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Role of new imaging techniques in diagnosing and staging of patients with Multiple Myeloma

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DEUTSCHES
KREBSFORSCHUNGSZENTRUM
IN DER HELMHOLTZ-GEMEINSCHAFT

Staging systems

- Durie/ Salmon
- International Staging System (ISS)
- International Myeloma Working Group definitions of MGUS, smoldering myeloma, and multiple myeloma

IMWG Criteria: Role of imaging

- **Confirm or exclude damage to mineralized bone**
 - Osteopenia
 - Lytic bone lesions
 - (Extraosseous plasmacytomas)
- **Asymptomatic multiple myeloma**
 - Detect progression into symptomatic stage
 - Assess the risk for early progression
- **Symptomatic multiple myeloma**
 - Help preventing complications
 - Assess response and detect relapse

New imaging techniques

- **Low-dose whole-body CT**
- **MRI**
 - Spinal and pelvic
 - Whole body
- **FDG-PET**

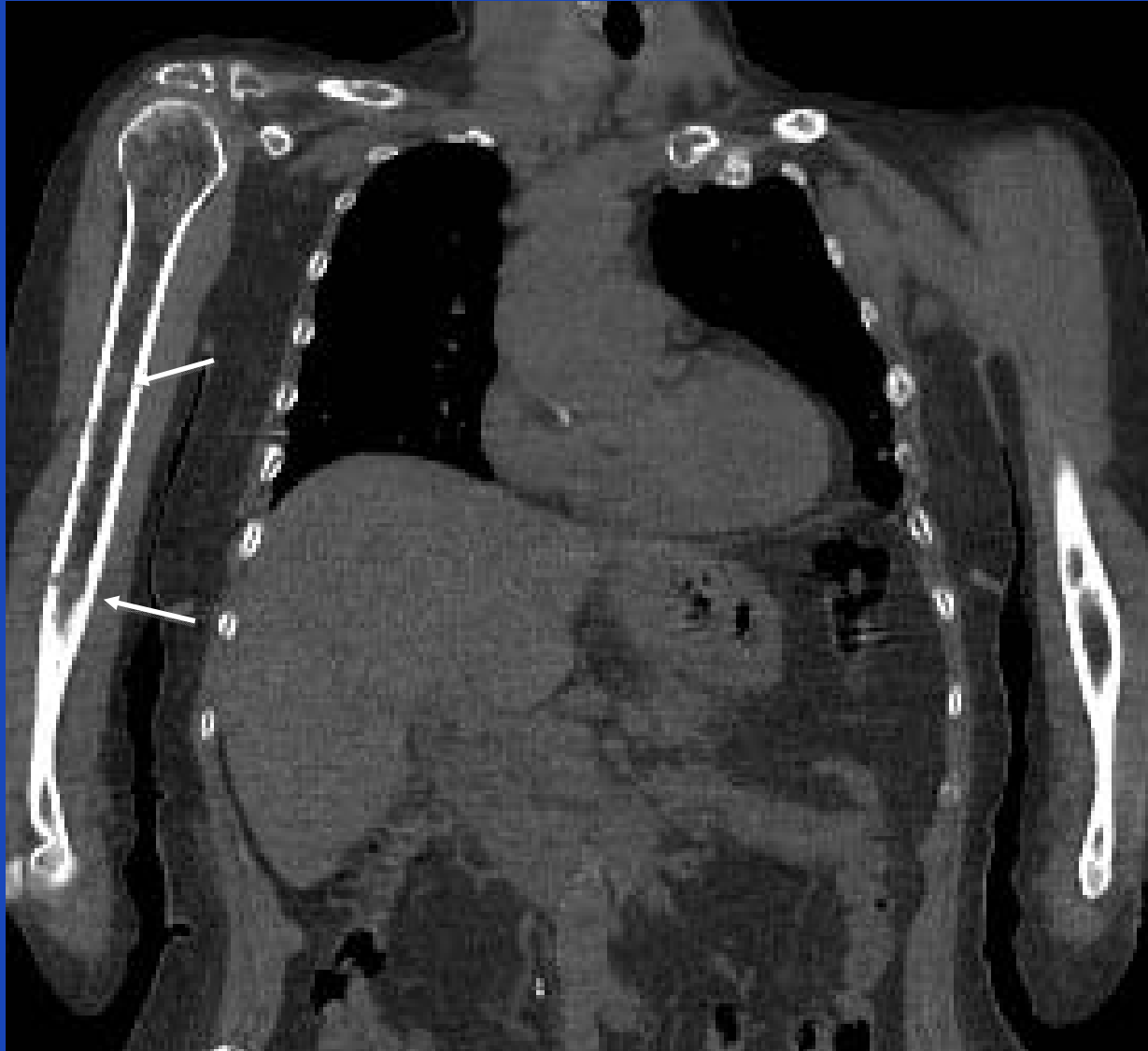
CT: The facts

- **More sensitive for lytic lesions than plain films**
 - No superimposition
- **Shows solid foci within fatty marrow**
- **Greater ease for patients**
- **Radiation dose comparable to plain films**

Plain films and CT



Bone marrow lesions in CT



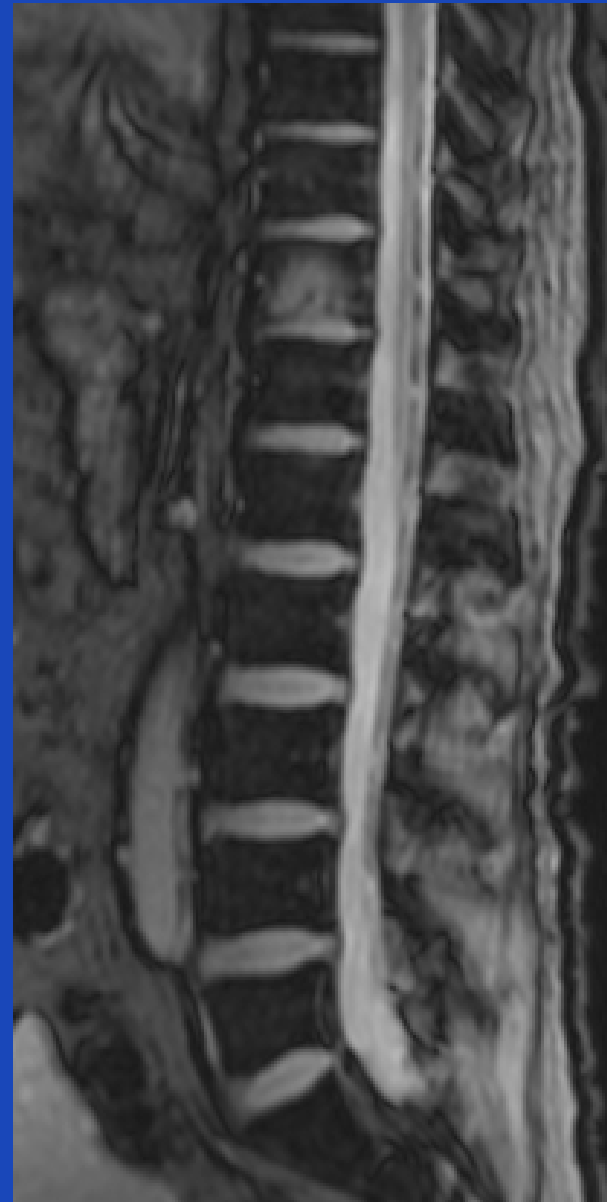
MRI: The facts

- **More sensitive for lytic lesions than plain films**
- **At least as sensitive for focal lesions as CT**
- **More sensitive for diffuse bone marrow infiltration than CT**
- **Whole-body MRI not available everywhere**

Plain films, CT, and MRI



CT and MRI



FDG-PET: The facts

- Shows solid nodules but not diffuse infiltration
- FDG uptake mirrors activity and treatment response
- Earlier detection of response than with MRI or CT
- Reimbursement and availability issues

Issues

- **Osteopenia in early stage plasma cell disorders**
- **Whole-body assessment**
- **Response assessment**
- **Prognosis**

Osteopenia in patients with MM or MGUS

- **Caused by MM or age / menopause?**
 - No specific criteria to differentiate
- **Look at bone marrow between trabeculae!**
 - Fat density -> Age / Menopause
 - Soft tissue density -> MM
- **Use MRI to assess bone marrow**

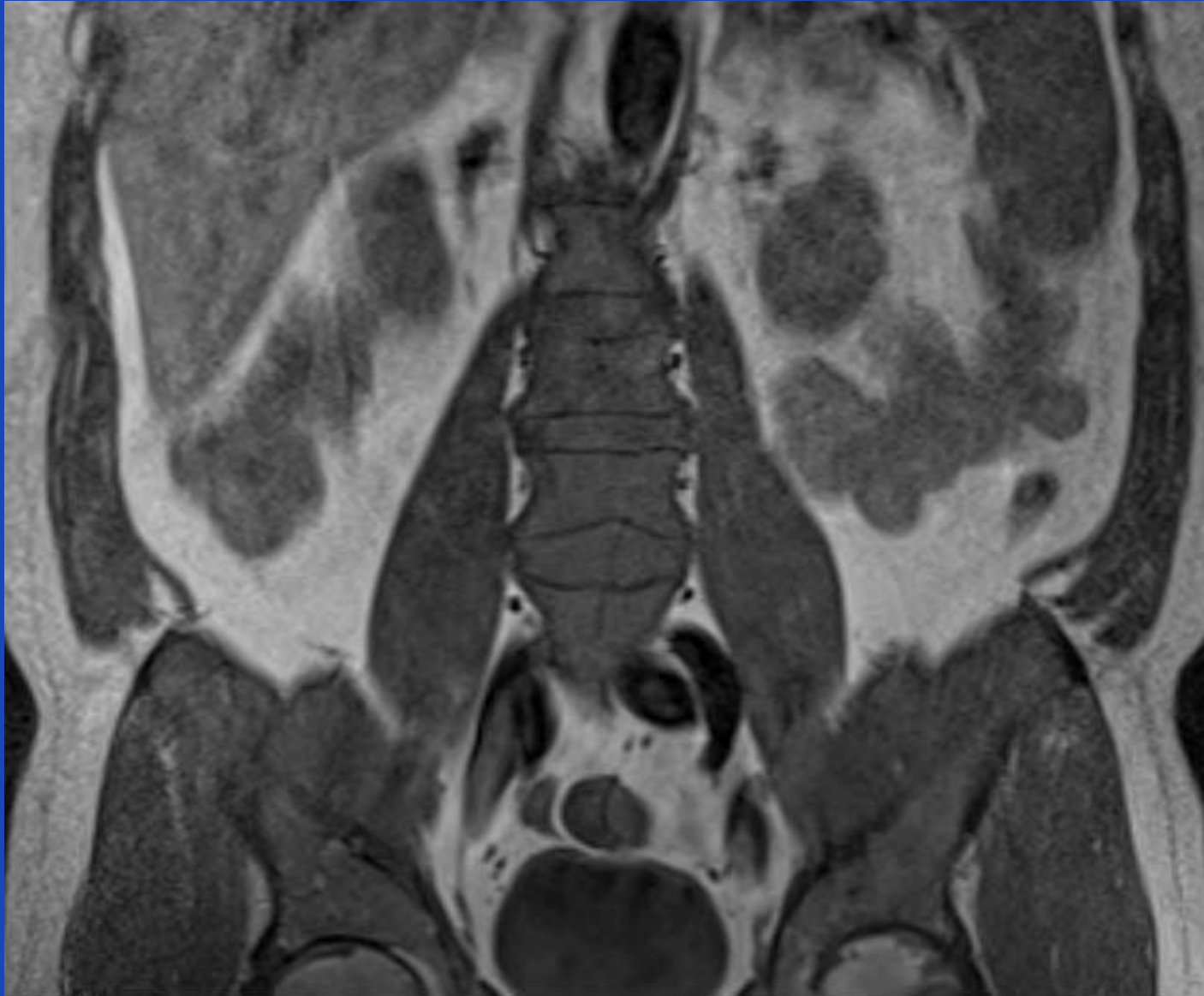
MM stage I + osteoporosis



Small lytic lesions



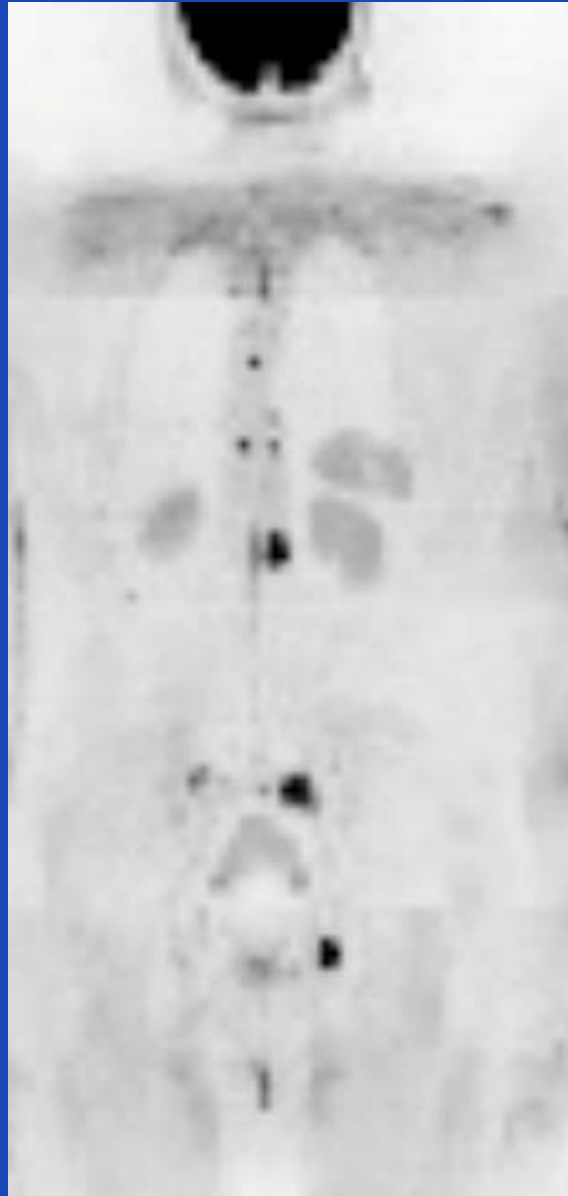
MM: Diffuse BM infiltration



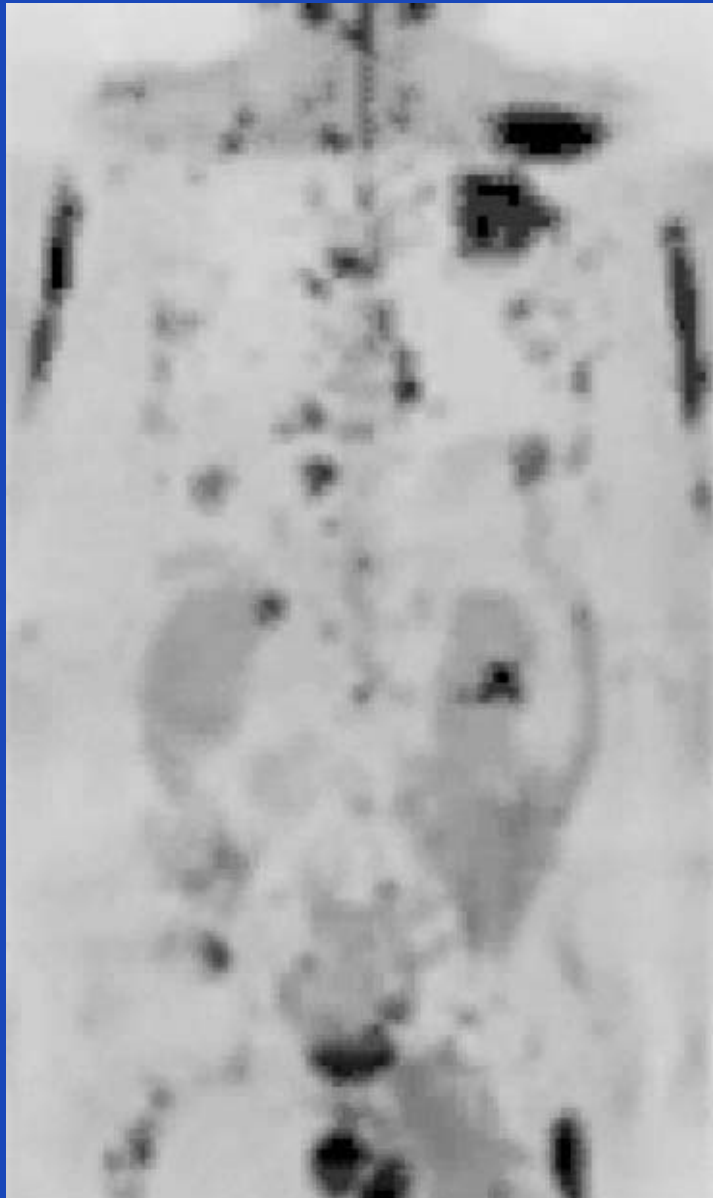
Whole-body assessment

- Not to miss lesions
- Assess globally treatment response

Diffusion-weighted MRI

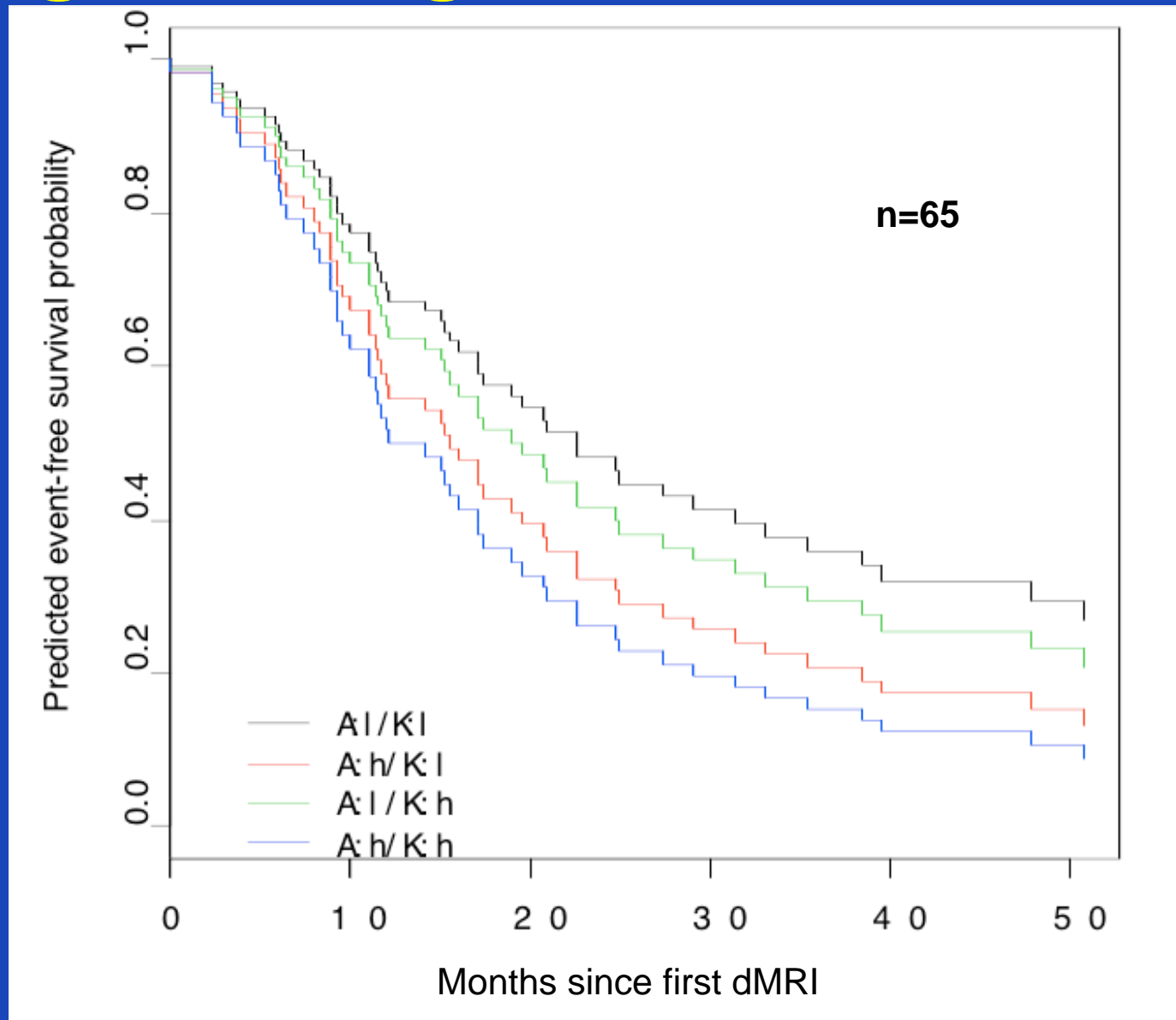


Diffusion-weighted MRI: Pre and post treatment

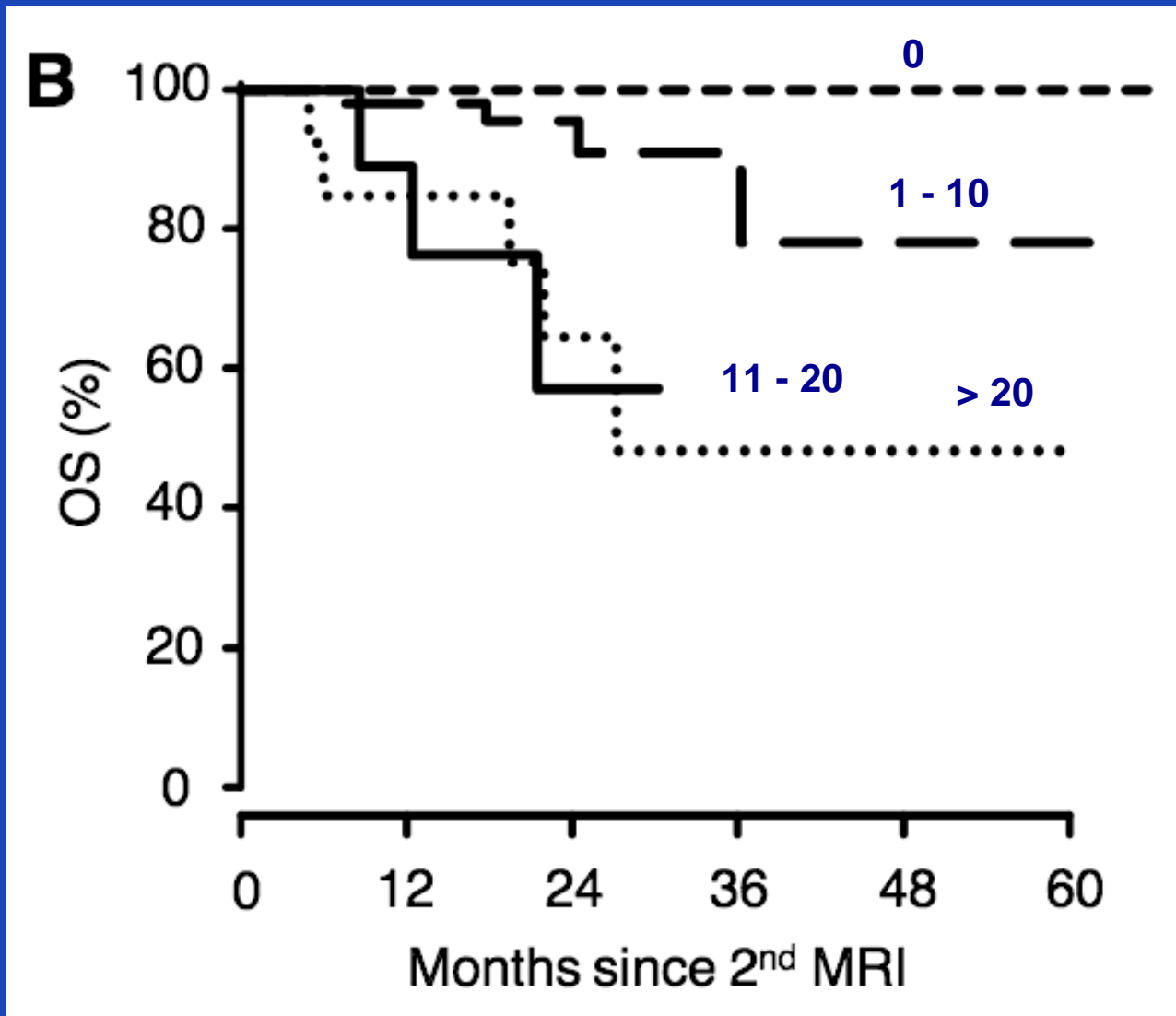


Prognosis

Prognostic significance of DCE-MRI



Residual lesions after autologous stem cell transplantation



How we do it

- **MGUS and SMM**

- WB CT in high-risk patients to confirm absence of bone damage
- Baseline WB MRI + follow-up MRI
- CT only if progression in MRI

- **Symptomatic MM**

- CT for assessing extent of bone damage
- MRI and / or PET in individual cases
 - » Predominant bone marrow involvement
 - » Hyposecretory MM
 - » Response assessment

New techniques, new problems...

- **New imaging feature: Diffuse bone marrow infiltration**
 - Seen mainly with MRI
- **How to handle patients staged higher than with plain films?**
- **How to image in future?**
 - WB-CT or WB-MRI only?
 - CT plus MRI?
 - Any x-rays if MRI is normal?
 - Role of PET?
 - DWI as poor man's PET?