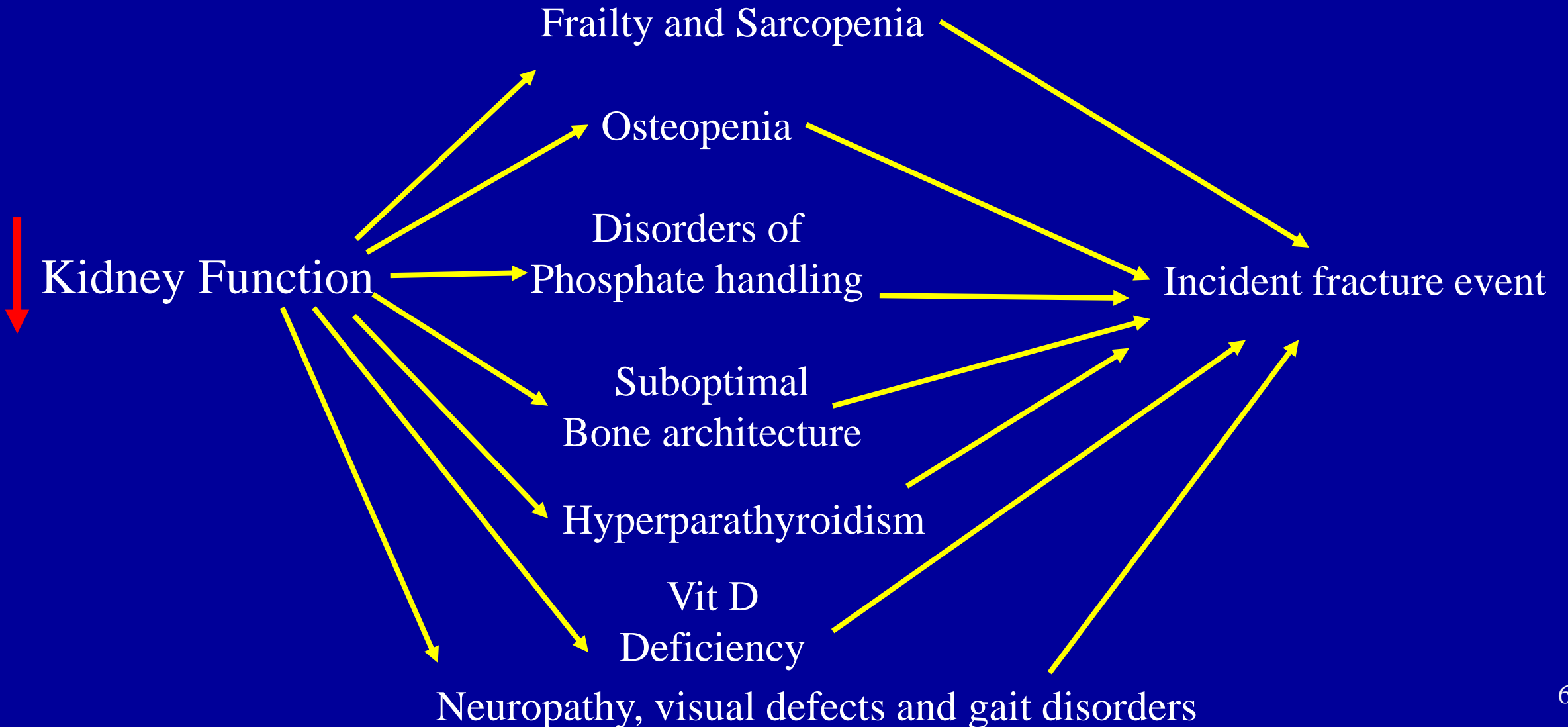   – Fragility fractures

Risk of fracture in CKD

- Risk in patients on dialysis   12 to 45/1000 patient-year

- Risk of hip fracture   up to 4 times higher

- Risk of fracture is up to 5 times higher in

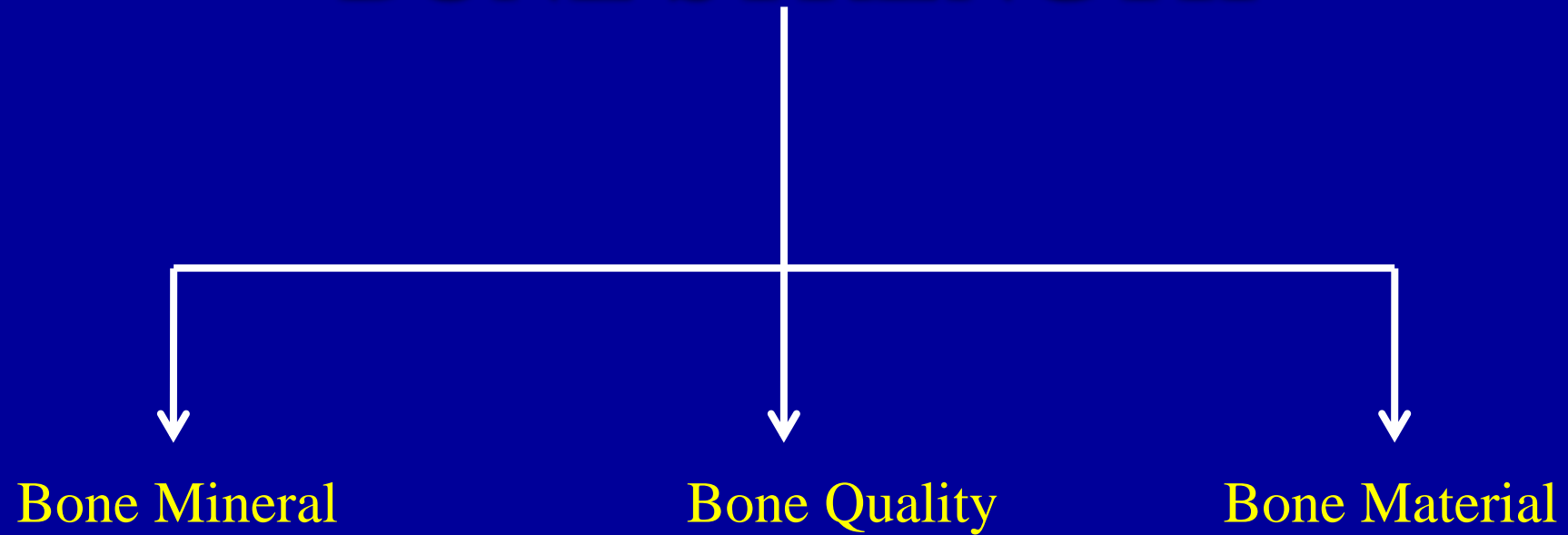 – GFR < 15   versus   GFR > 60

Calcified Tissue International, 2021

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Factors contributing to fracture risk in CKD

Kidney Function

Frailty and Sarcopenia

Osteopenia

Disorders of
Phosphate handling

Suboptimal
Bone architecture

Hyperparathyroidism

Vit D
Deficiency

Neuropathy, visual defects and gait disorders

Incident fracture event

BONE STRENGTH

Bone Mineral   Bone Quality   Bone Material

Adams, Nat Rev Endocrinol. 2013

Osteoporosis Definition

- Normal Bone
  - $-1 \leq$ T-Score $< +1$

- Osteopenia
  - $-2.49 \leq$ T-Score < -1

- Osteoporosis
  - T-Score ≤ -2.5

BMD at which frequency?

- Usually

- 23 months

BMD in CKD

- Good predictive value of BMD for risk of peripheral fracture and hip fractures in CKD stages 3-5D

  Nephrol Dial Transplant, 2012
  Clin J Am Soc Nephrol, 2015
  J Bone Miner RES, 2015
  Clin J Am Soc Nephrol, 2012

- 2017 KDIGO guidelines

  – BMD if results will impact treatment decisions

CLINICAL RISK FACTORS
for FRACTURE

- Age
- Sex
- Weight
- Height
- History of Fracture
- Parental History of Fracture
- Current Smoking
- Steroid Use
- Alcohol Use
- RA
- Secondary Osteoporosis

FRAX

FRAX in CKD

- FRAX works good in CKD stages 2–5

  Calcified Tissue International, 2021

- Underestimation of bone fracture risk in dialysis patients

  Bone, 2020

- FRAX predicts fracture better than all other clinical risk factors

  Osteoporosis International, 2017

Trabecular Bone Score

- TBS is derived from texture of the DXA image

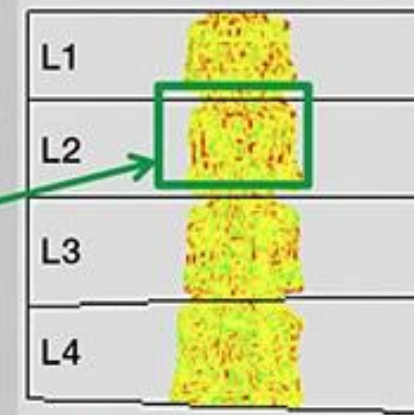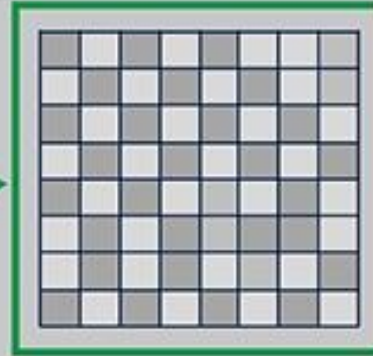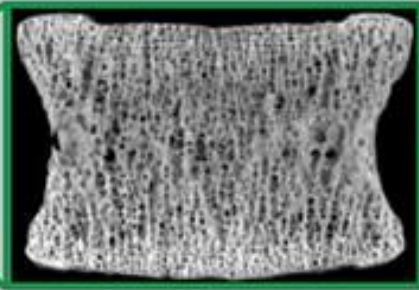 – Bone micro architecture

  – Fracture risk

Trabecular Bone Score

- TBS uses standard DXA spine images to measure texture inhomogeneity.

- TBS identifies differences between pixels in densitometry pictures from lumbar spine.
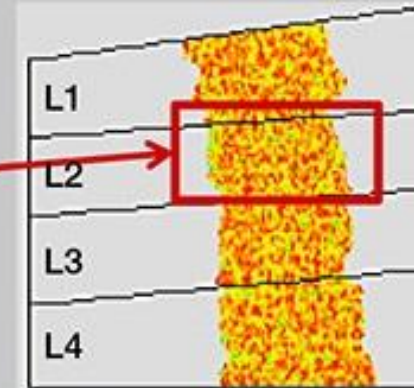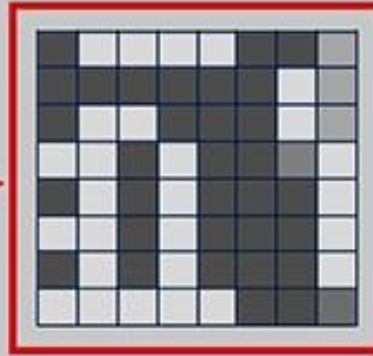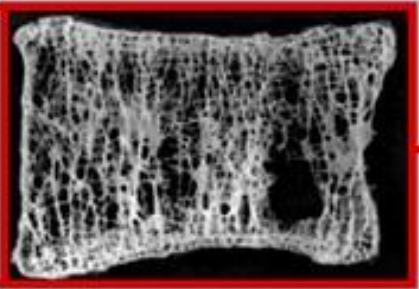
TBS

Healthy Well-structured trabecular bone

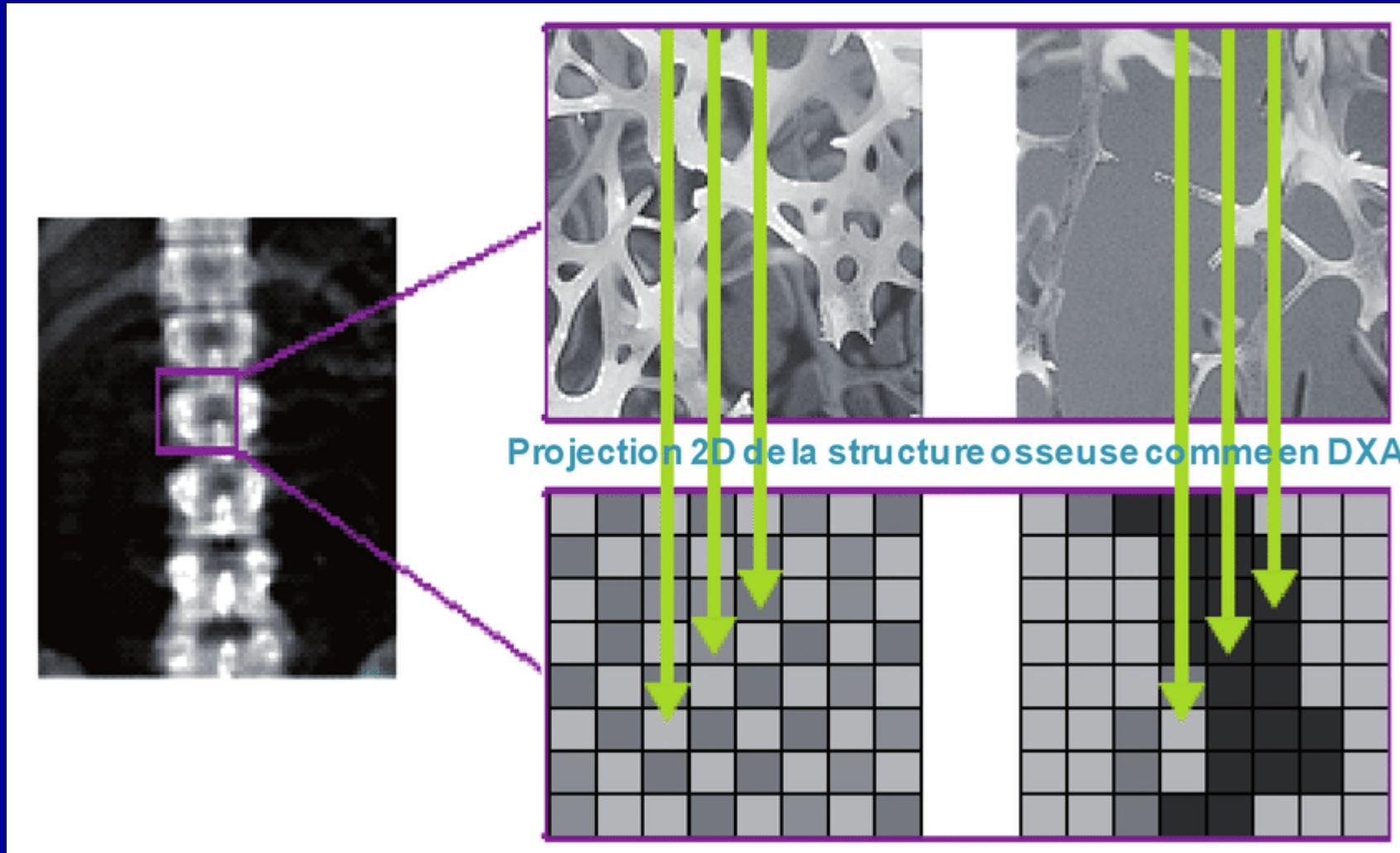Osteoporosis Altered trabecular bone

TBS = 1.360

TBS = 1.102

TBS

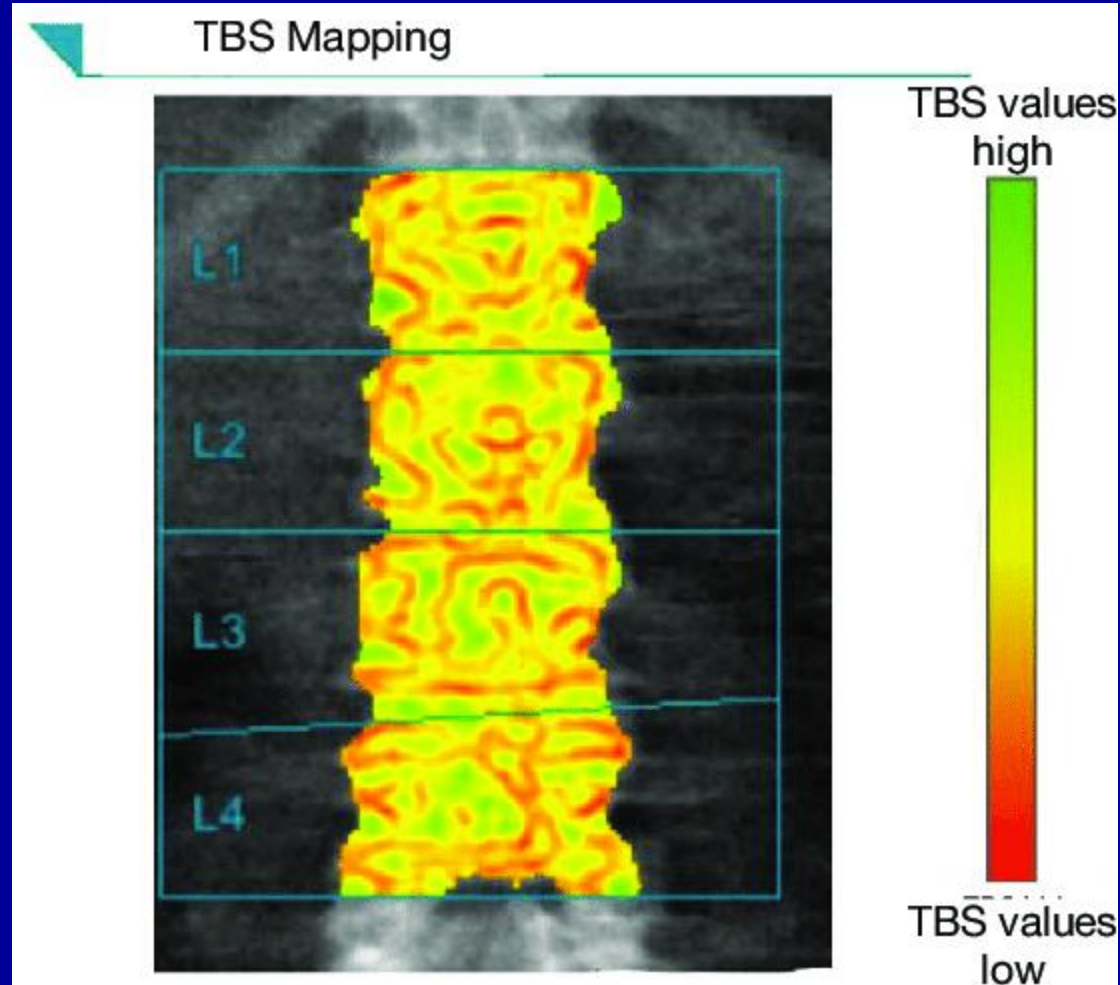Projection 2D de la structure osseuse comme en DXA

TBS

TBS

- TBS independently predict fracture risk in patients with low bone mass

- Better relation to fracture risk than does areal BMD in patients with secondary osteoporosis.

TBS Ranges

- TBS ≥ 1.35   Normal

- $1.2 < TBS < 1.35$ Partially degraded bone

- TBS ≤ 1.2   Degraded bone

TBS in CKD

- Lower TBS was only statistically significant for osteoporosis prediction for GFR ≥ 60

- Addition of TBS to the FRAX score did not significantly improve fracture risk prediction in patients with CKD.

Osteoporosis International, 2020

TBS in CKD

- TBS has inverse association with PTH

  – Hyperparathyroidism and increased bone turnover on trabecular microarchitecture

Osteoporosis International, 2018

Bone Turnover Markers

- Bone formation

  - Serum bone-specific AlkP
  - Serum Osteocalcin
  - Serum Propeptide of type I Collagen

- Bone Resorption

  - Urine and Serum Cross-linked C&N-telopeptide

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Bone Turnover Markers in CKD

- They are cleared by kidney   Usefulness in CKD?

J Clin Endocrinol Metab, 2020

- A recent study showed benefits of these markers +PTH

J Am Soc Nephrol, 2018

- Some markers use to identify low bone turnover

  - Lower FGF-23 + higher α-Klotho + lower PTH

J Clin Endocrinol Metab, 2020

Thanks for your kind attention