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dkfz. GERMAN CANCER RESEARCH CENTER IN THE HELMHOLTZ ASSOCIATION

Whole body MRI in Myeloma

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No conflicts of interest to disclose

Appearance of monoclonal plasma cell diseases in MRI

normal diffuse focal mixed

Appearance of monoclonal plasma cell diseases in MRI

normal

focal

diffuse

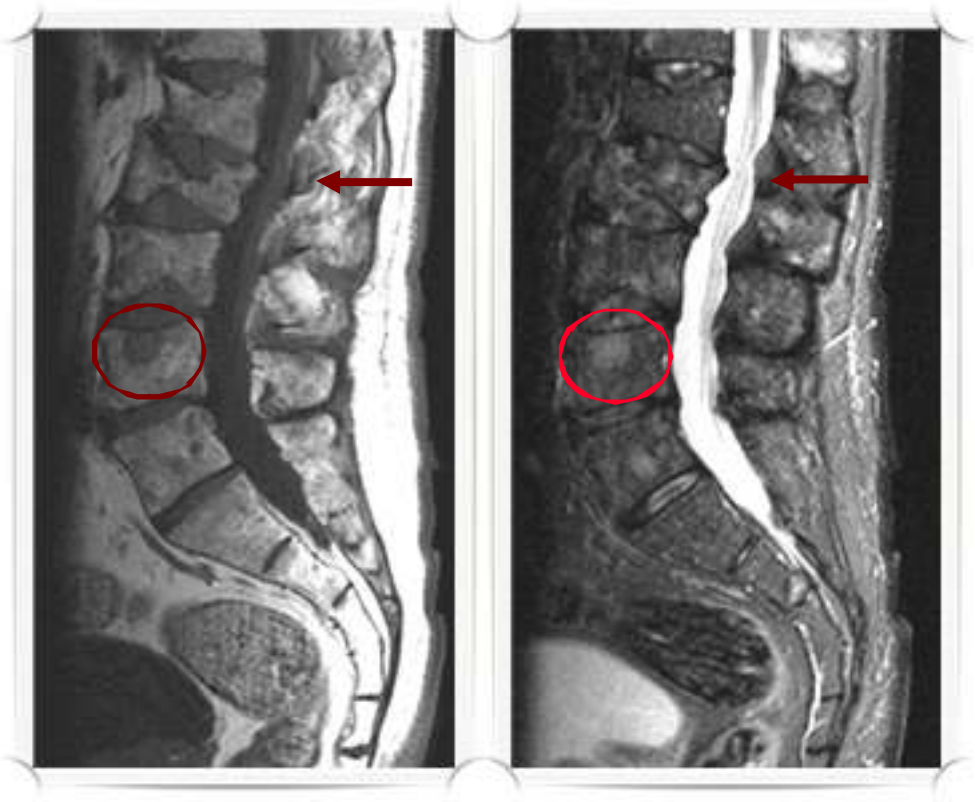
Appearance of monoclonal plasma cell diseases in MRI

	normal	diffus	focal	mixed	Salt and Pepper	diffus total
Ghanem 2006 EJR n = 54 (MGUS and myeloma)	14 (26%)	40-55%	16-26%			**40-55%**
Baeuerle 2009 Radiology N = 100 (MGUS and myeloma)	23 (23%)	34 (34%)	4 (4%)	36 (36%)	4 (4%)	**74 (73%)**
Staebler 1996 AJR n = 53 (myeloma all stages)	5 (10%)	12 (23%)	18 (34%)	13 (25%)	5 (9%)	**30 (57%)**
Baur 2002 Cancer n = 77 (myeloma all stages)	20 (26%)	24 (31%)	22 (28%)	9 (12%)	2 (3%)	**35 (46%)**
Kusumoto 1997 Br. J. Haematol n = 61 (symptomatic myeloma)	11 (18%)	25 (41%)	11 (18%)	14 (23%)		**39 (64%)**
Lecouvet 1998 Radiology n = 80 (symptomatic myeloma)	19 (24%)	26 (32%)	35 (44%)			**26 (32%)**
Moulopoulos 2005 Ann Oncol n = 142 (symptomatic myeloma)	11 (8%)	40 (28%)	71 (50%)	20 (14%)		**60 (42%)**

%20 %30 %30 %20

Advantages of MRI

1. highest **sensitivity** for investigation of bone marrow infiltration[1]
2. Detection of **soft tissue** tumors
3. Assessment of **bone marrow cellularity**
4. Differentiation between **malignant** and „**benigne**“ fracture
5. **no radiation** exposure, **no contrast medium** needed
6. estimation of **treatment** response
7. **prognostic** significance



(1) Ghanem Eur. Radiol. 2006; **Gleeson** Skeletal Radiol 2008; **Baur-Melnyk** AJR 2008**; Zamagni** Haematologica 2007; **Shortt** AJR 2009; **Scudla** IMW 2011 Poster 100

Prognostic significane of MRI

presence and number of focal lesions

symptomatic MM > 7 focal lesions

(Walker JCO 2006)

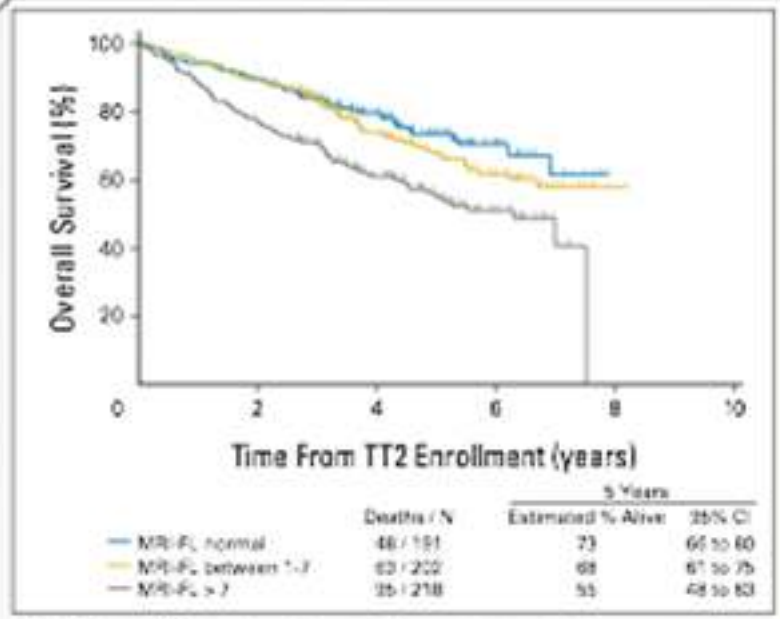


Fig 2. Kaplan-Meier plots of survival from initiation of therapy according to magnetic resonance imaging–defined focal lesions (MRI-FL). Survival was significantly longer among patients without and with up to seven FLs than in the those presenting with more than seven FLs. *P* value: Overall < .0001; MRI-FL normal versus MRI-FL normal between 1 and 7, .28; MRI-FL normal versus MRI-FL > 7, .0001; MRI-FL normal between 1 and 7 versus MRI-FL > 7, .0001

asymptomatic MM > 1 focal lesion

(Hillengass JCO 2010)

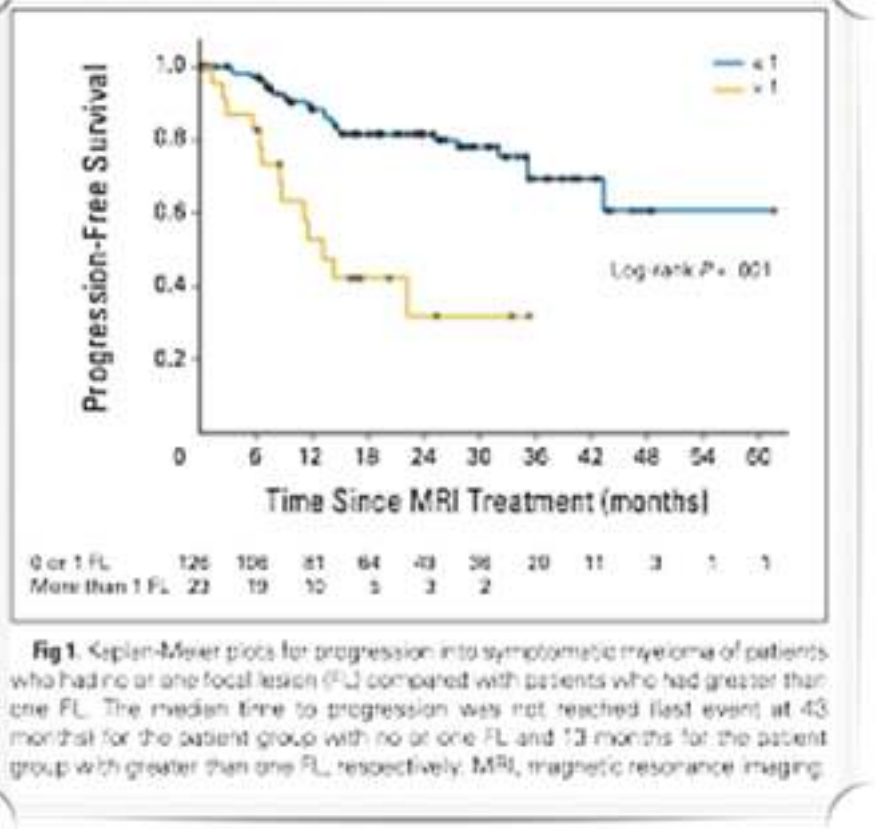
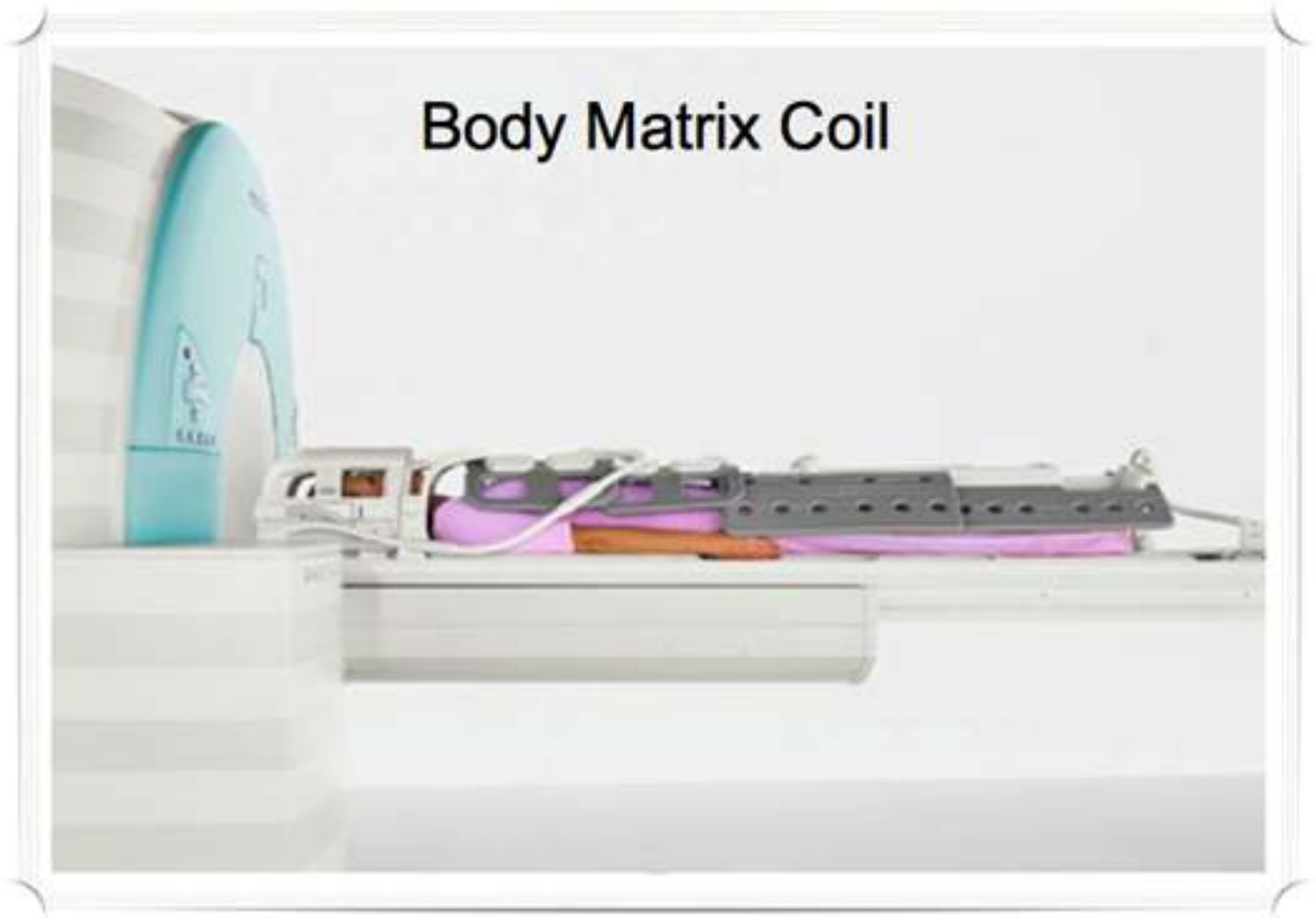


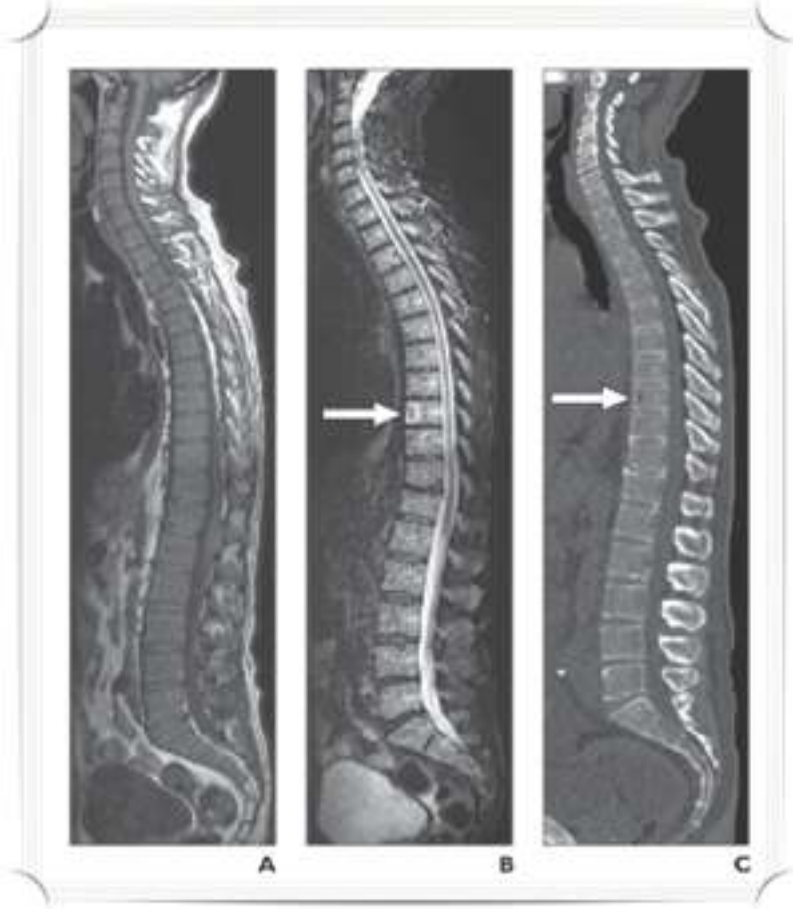
Fig 1. Kaplan-Meier plots for progression into symptomatic myeloma of patients who had no or one focal lesion (FL) compared with patients who had greater than one FL. The median time to progression was not reached (last event at 43 months) for the patient group with no or one FL and 13 months for the patient group with greater than one FL, respectively. MRI, magnetic resonance imaging.

Whole body MRI

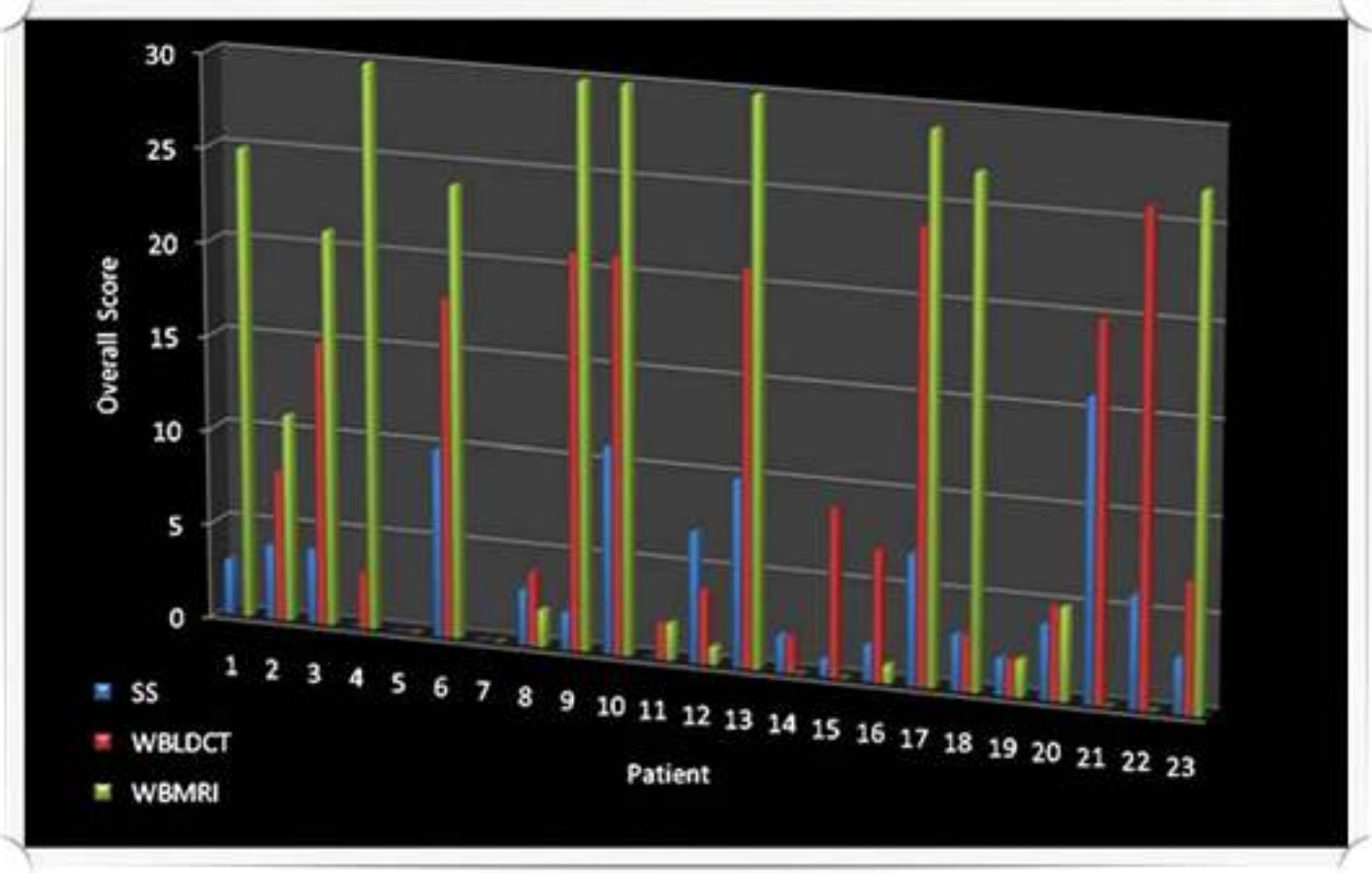


Whole body MRI

Higher sensitivity compared to CT



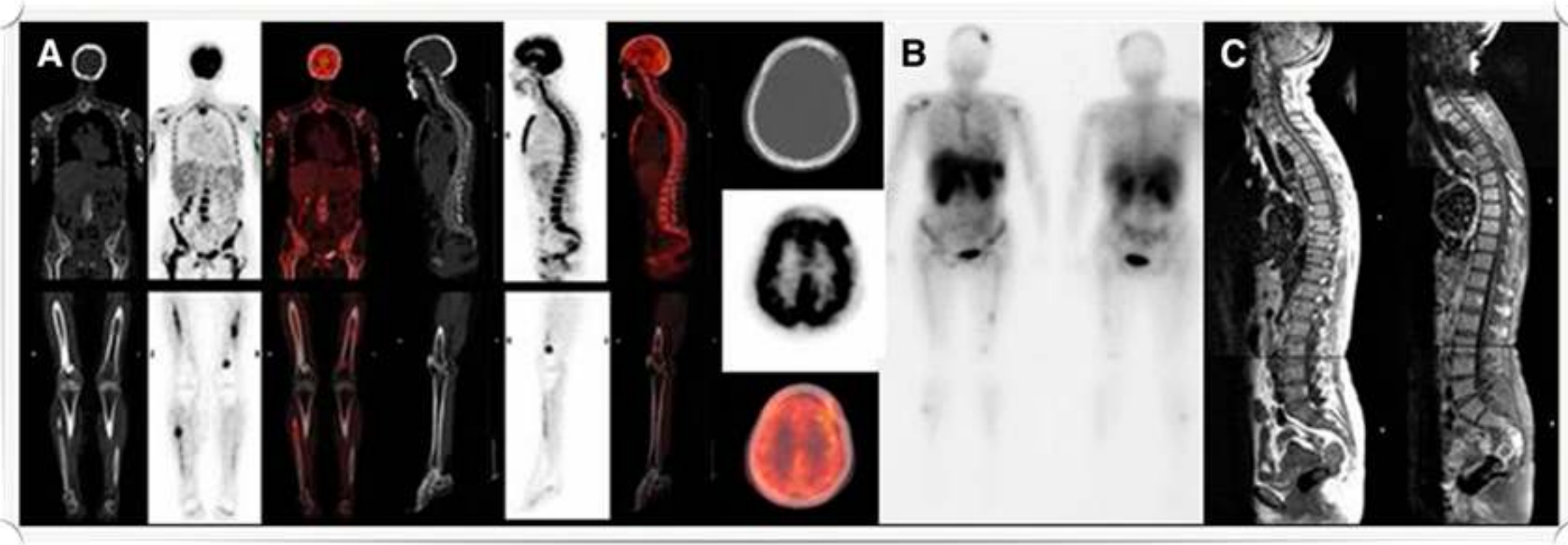
Baur-Melnyk 2008 AJR



Gleeson 2009 Skeletal Radiol.

MRI

Comparable sensitivity compared to PET-CT



Fonti 2008 J. Nucl Med.

Whole body MRI versus MRI of the axial skeleton

- whole body-MRI significantly outperforms spinal-MRI

n = 100

axial			Extra-axial		
intra-osseous	exceeding cortical bone	both	intra-osseous	exceeding cortical bone	both
24	2	14	24	0	15

axial lesions only	extra-axial lesions only
11	**10**

Bäuerle, Hillengass 2009 Radiology and Louvre Paris

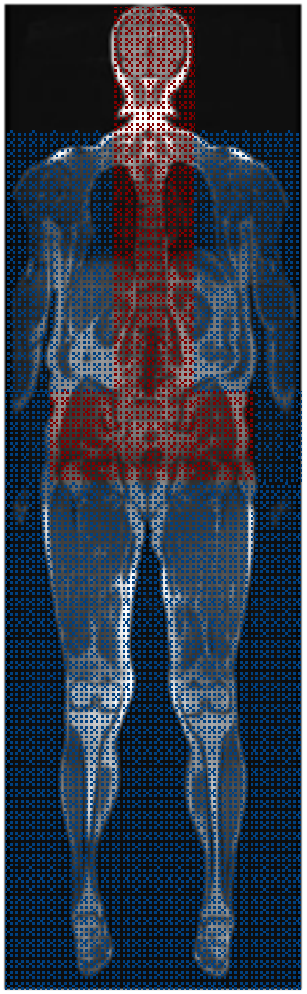
Appearance of monoclonal plasma cell diseases in whole body MRI

n = 413 untreated patients

- MGUS n = 96
- solitary plasmacytoma n = 15
- smoldering MM n = 135
- symptomatic MM n = 156
- AL-amyloidosis n = 11

Analysis:

- assessment of diffuse infiltration
- number focal lesions (FL)
  - axial versus extra-axial
  - **intra-osseous** versus **penetrating cortical bone** versus **soft tissue**

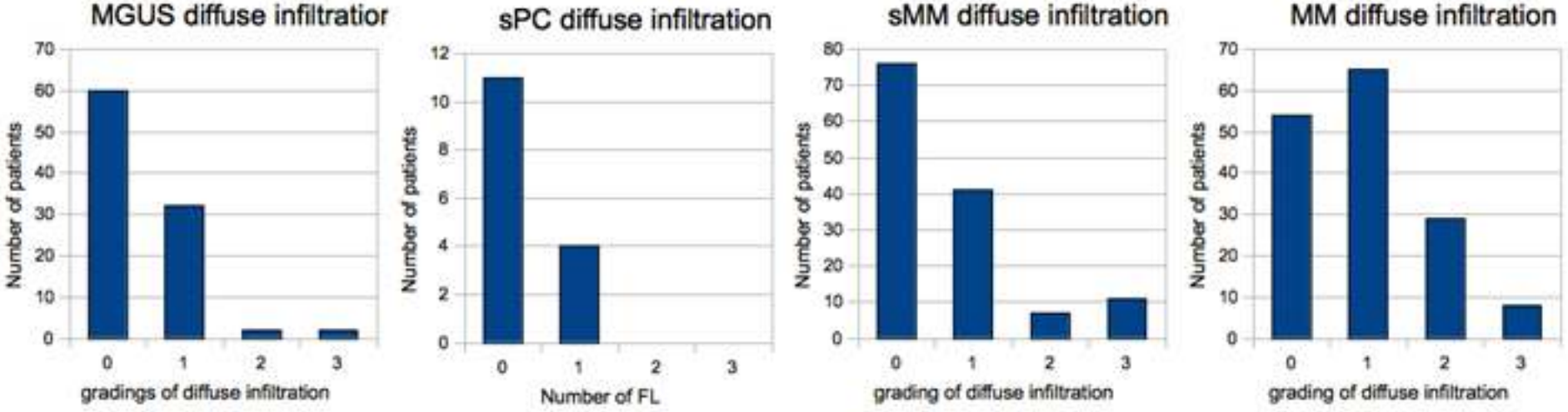


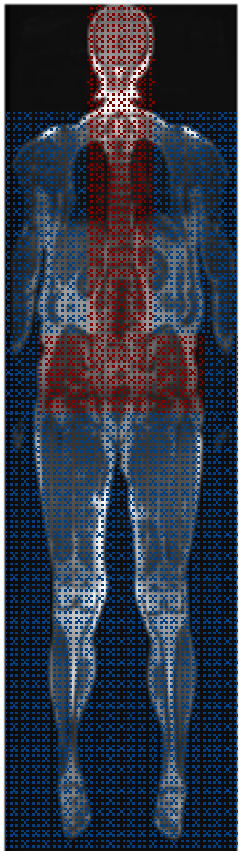
Hillengass unpublished data

Appearance of monoclonal plasma cell diseases in whole body MRI

Grading of diffuse infiltration:

0 = normal; 1 = low; 2 = medium; 3 = severe





Hillengass unpublished data

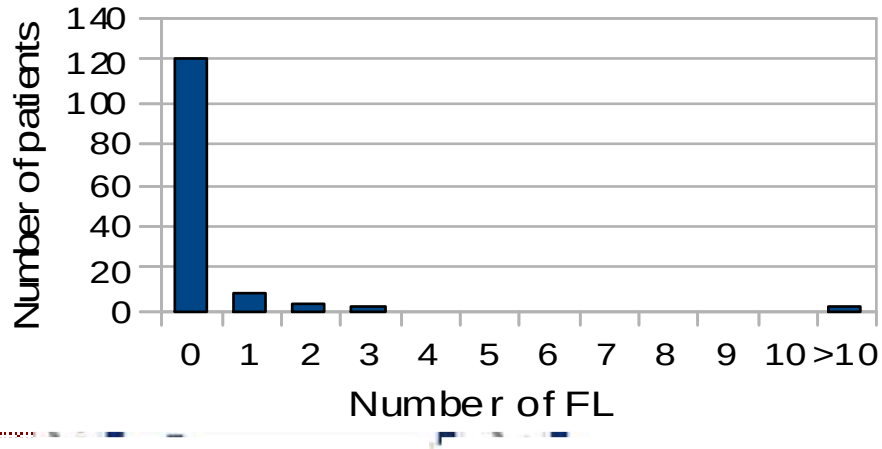
Appearance of monoclonal plasma cell diseases in whole body MRI

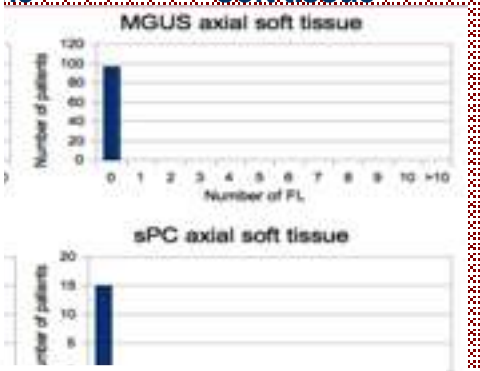
FL axial

MGUS

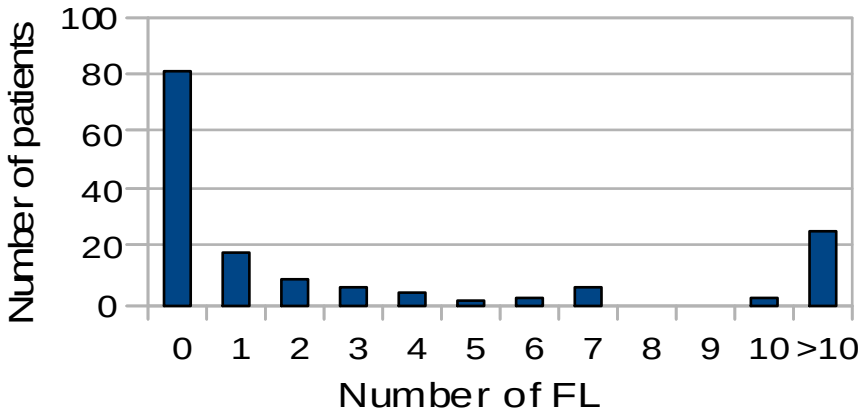
solitary PC

sMM axial intra-osseous

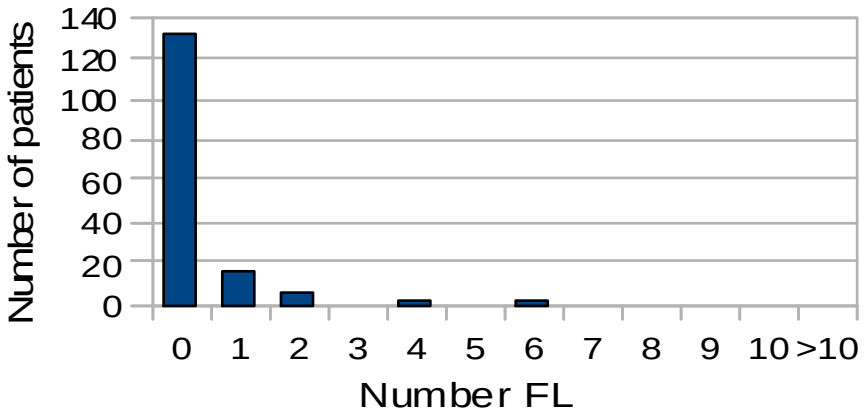


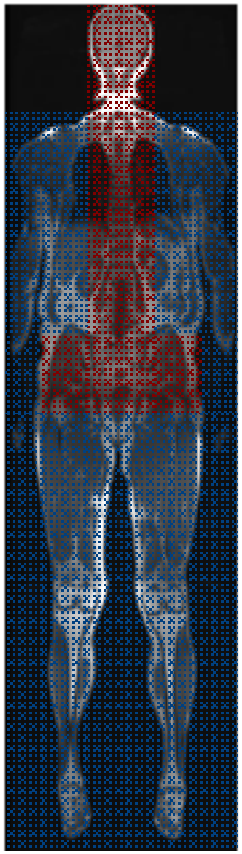


MM axial intra-osseous



MM axial penetrating cortical bone



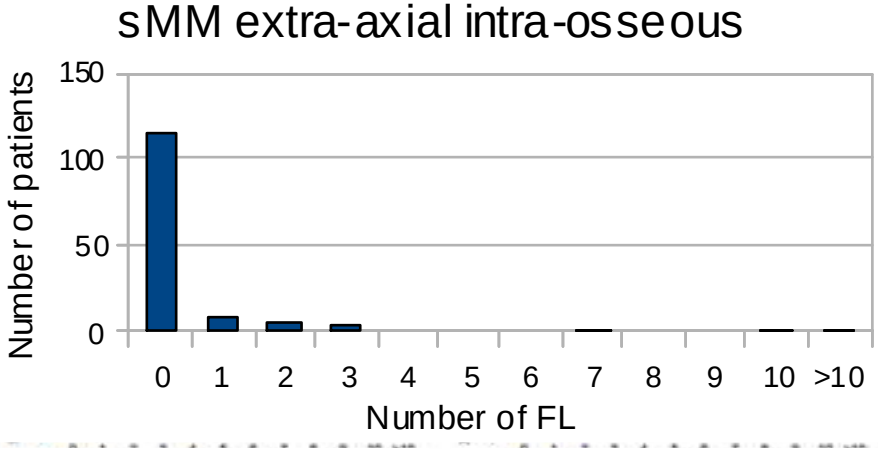


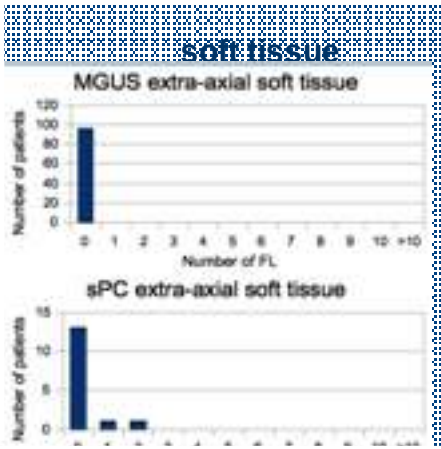
Appearance of monoclonal plasma cell diseases in whole body MRI

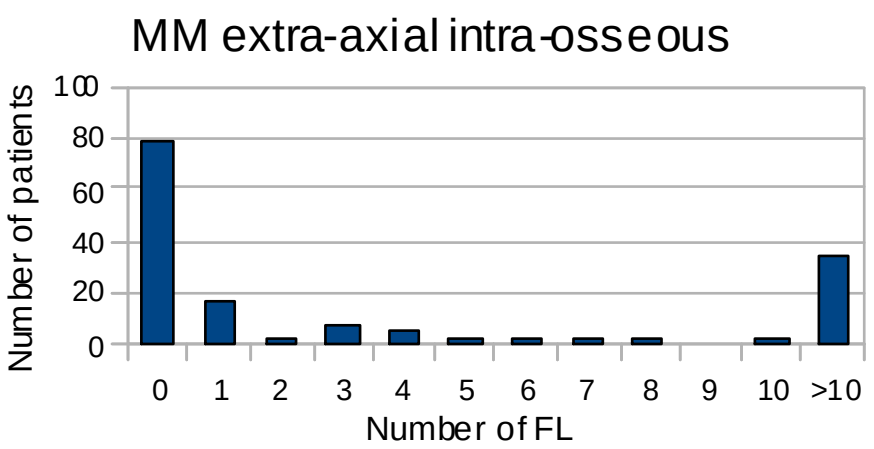
FL extra-axial

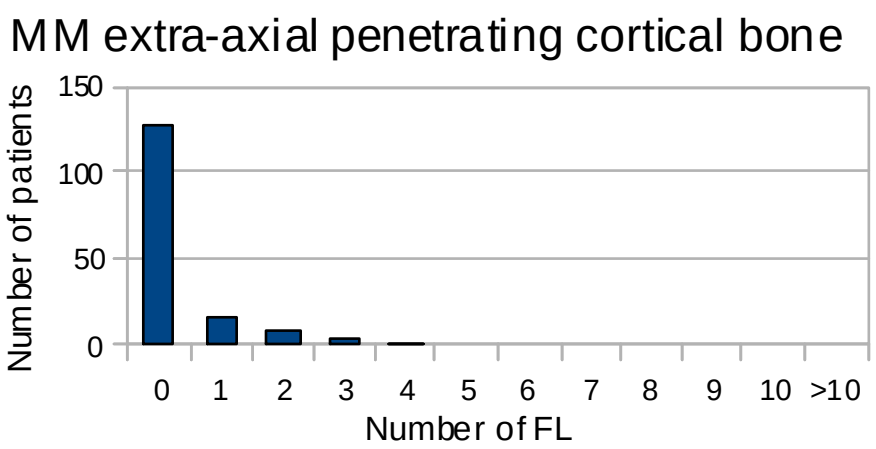
MGUS

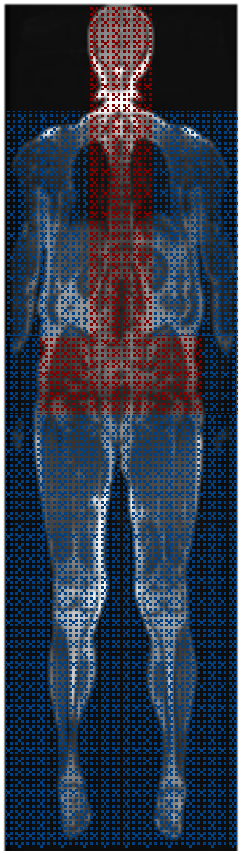
Solitary PC





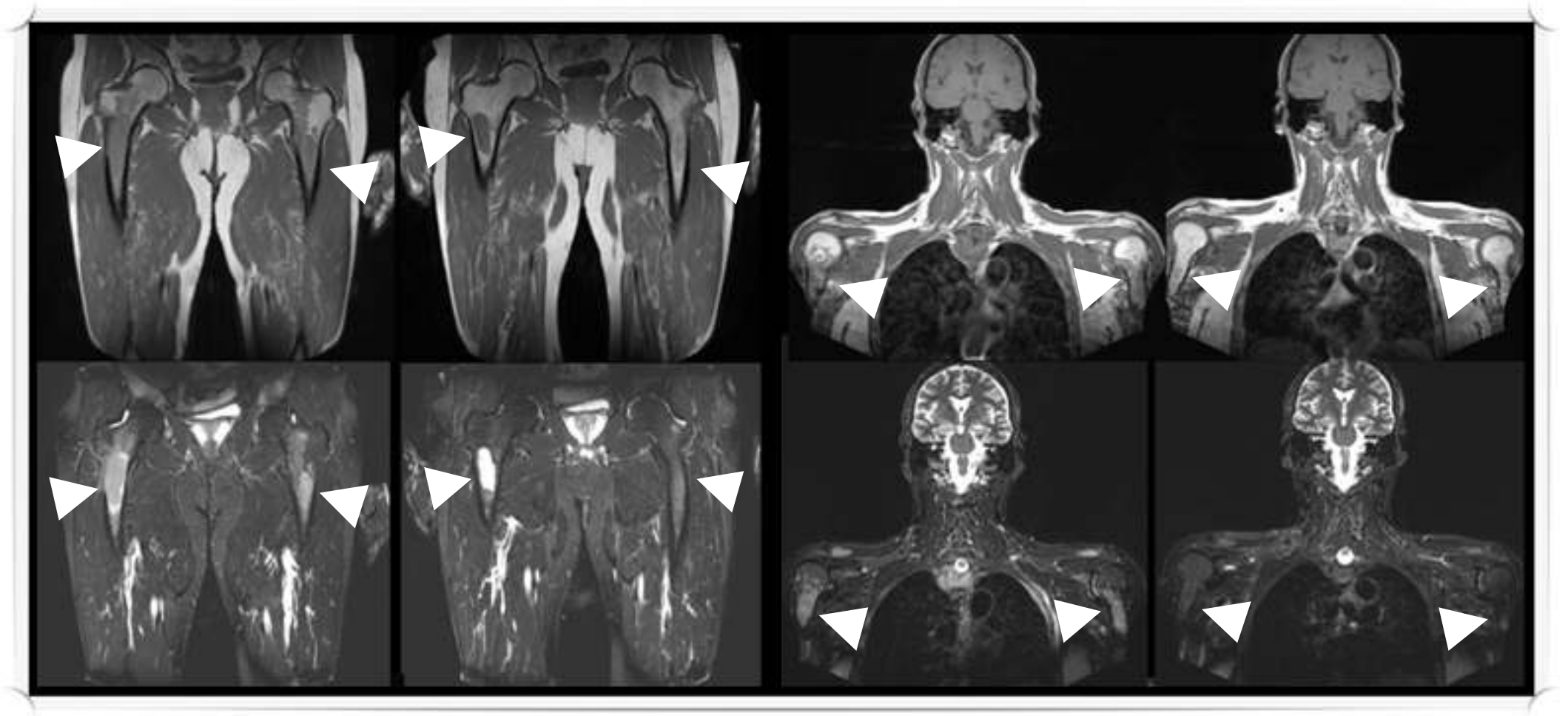






Detection of residual disease after ASCT

n = 100 patients with symptomatic MM

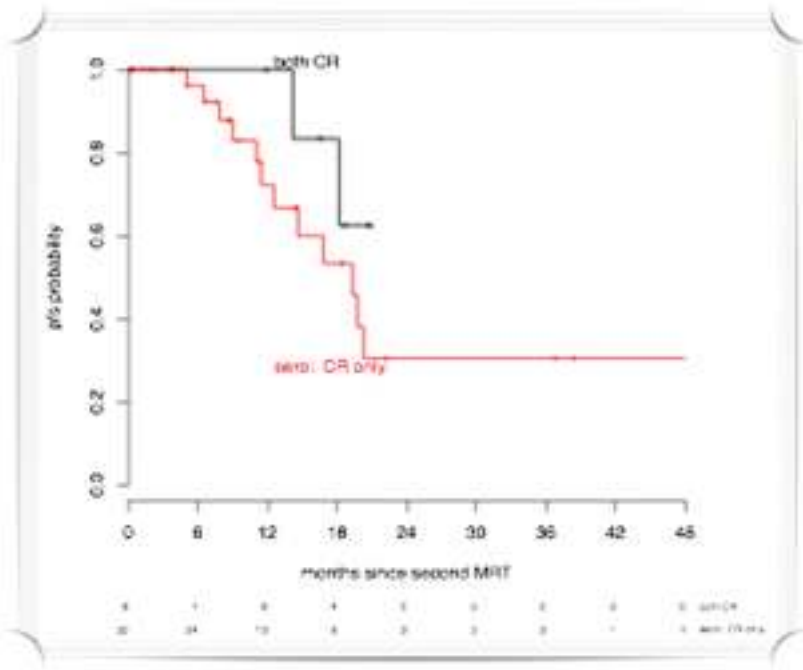


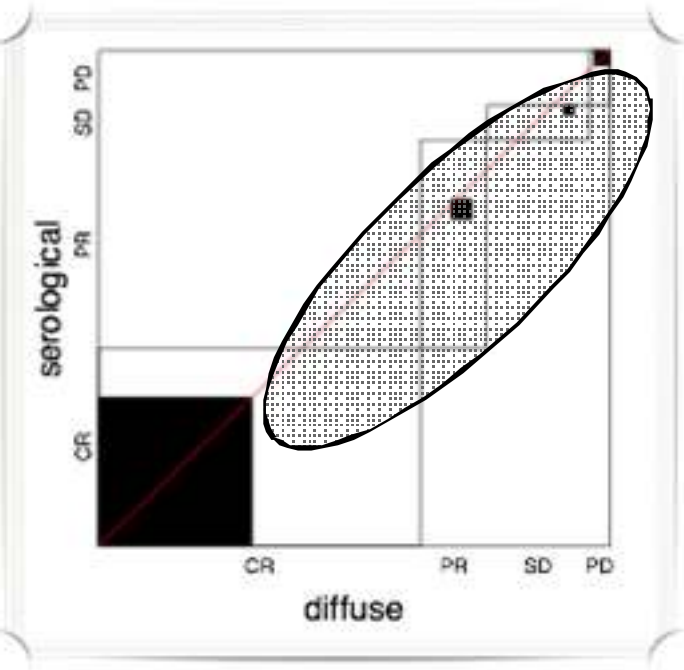
Hillengass ASH 2010

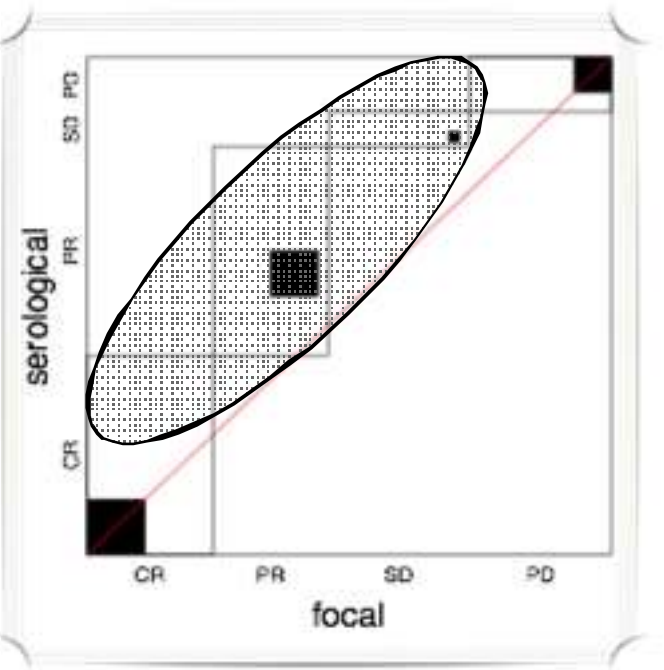
Whole body MRI for monitoring of treatment

n = 100 patients with symptomatic MM

- **Correlation** of serological and MRI-derived response
- **better prognosis** if complete remission in both methods
- response of **diffuse** infiltration **earlier**, **focal** lesions **later** (residual disease?!)



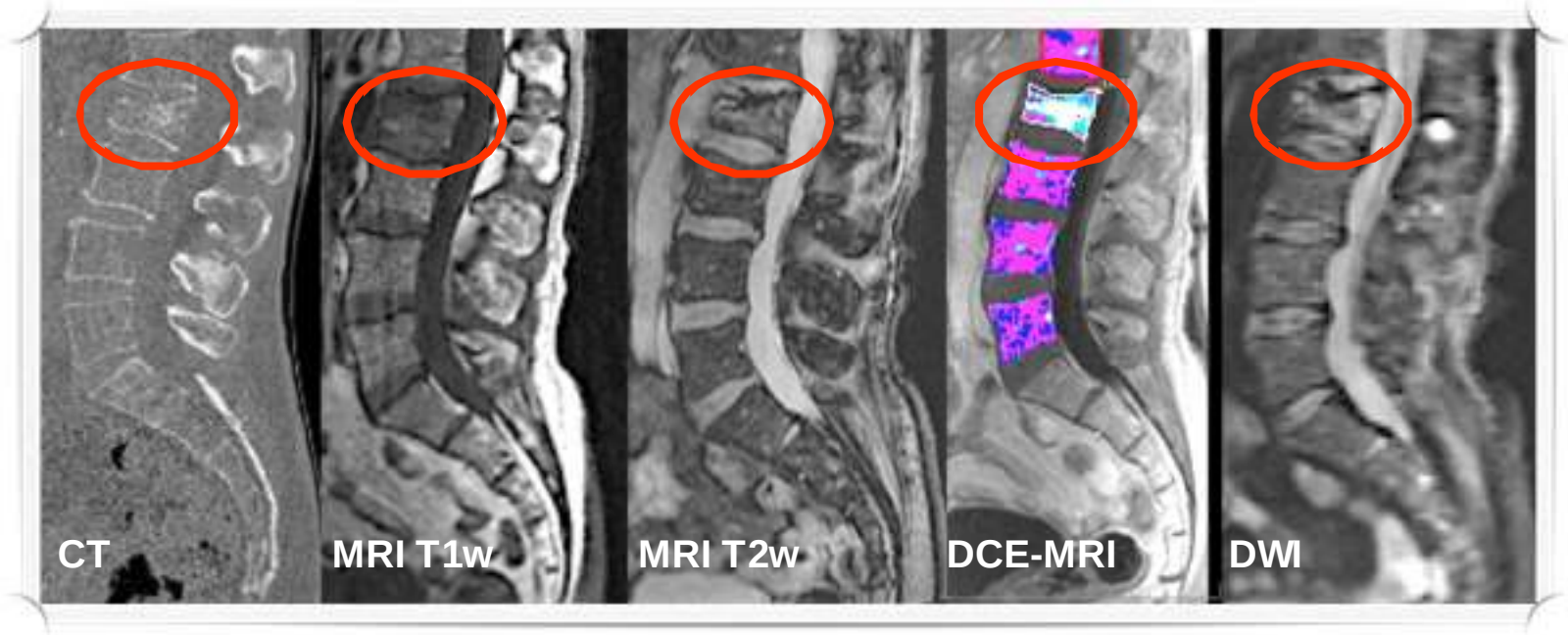




MRI

functional techniques

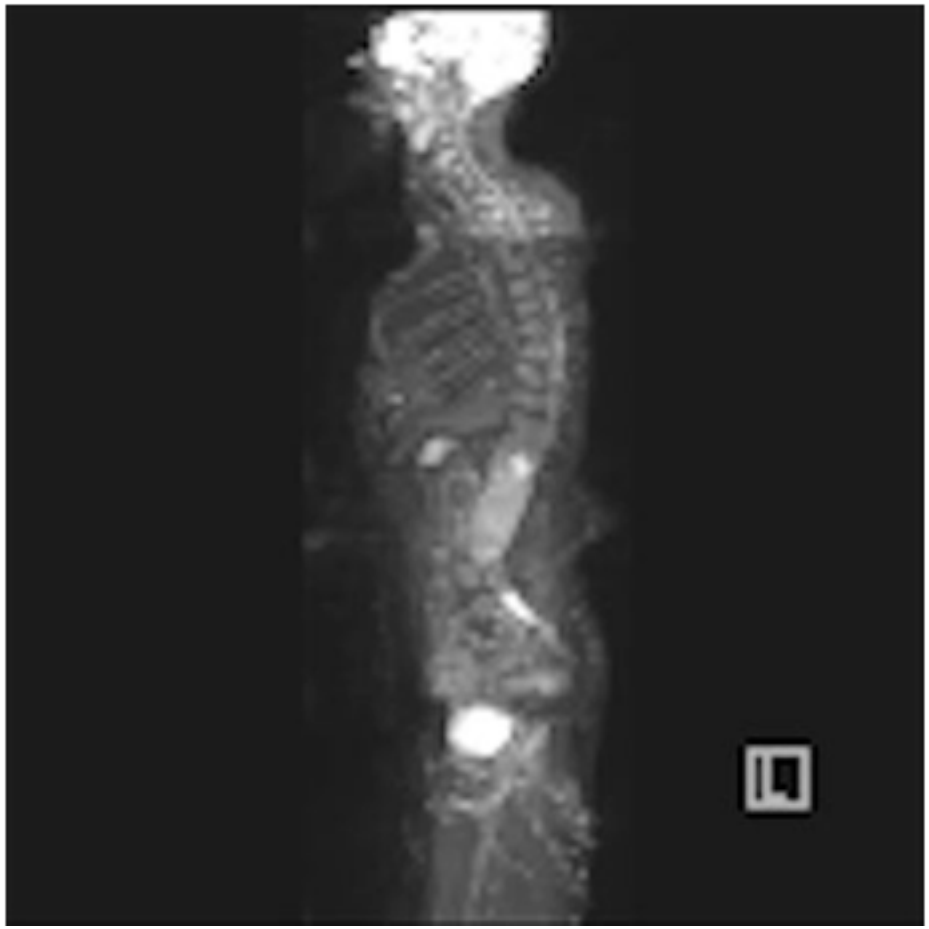
1. Dynamic contrast-enhanced MRI (DCE-MRI) => microcirculation
2. Diffusion-weighted imaging (DWI) => cellularity



Tan 2011 IMW Poster 121; Hillengass 2009 CCR and 2011 Brit J. Haematol

MRI

Whole body DWI



Spina 2011 IMW Poster 113; Decaux 2011 IMW Poster 127

Summary

Reasons for the application of Whole body MRI

1. Significantly **superior** to **spinal** MRI
2. Assessment of **bone marrow infiltration** (better than CT and x-ray)
3. **No radiation** exposure
4. Detection of **soft tissue tumors**

Further goals

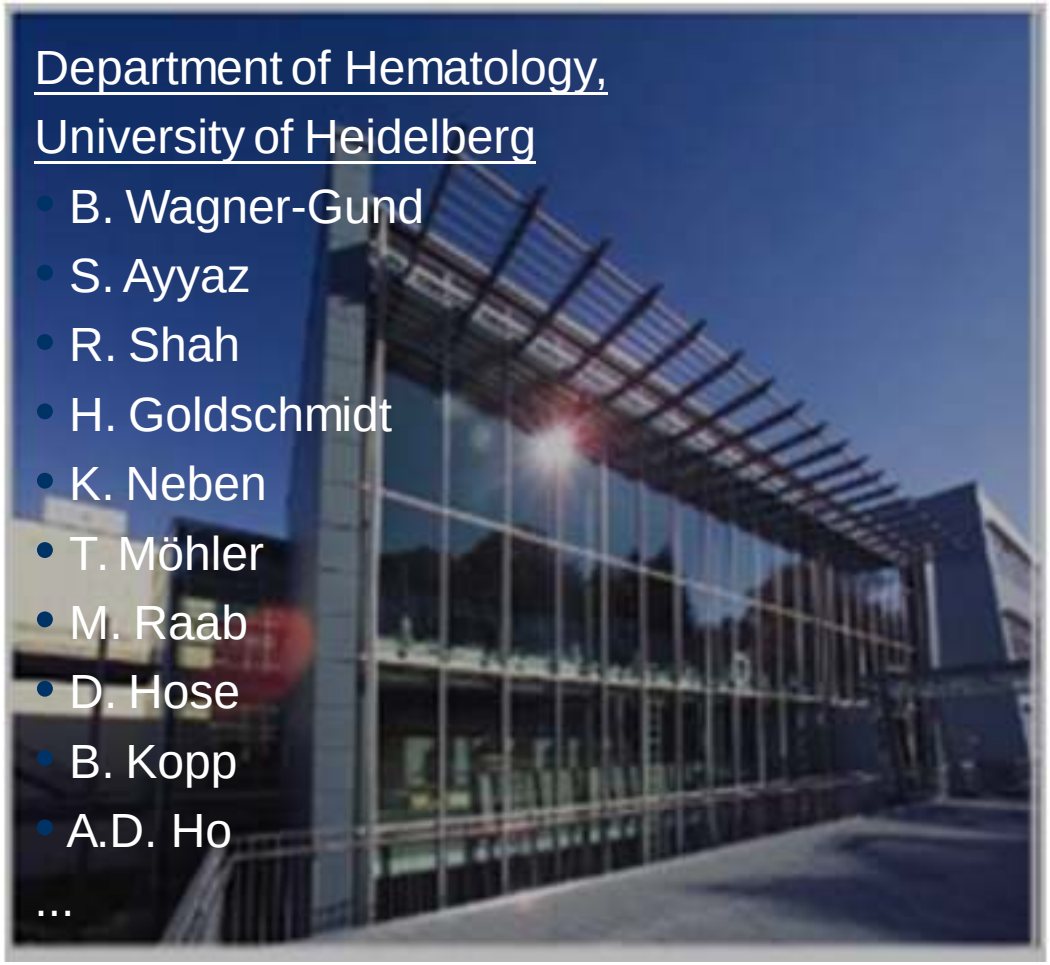
1. Assessment of **residual disease**
2. Evaluation of the significance for **treatment decisions**
3. Improvement of **resolution**
4. Implementation of **functional sequences**

Summary

Do we need **whole body MRI** or is **spinal MRI** enough**?**

Summary

Sometimes we have to look at the **complete picture**



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Thank you!

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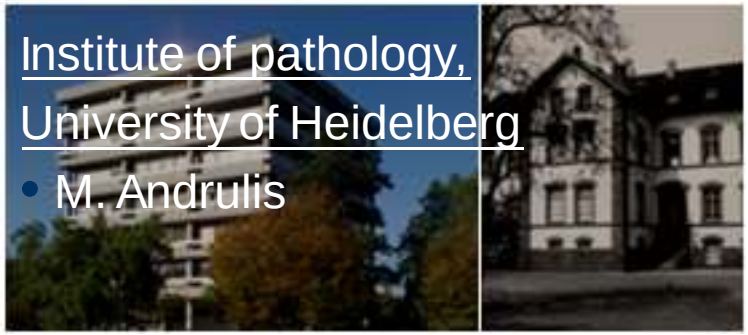

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