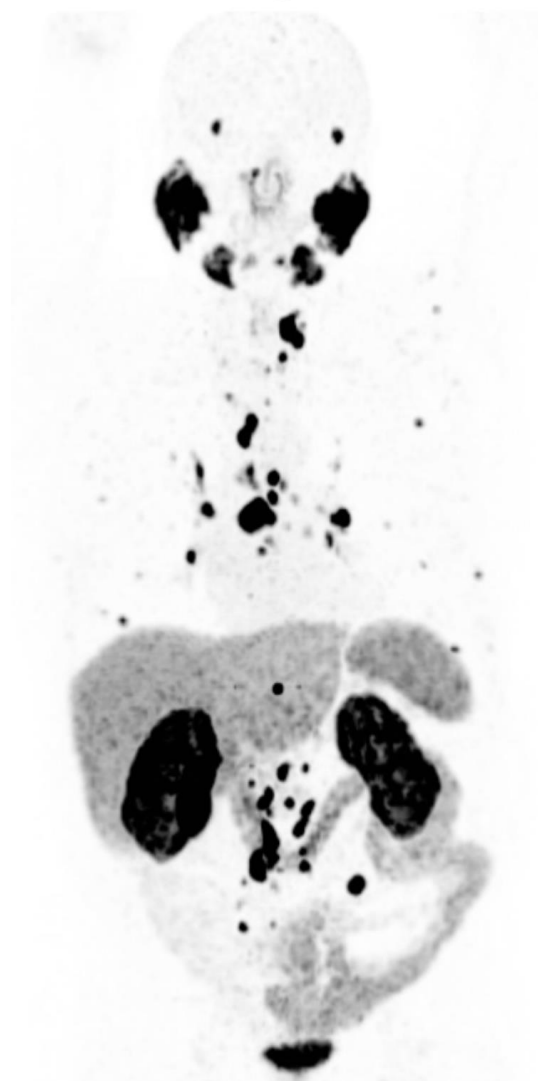
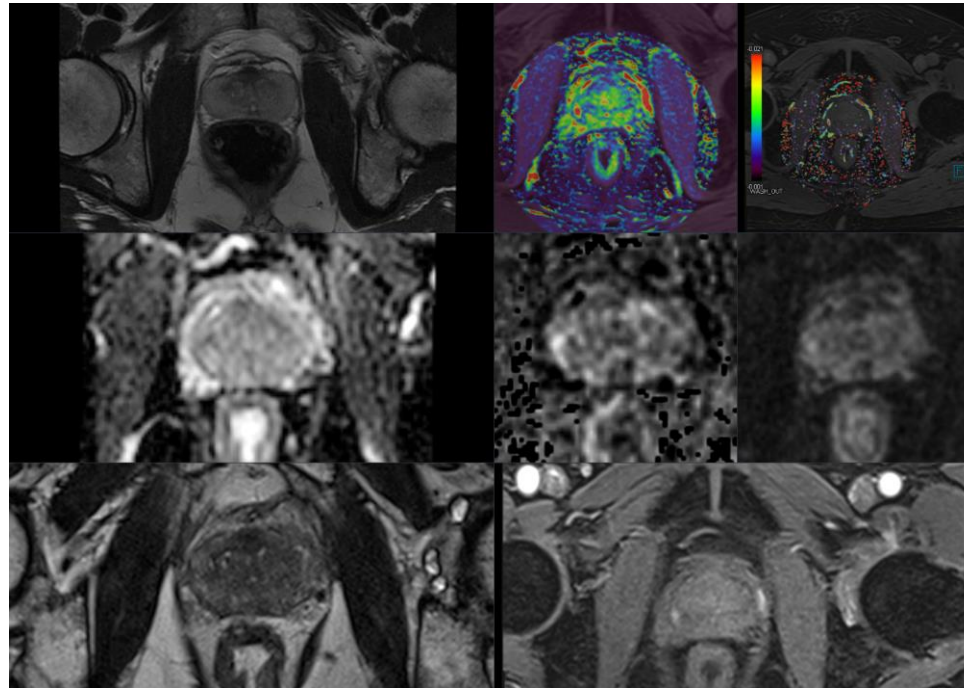


PSMA PET - diagnostikk og oppfølging



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Nukleærmedisinsk avdeling, Oslo universitetssykehus

Center for NM/PET, Radiologisk avdeling, Haukeland universitetssjukehus

mpMR

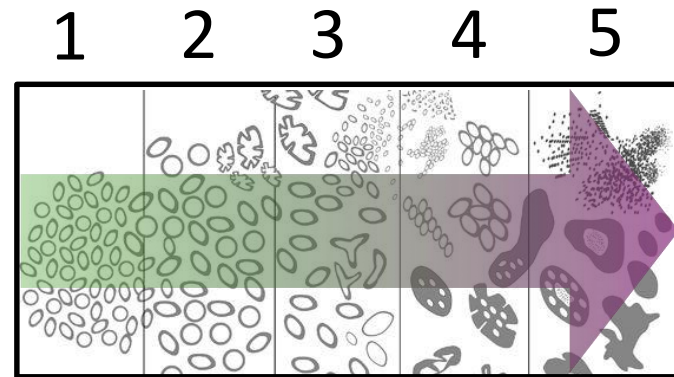
[¹⁸F]PSMA-1007

Disposisjon

- Prostatakraft avbildning
 - Prostate Specific Membrane Antigene (PSMA) Positron Emisjons Tomografi (PET)
 - Primær diagnostikk
 - Residiv diagnostikk
- Kliniske eksempler
 - Primær- og residiv setting
 - Radioligand behandling ($^{177}\text{Lutetium-PSMA}$, $^{223}\text{Radium}$ (Xofigo[®]))
- Diskusjon

Risikoinndeling

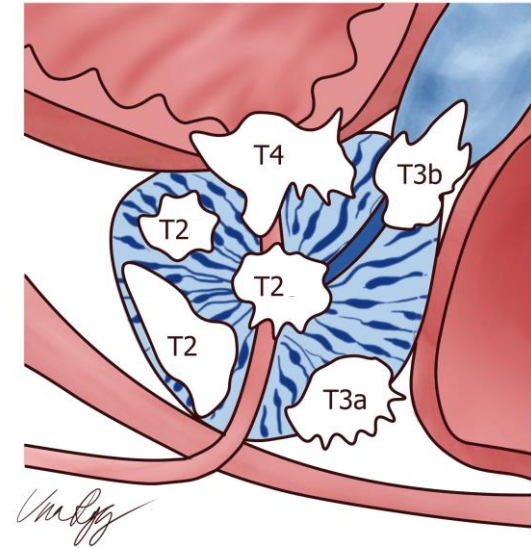
- Tumor-Node-Metastasis classification



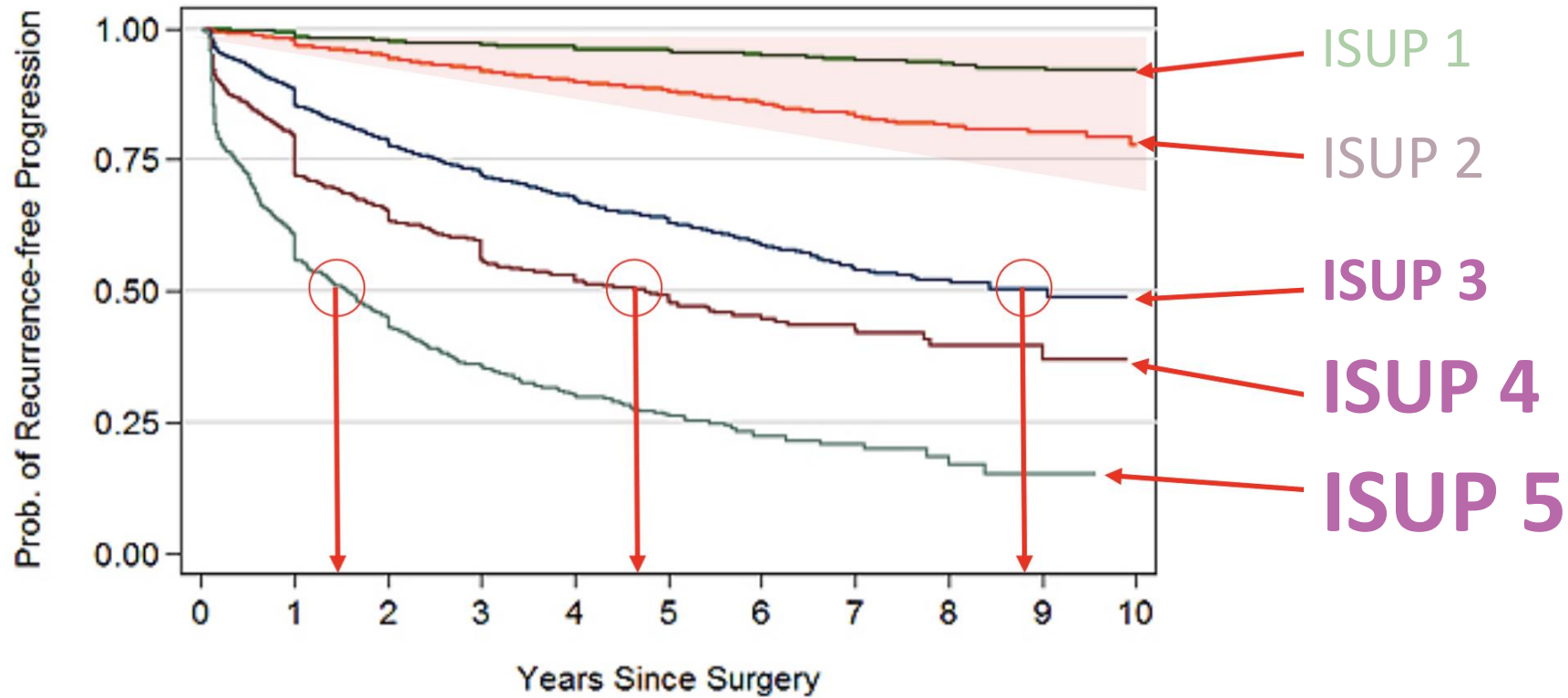
Epstein (2018) Mod Pathol 31:47-63

- Gleason grad

- Prostate Specific Antigen (PSA)



ISUP-grad-gruppe og tilbakefall



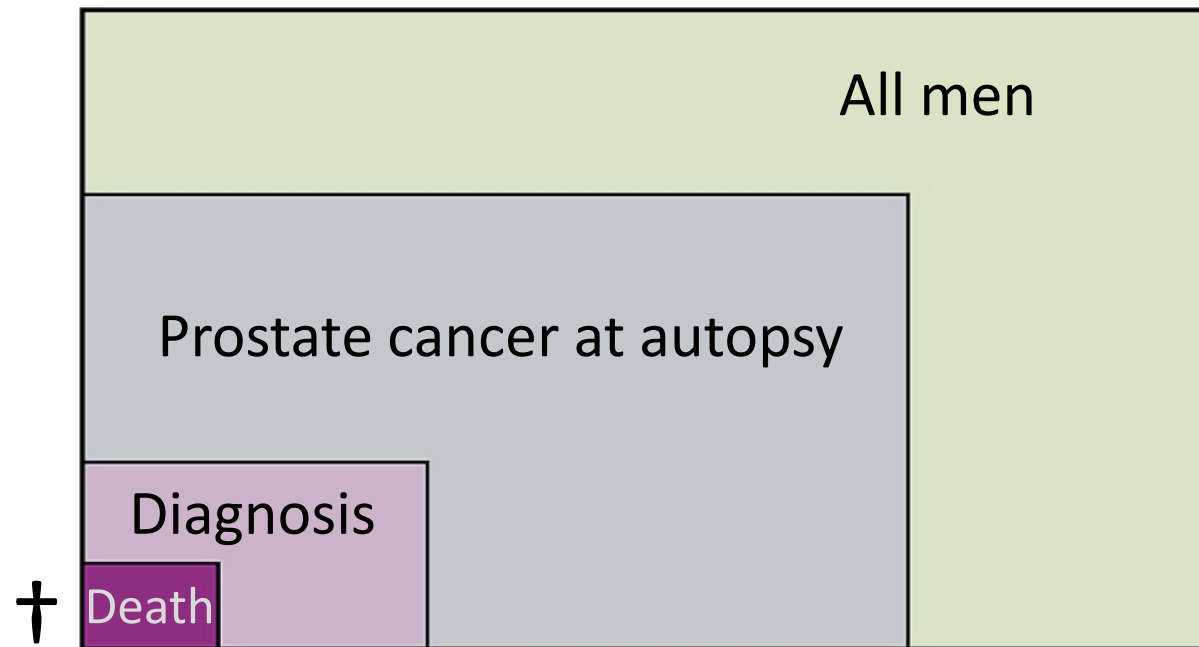
Number at risk

6	7397	6973	5104	4064	3226	2461	1768	1186	670	278	108
3+4	8353	7202	5298	3983	2955	2091	1299	778	393	135	45
4+3	3106	2452	1605	1152	839	569	350	199	90	38	15
8	917	678	412	280	191	129	86	59	35	14	7
≥9	1051	578	325	194	118	73	41	24	12	4	2

Prostatkreft

Kreftregisteret 2021

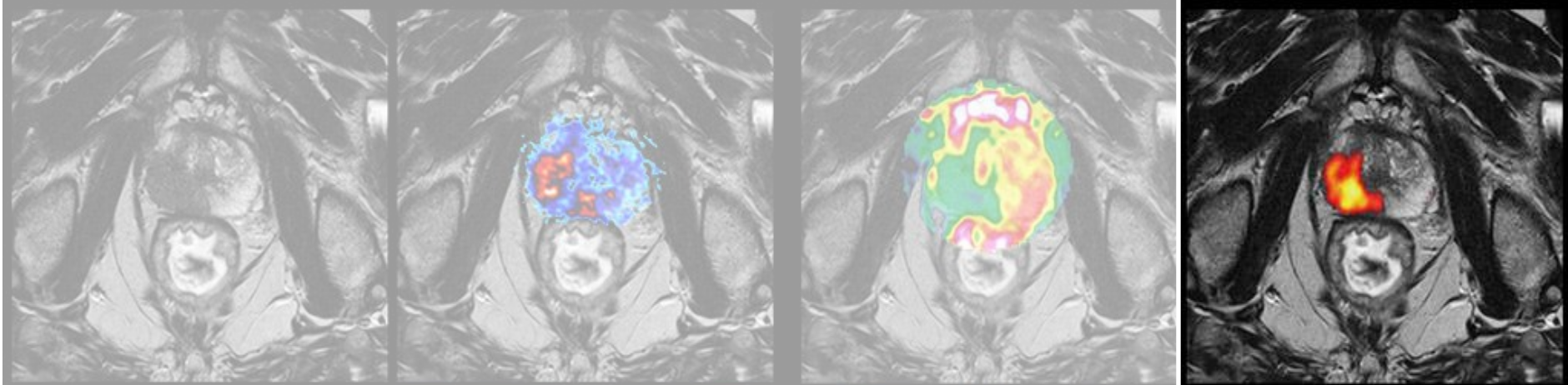
~5.000.000 innbyggere



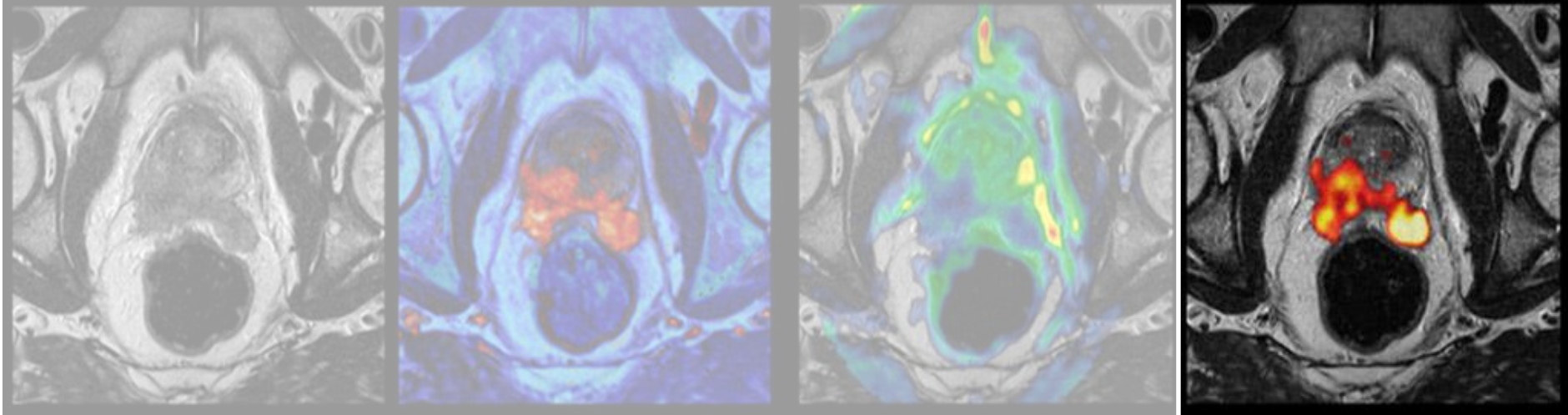
Damber (2008) Lancet 371:1710-21

MR for deteksjon, biopsy veiledning og T-staging

T3



T4



T2

T2/DCE

T2/Ktrans

T2/DWI

Node Metastasis Classification

PSMA - PET ~95%

MRI

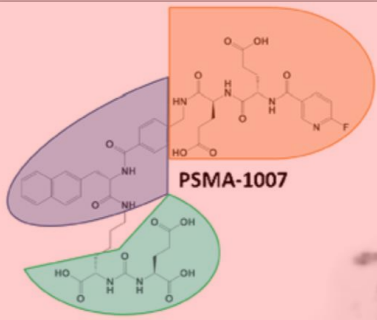
(Skjelettscintigrafi)



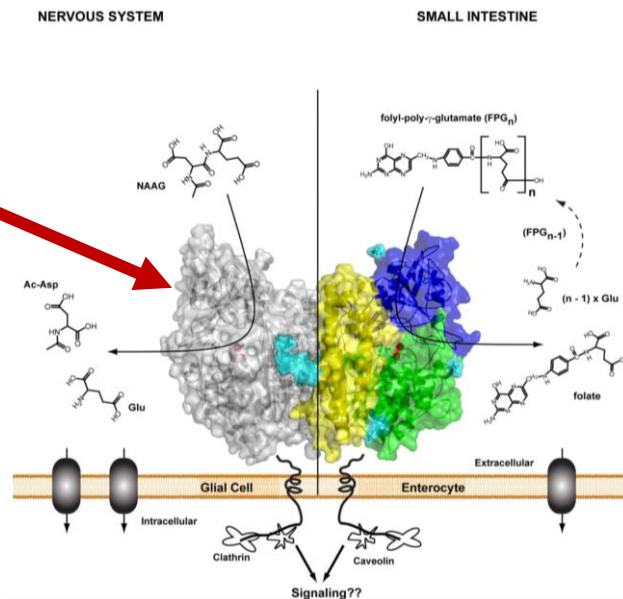
Prostate Specific Membrane Antigen

PSMA

PSA

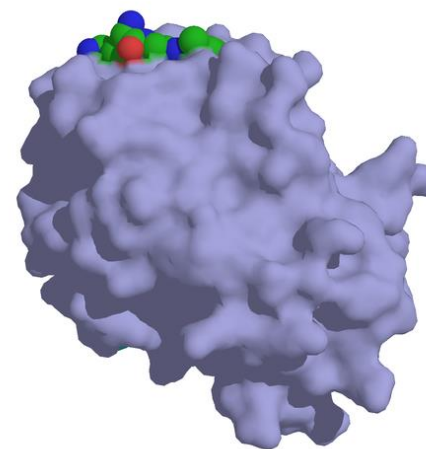


PET-ligand



C. Bařinka et al. Curr Med Chem. 2012; 19(6): 856–870

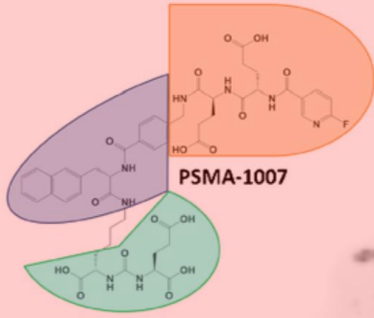
Glutamate Carboxy Peptidase II
 alias NAAG peptidase
 alias Folat Hydrolase I
 alias **PSMA**



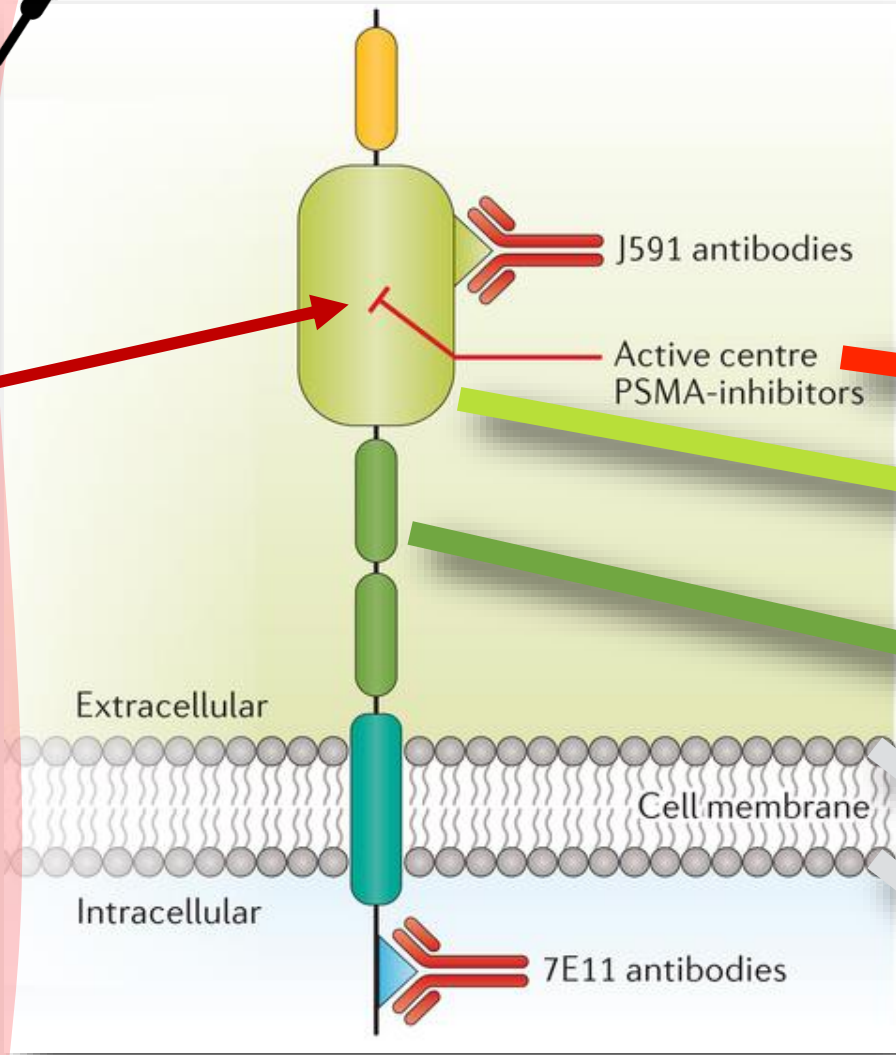
Wikipedia

Semenogelase
 alias Kallikrein-3
 alias **PSA**

Folat Hydrolase I alias PSMA



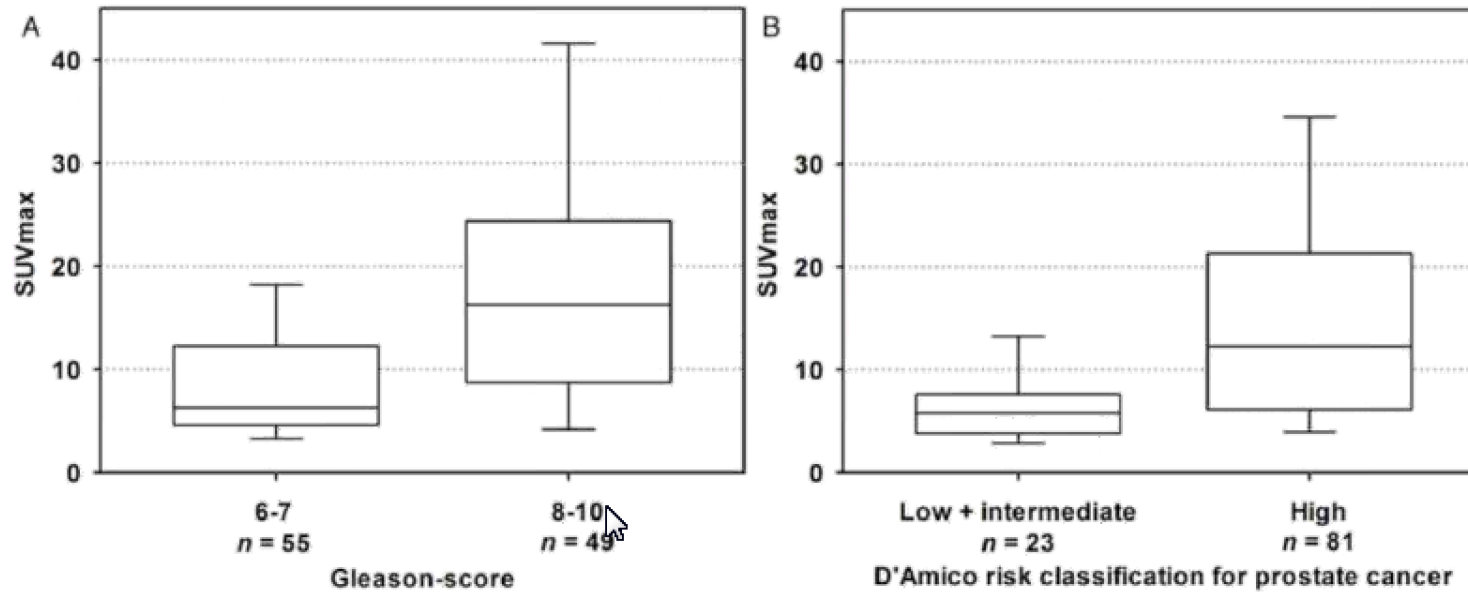
PET-ligand



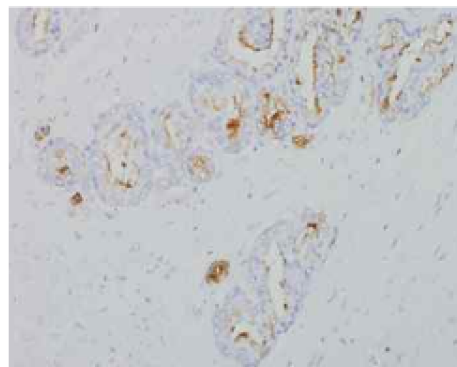
PSMA inhibitor



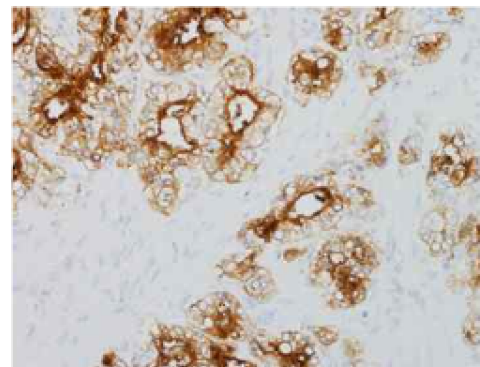
PSMA-uttrykk på celleoverflaten øker med tumorgrad



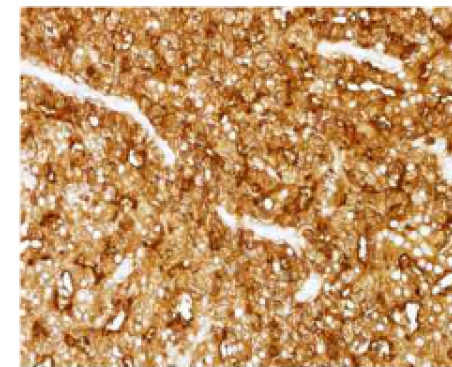
PSMA
immunfarging



Gleason 3



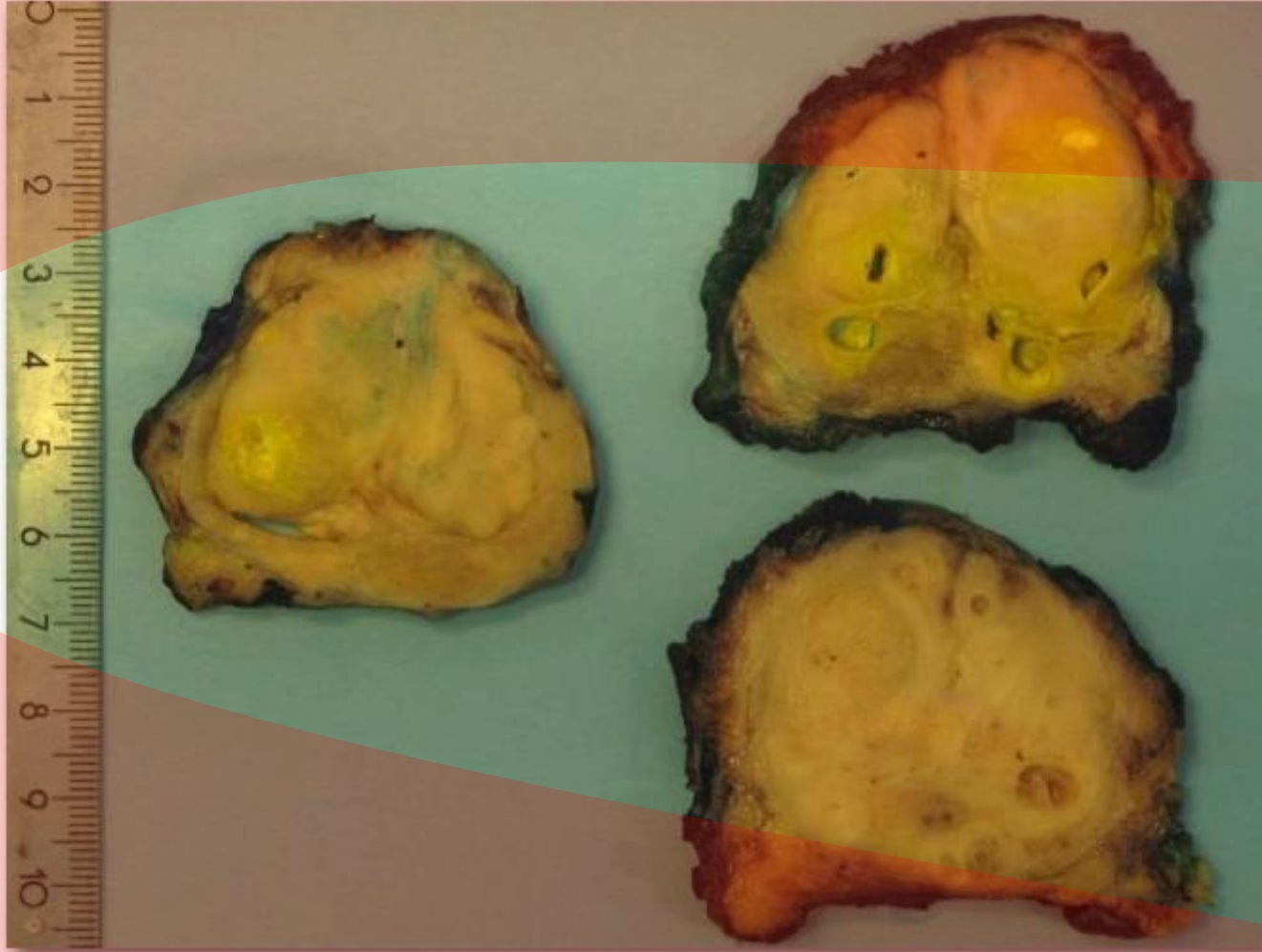
Gleason 4



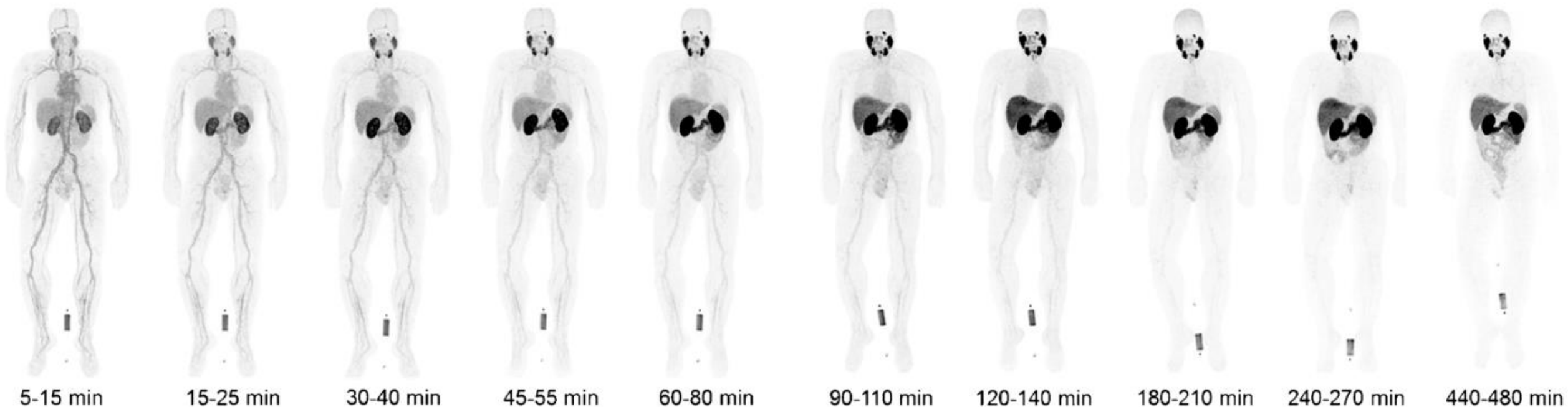
Gleason 5



PSMA opptaksmekanisme



[¹⁸F]PSMA-1007 opptak over tid



Beste tidspunkt:
2-3 timer p.i.

[¹⁸F]PSMA-1007



[⁶⁸Ga]PSMA-11



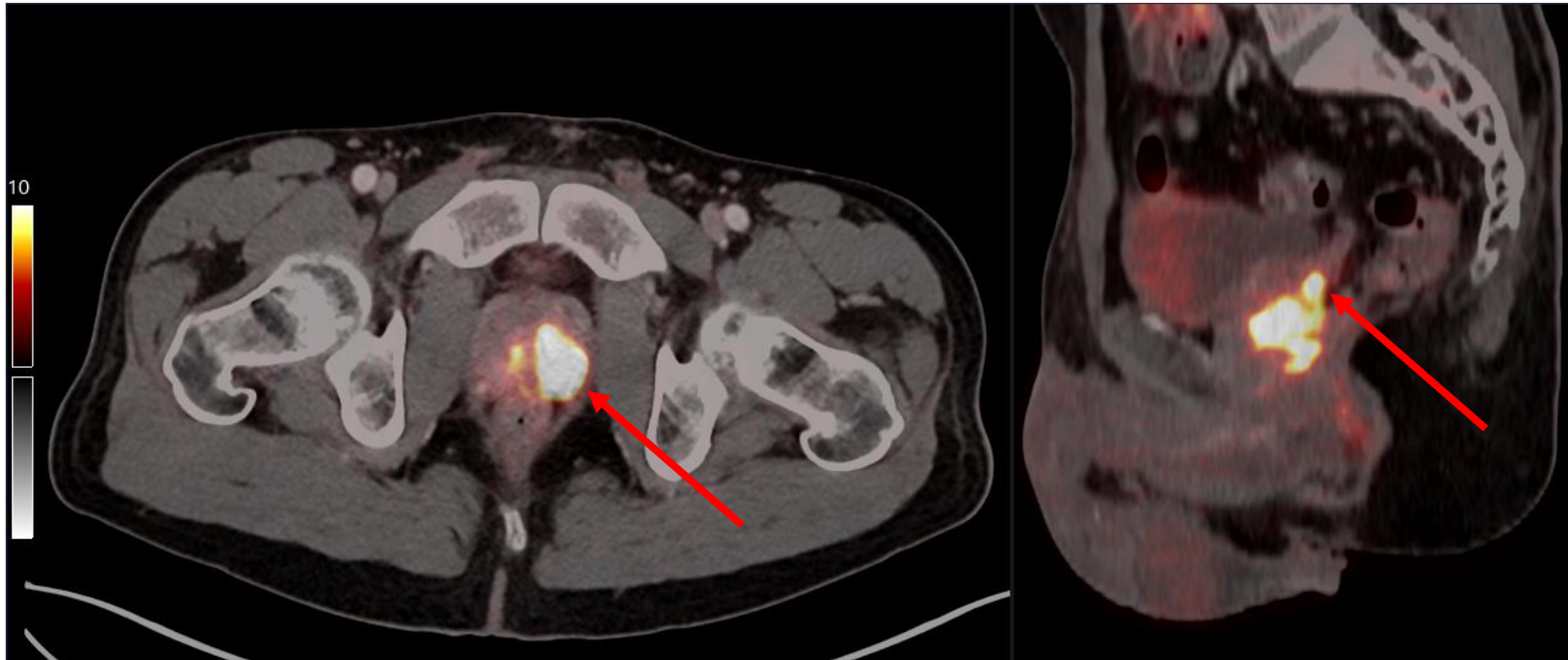
[¹⁸F]PSMA-1007



[⁶⁸Ga]PSMA-11

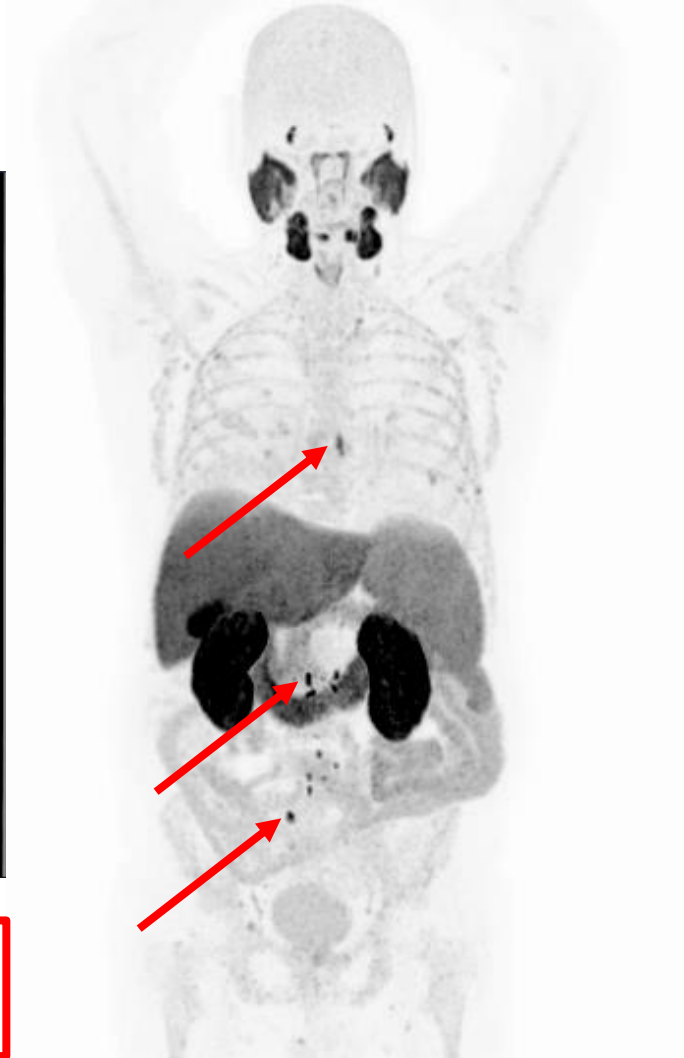
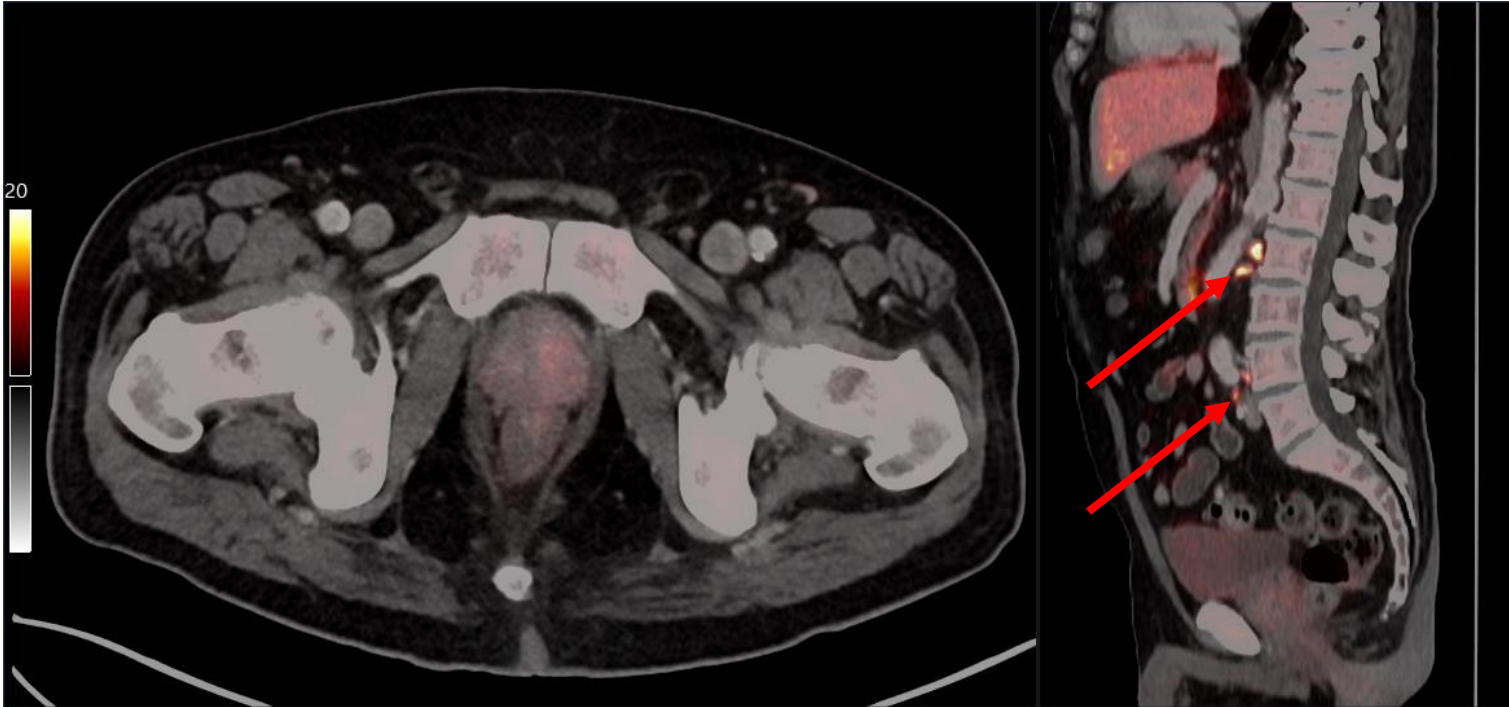


Primær ISUP 4, PSA 24.3, T3b m 46 år Metastaser?



M0,N0

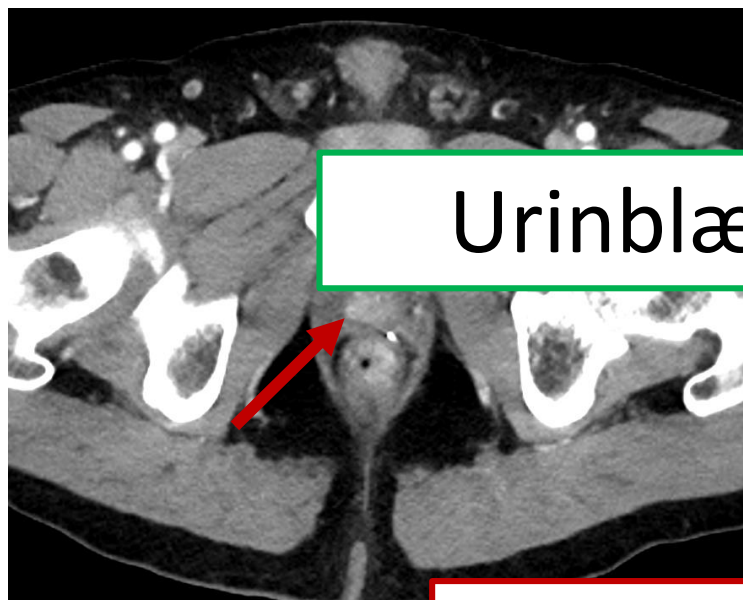
Primær ISUP 4, PSA 11.8, T3a m 63 år Metastaser?



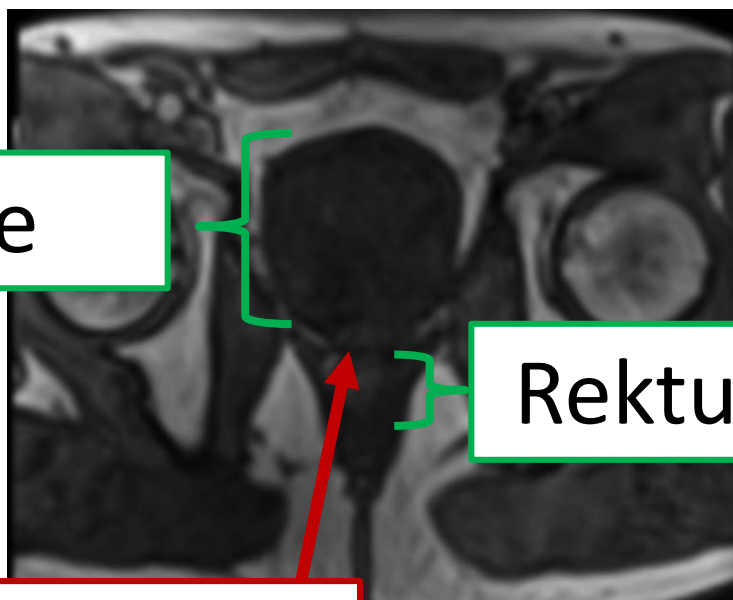
M1a

RALP 2020, ISUP III, PSA 0 -> 0.2 m 67 år

CT
+ivk.



Urinblære

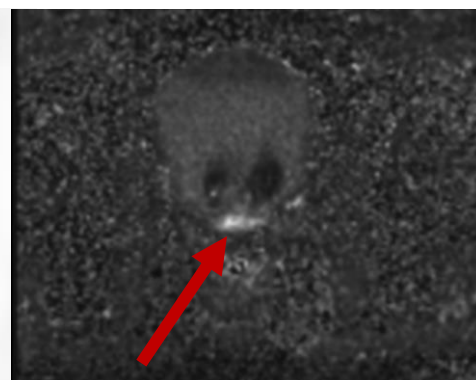
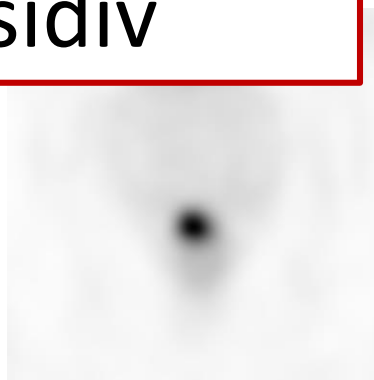
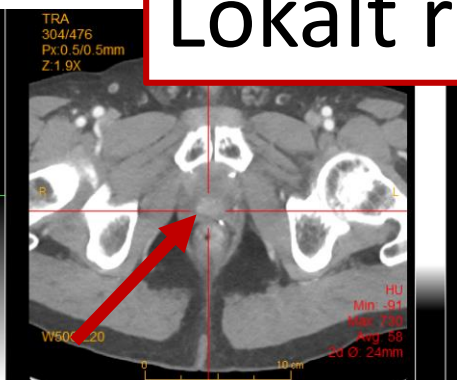
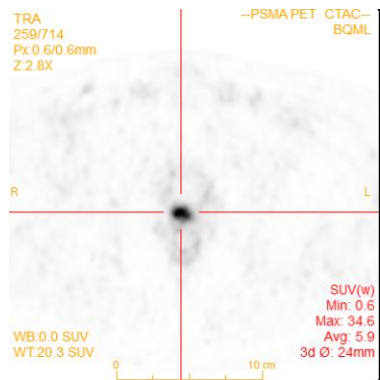


Rektum

DCE MRI
(5 min/25 sec)

*dyn. [¹⁸F]FACBC &
DCE & local recurrence:
Tulipan (2019)
Acta Radiol 60:1018-38

Lokalt residiv

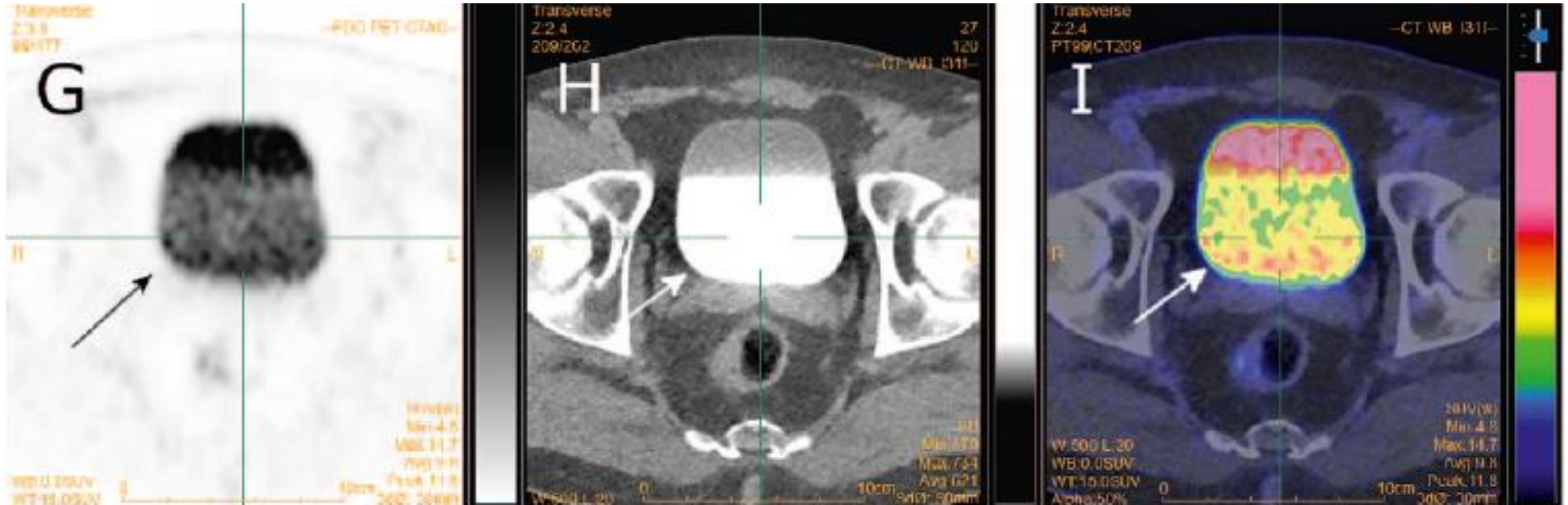


DWI

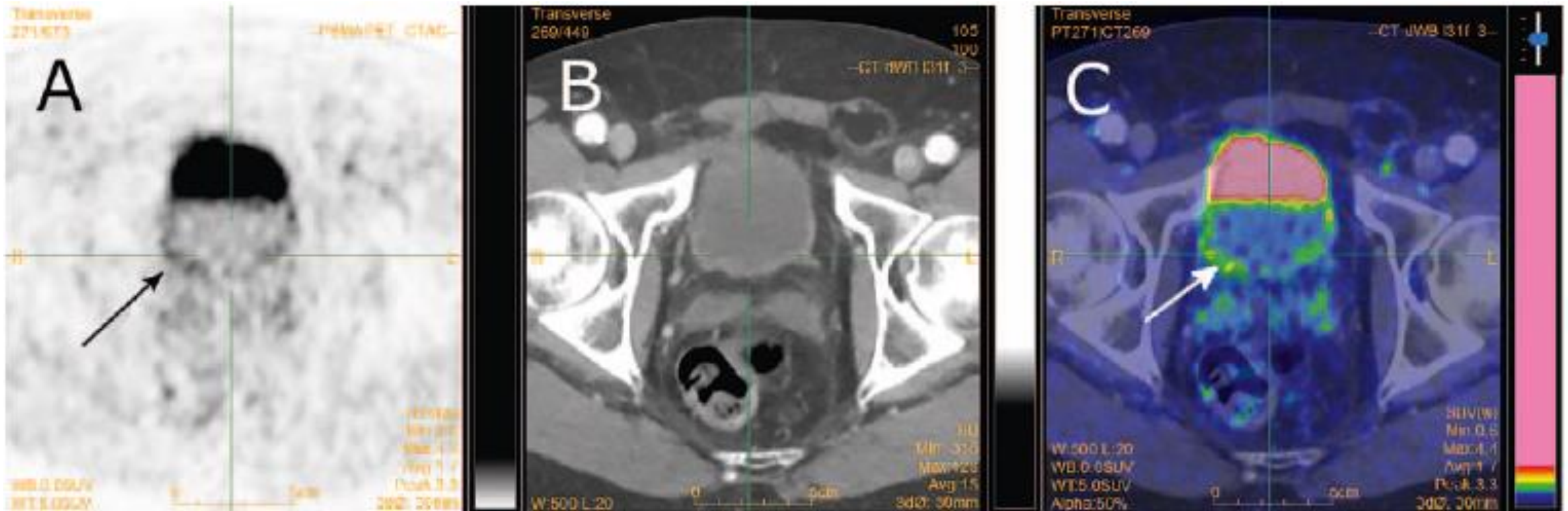
[¹⁸F]PSMA PET/CT

PET/MR*

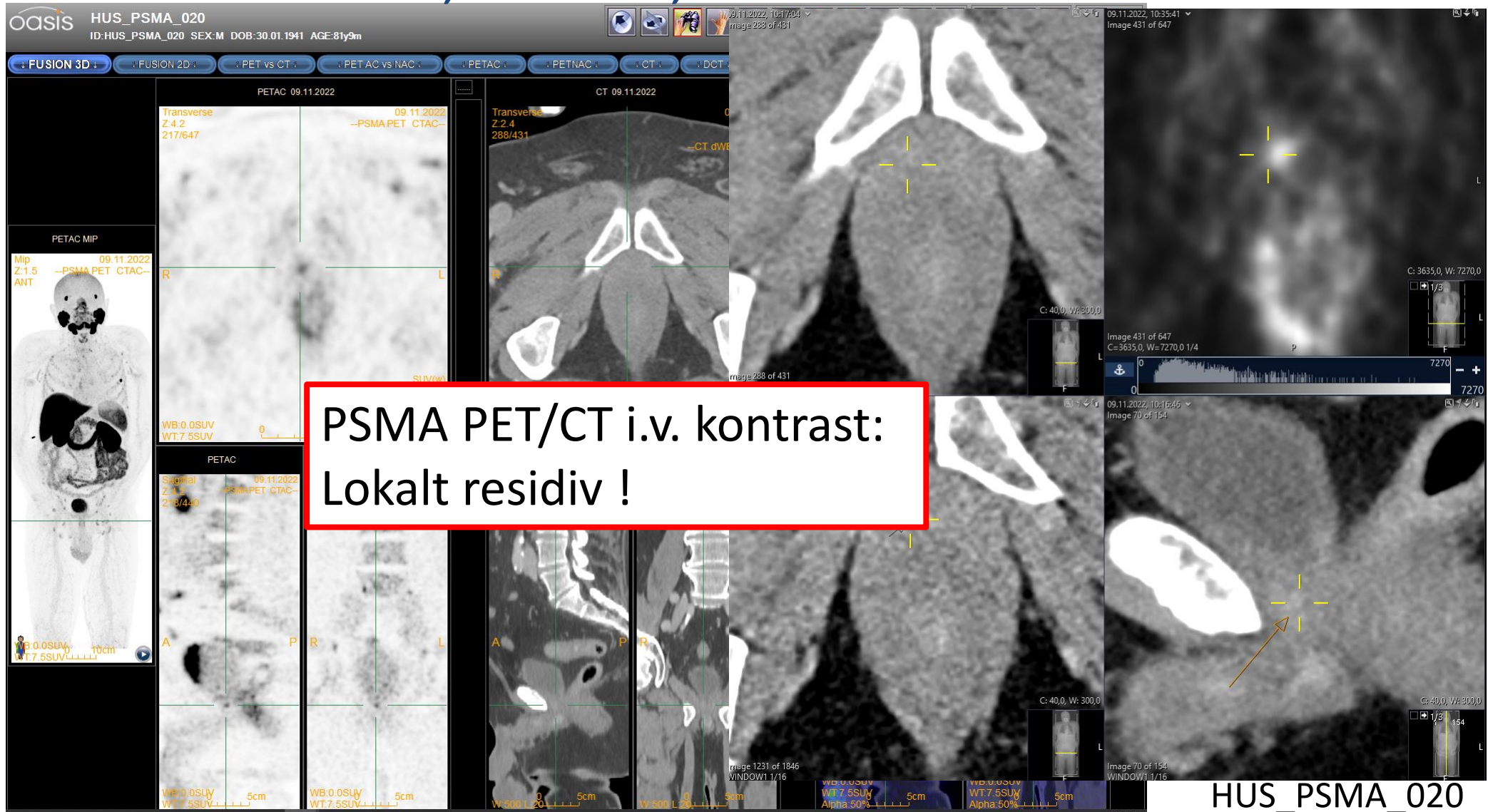
Urinutskilt Kontrastmiddel



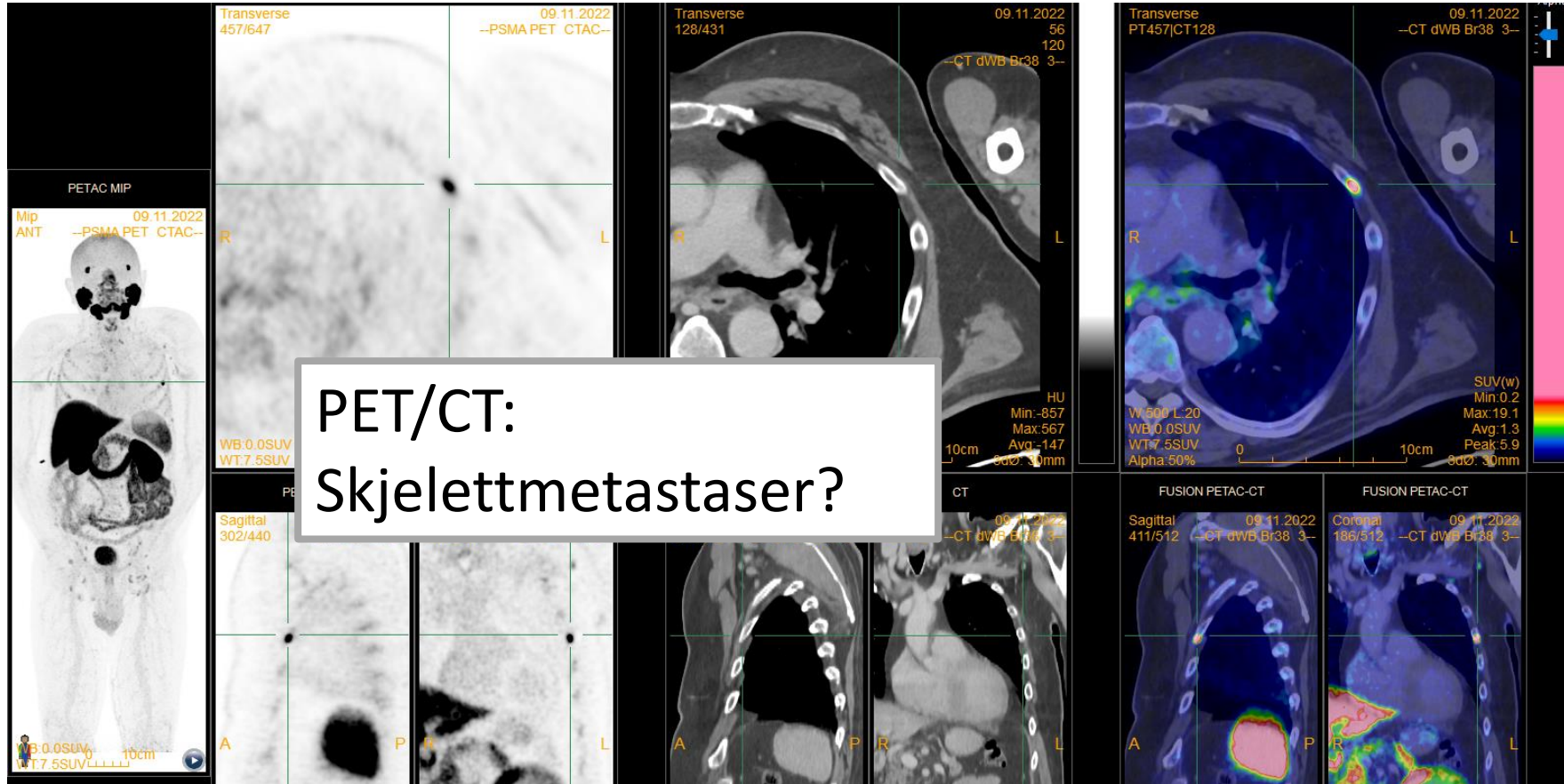
Urinutskilt Kontrastmiddel



RALP 2021, ISUP III, S-PSA 0.0 -> 0.2 m 74 år

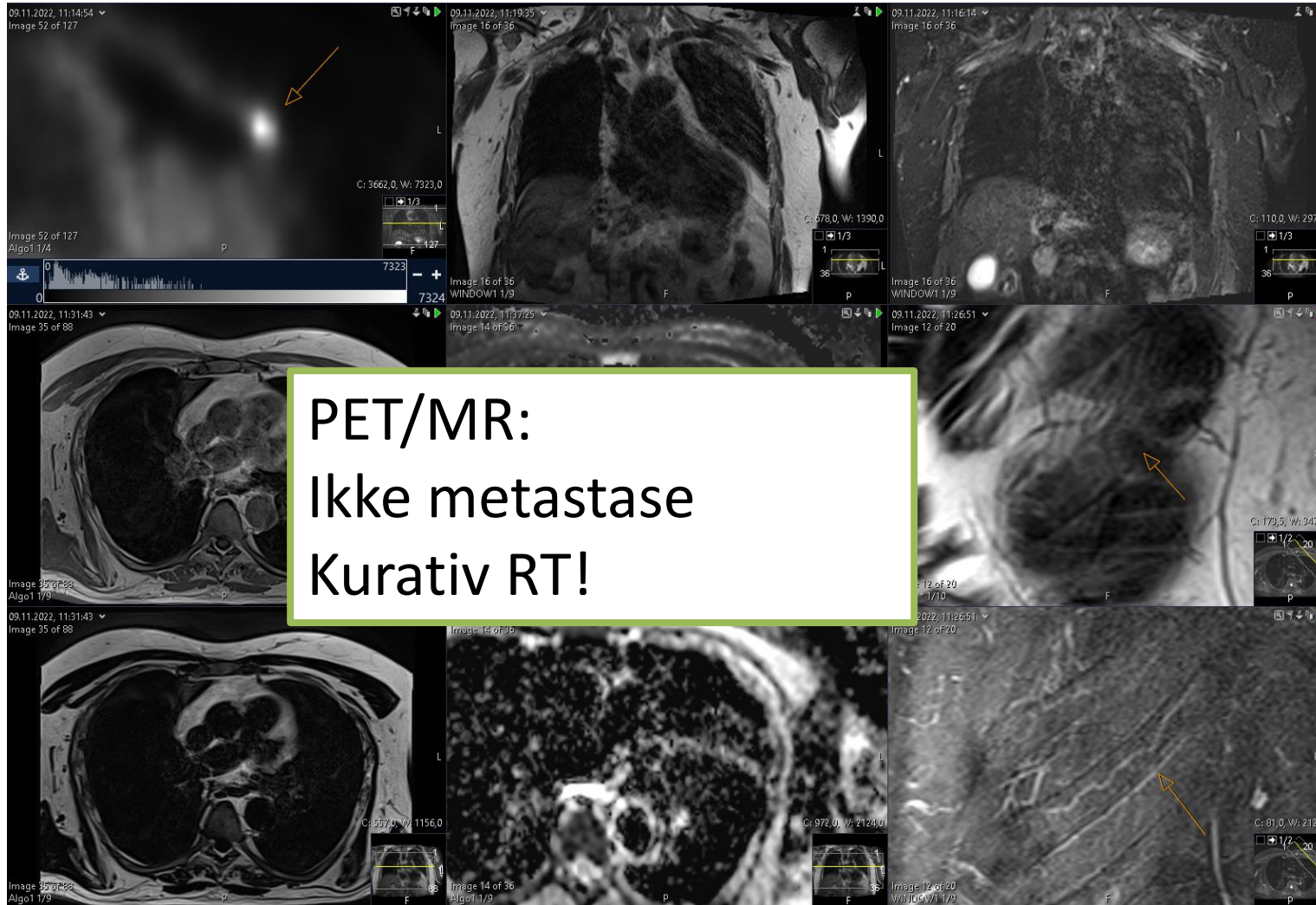


RALP 2019, ISUP III, S-PSA 0.0 -> 0.2 m 74 år (lokalt residiv)



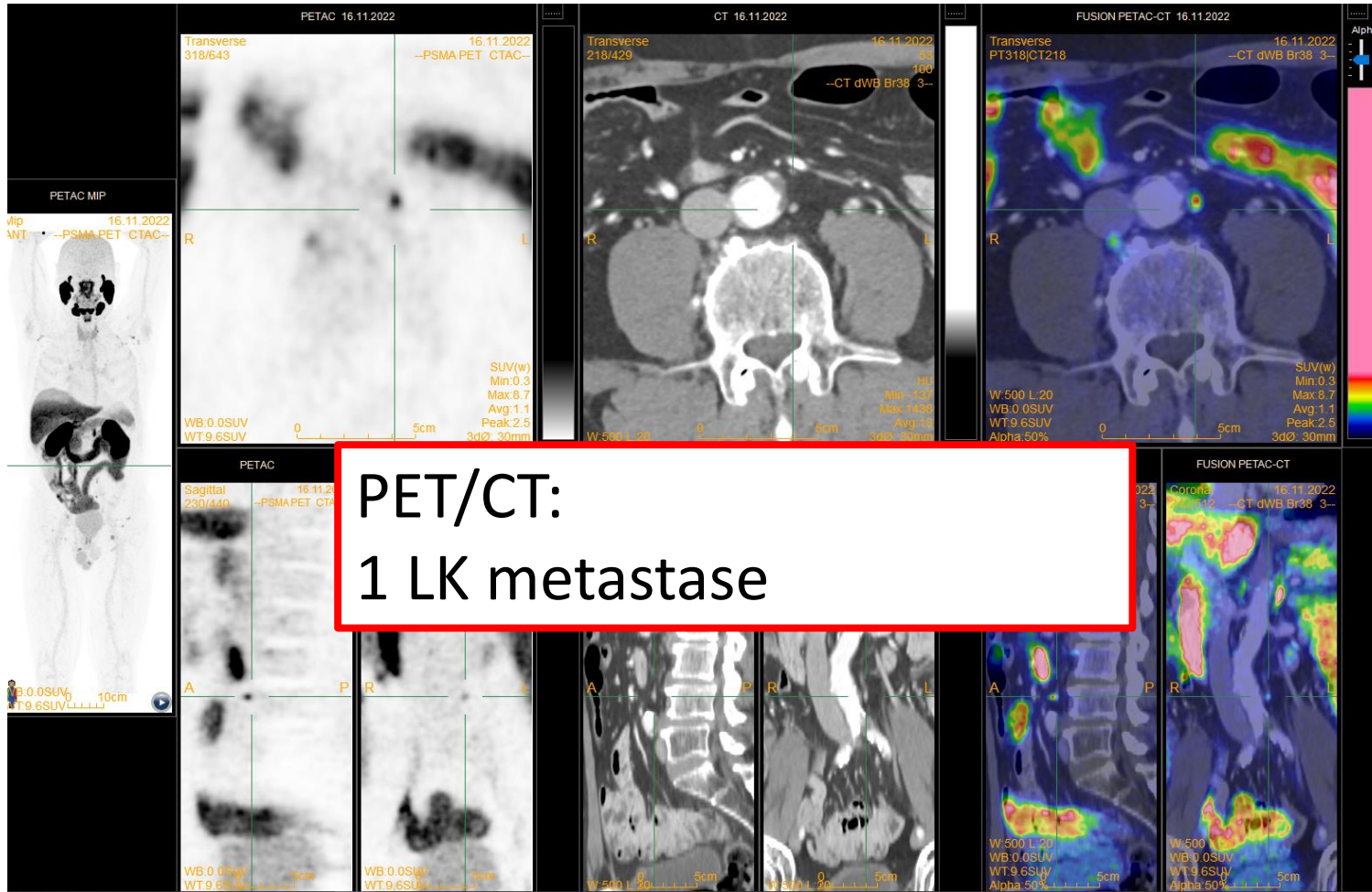
HUS_PSMA_020

RALP 2019, ISUP III, S-PSA 0.0 -> 0.2 m 74 år (lokalt residiv)



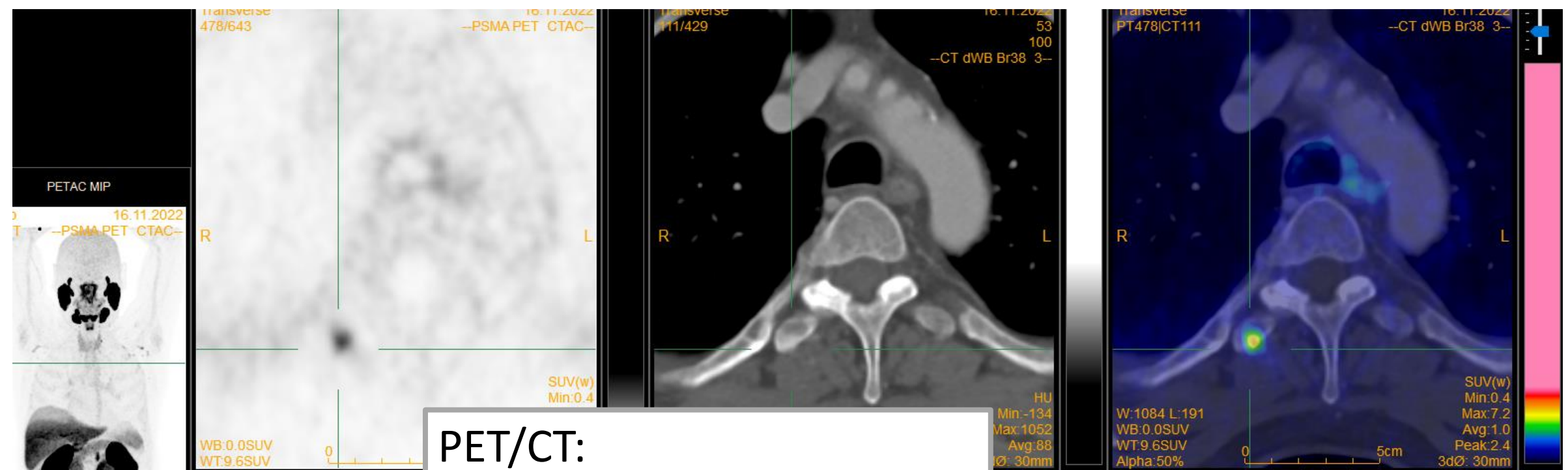
HUS_PSMA_020

RALP 2020, ISUP IV, RTx 2021, PSA 0 -> 0.2 m 67 år



HUS_PSMA_021

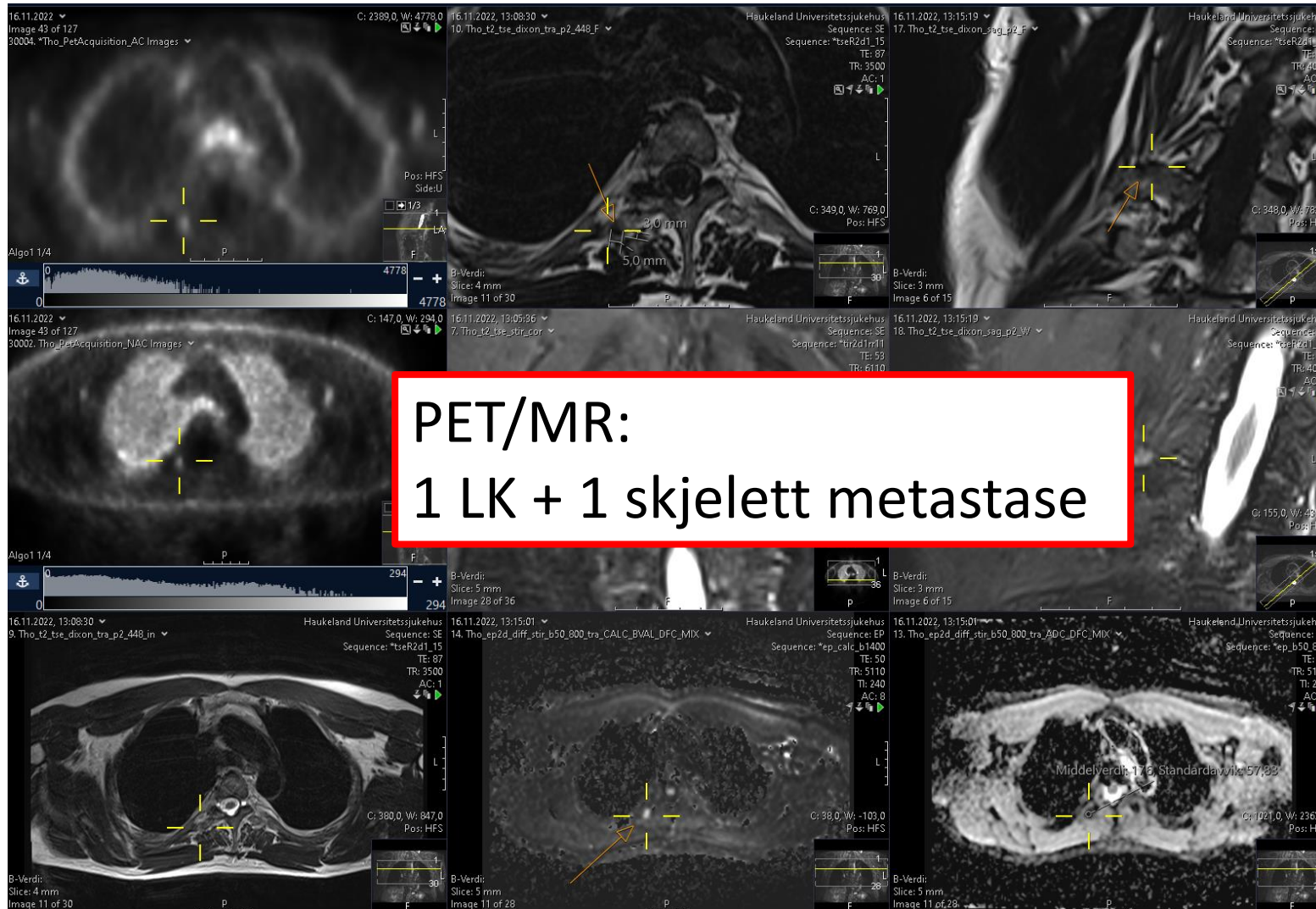
RALP 2020, ISUP IV, RT 2021, PSA 0 -> 0.2 m 67 år



PET/CT:
Skjelettmetastase ??

HUS_PSMA_021

RALP 2020, ISUP IV, RT 2021, PSA 0 -> 0.2 m 67 år



HUS_PSMA_021

Henvising helt ok med PSA > 0,2, men hva med PSA ~0,1

Cancer prostata operata oktober -21:

Gleason 9 a, pT3b

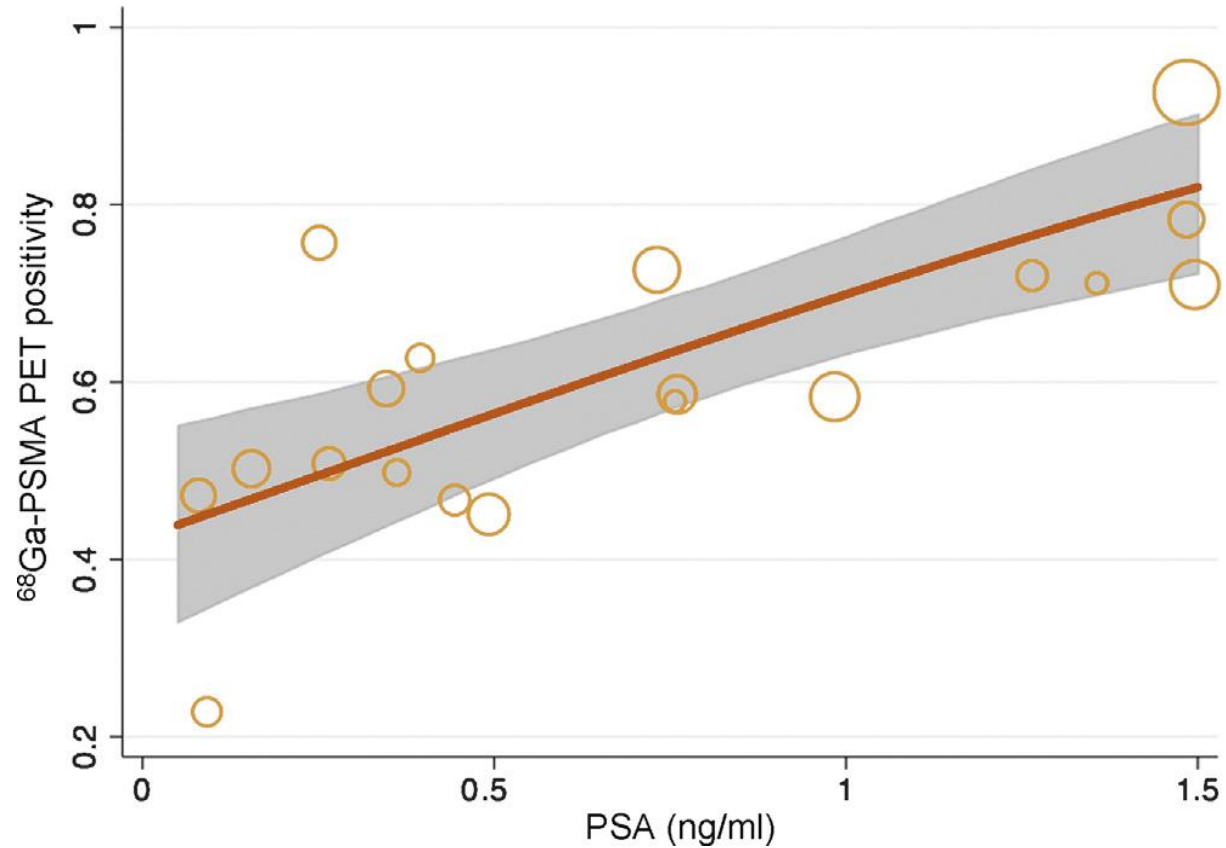
pN0 frie render (0/9 hø., 0/13 venstre),

Preoperativ PSA 10, aktuelle PSA ikke påvisbar.

April PSA 0,06 Juni 0,08 Nå i August 0,12

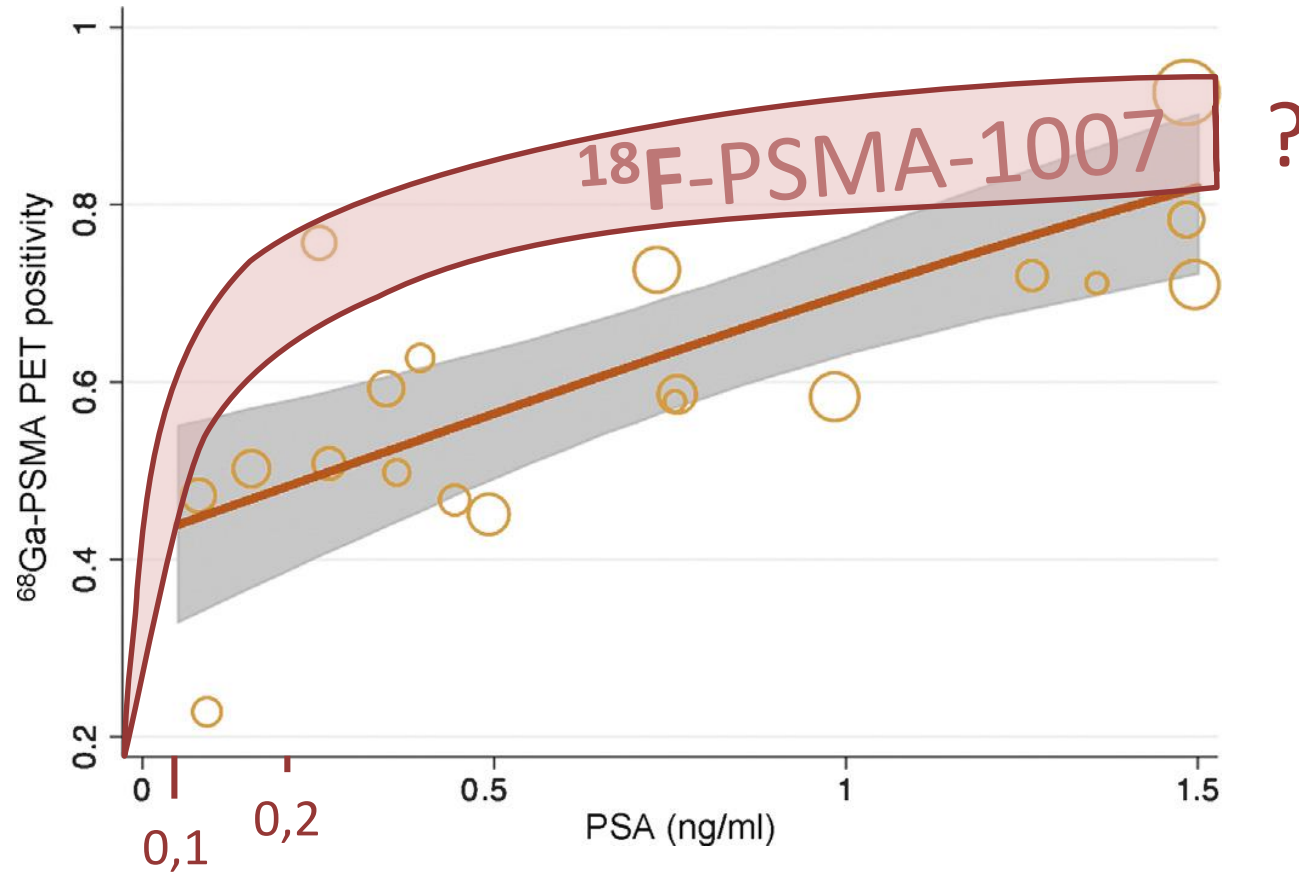
Ca. 4 mnd. PSA doblingstid

^{68}Ga -PSMA PET “Sensitivitet”



PSA level versus the proportion of ^{68}Ga -PSMA PET positivity

^{68}Ga -PSMA PET "Sensitivitet"



Scatterplot of PSA level versus the proportion of ^{68}Ga -PSMA PET positivity

Sensitivitet og spesifisitet (histologi)

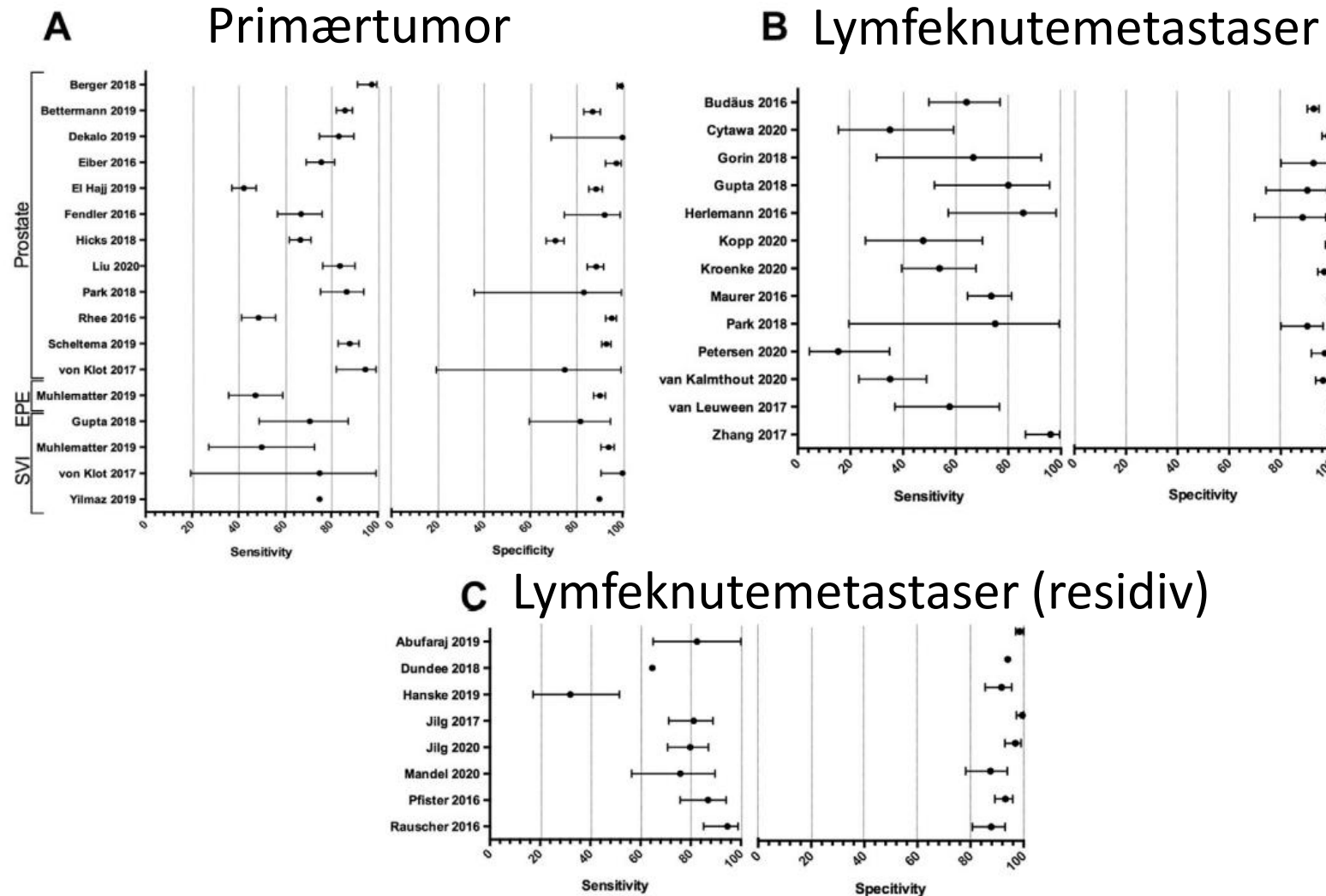
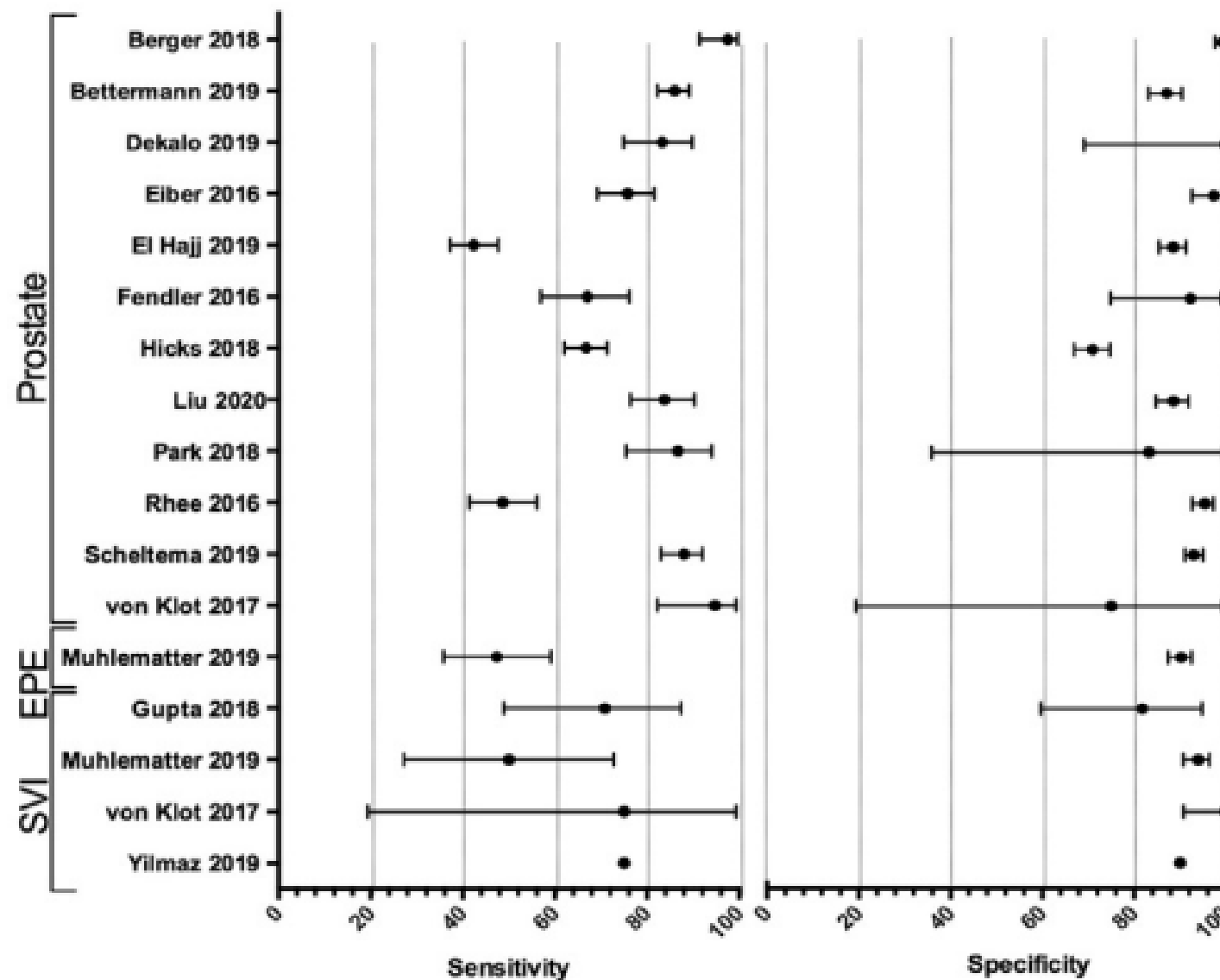
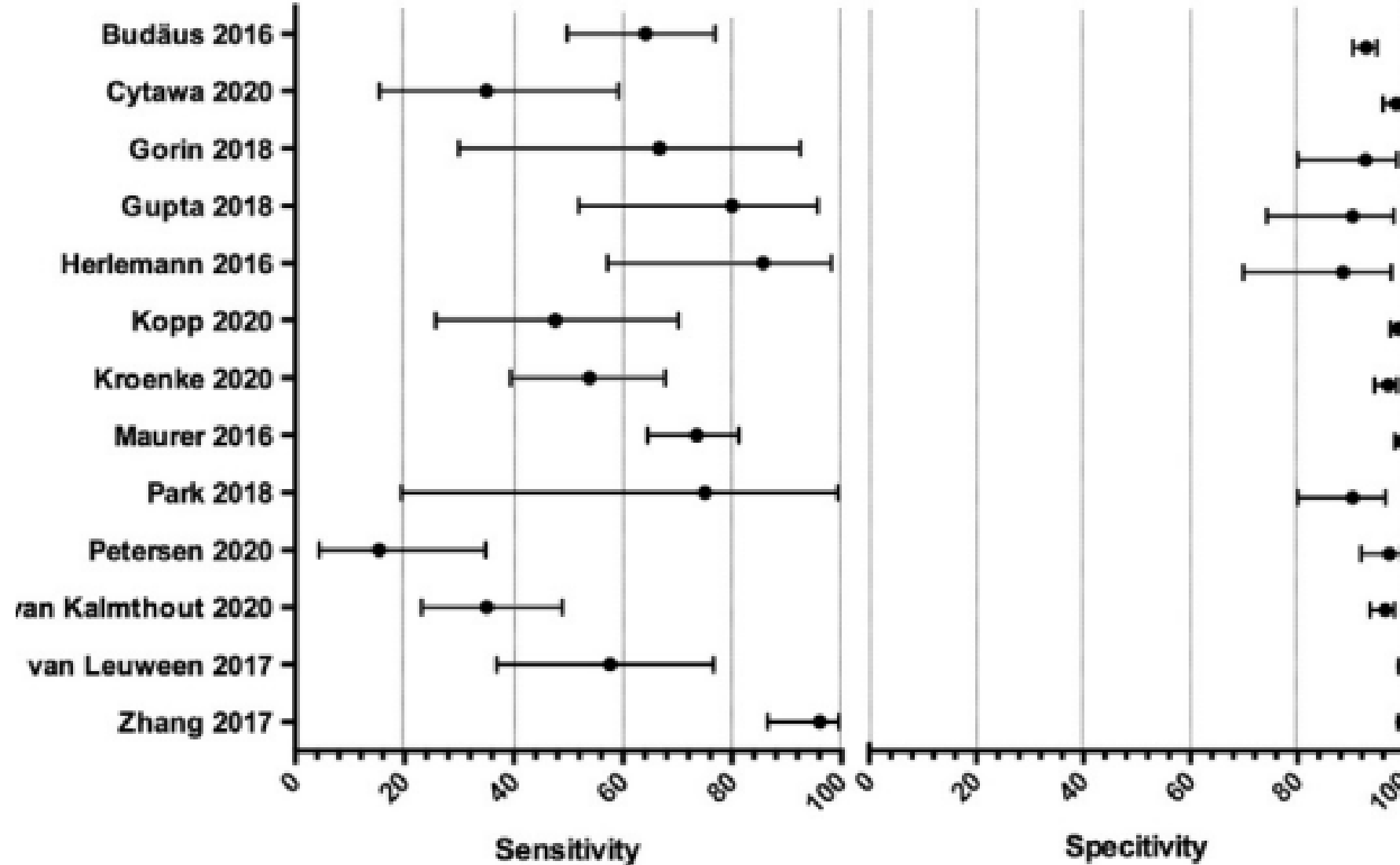


Fig. 3. (A–C) Forest plots of sensitivity and specificity (mean values, 95% confidence interval) for localization of primary prostate cancer tumor, EPE and SVI (A), primary lymph node metastases (B) and recurrent lymph node metastases (C).

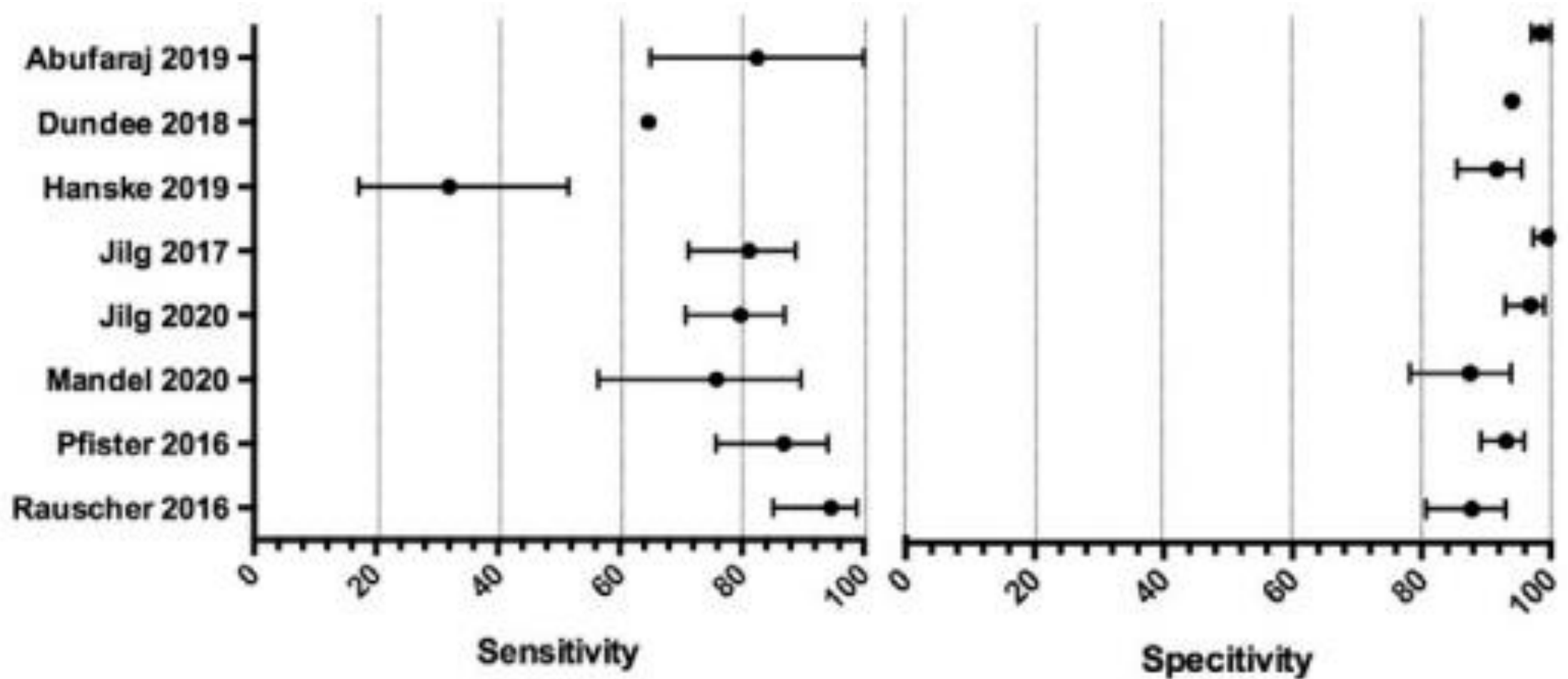
Sensitivitet og spesifisitet, primærtumor



Lymfeknutemetastaser, primær



Lymfeknutemetastaser, residiv



Primære

Stadium	n = 50
N0 M0	28 (56%)
N1 M0	7 (14%)
N1 M1a	11 (22%)
N1 M1b	3 (6%)
N1 M1c	1 (2%)

Endret behandling for

44%

Betydelig endring for

30 %

ISUP	n = 50
I	0
II	8
III	27
IV	4
V	11

Residiver

Residiv/met.	n = 194
Negativ	32 (17%)
LR	54 (28%)
LR + LK	22 (11%)
LR + LK + SM	2 (1%)
LK	60 (31%)
LK + SM	10 (5%)
Lunge	8 (4%)
Lever	6 (3%)

Lokalt residiv (LR)

Lymfeknutemetastase (LK)

Skjelettmetastase (SM)

Primære

Stadium	n = 50
N0 M0	28 (56%)
N1 M0	7 (14%)
N1 M1a	11 (22%)
N1 M1b	3 (6%)
N1 M1c	1 (2%)
ISUP	n = 50
I	0
II	8
III	27
IV	4
V	11

Diskusjon Primær high risk

Endret
44%
 Betydelig
 endret
30 %

- For pre PSMA cN1 – og beslutningen var tatt for abi/p og bekkenfelt – vil PSMA endre noe?
- Ved M1a – ekskludere bekkenfelt? Ved PSMA cN0 – ikke boost MR suspekt LK?
- For pre PSMA cN0 med mindre enn 2/3 Stampede risikofaktorer (PSA >40; T3/4; ISUP 4/5): dersom PSMA viser cN1 skal pas. få abi/p i tillegg til LHRHa.
- Dersom prePSMA under bekkenfelt terskel (?35%) skal det gis bekkenfelt? Risiko for M1 status - kan vi estimere risiko og skal vi bruke et cut off?

Residiver

Residiv/met.	n = 194
Negativ	32 (17%)
LR	54 (28%)
LR + LK	22 (11%)
LR + LK + SM	2 (1%)
LK	60 (31%)
LK + SM	10 (5%)
Lunge	8 (4%)
Lever	6 (3%)

Lokalt residiv (LR)

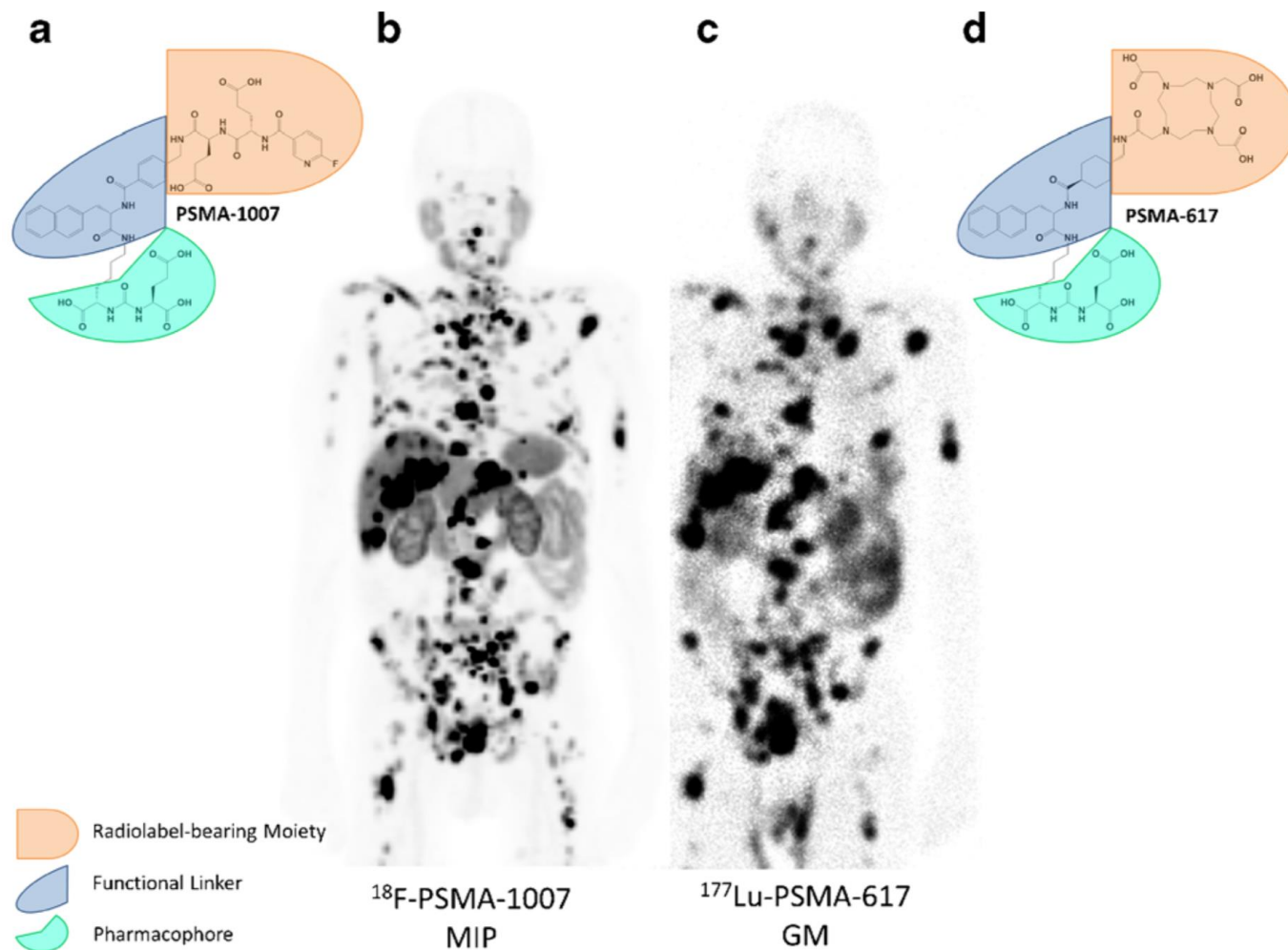
Lymfeknutemetastase (LK)

Skjelettmetastase (SM)

Diskusjon PSA Residiv

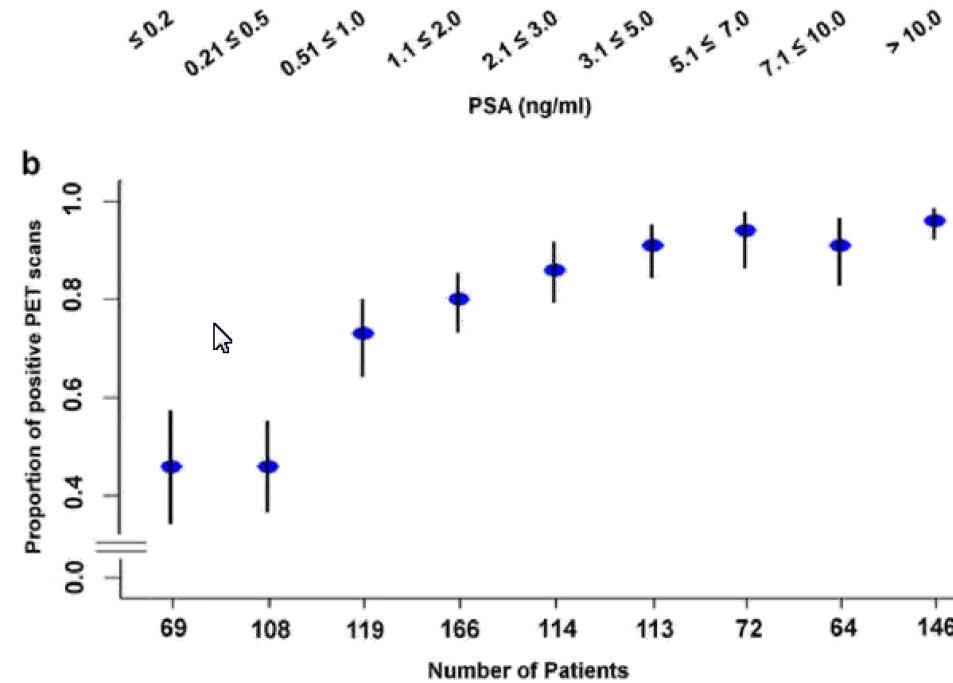
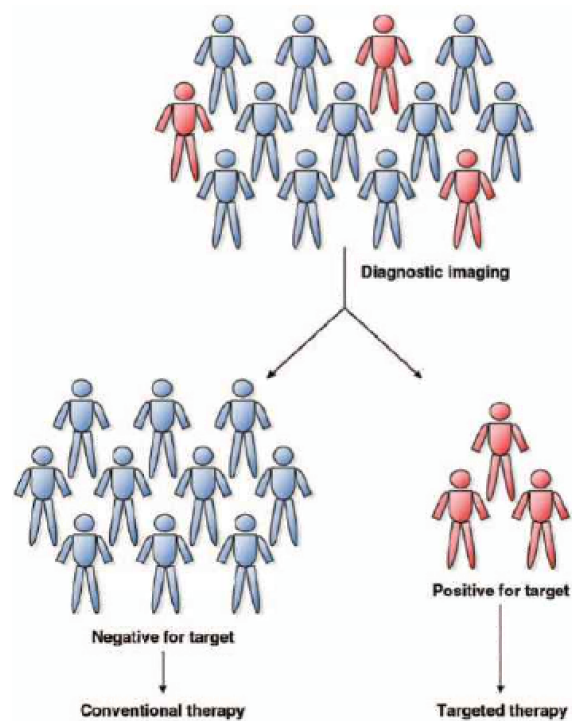
- Ta MR bekken først, og dersom MR med lokalt residiv, var det fortsatt nødvendig med PSMA PET (PET sensitivitet / sannsynlighet for å finne M1?). Dersom MR negativ for lokalt residiv: avklaring annen fokus og inklusjon bekkenfelt/boost bekken LK/ SBRT solitær/oligo met
- Til stråleonkologene: Vi mener at vi trenger en preplan MR postop? Kan diagnostisk MR erstatte dedikert preplan MR?
- Dersom oligo M1 – heller SBRT og bekkenfelt utgår – hvor hyppig er det tilfelle? Seleksjon?

Teranostikk (diagnostikk og terapi)



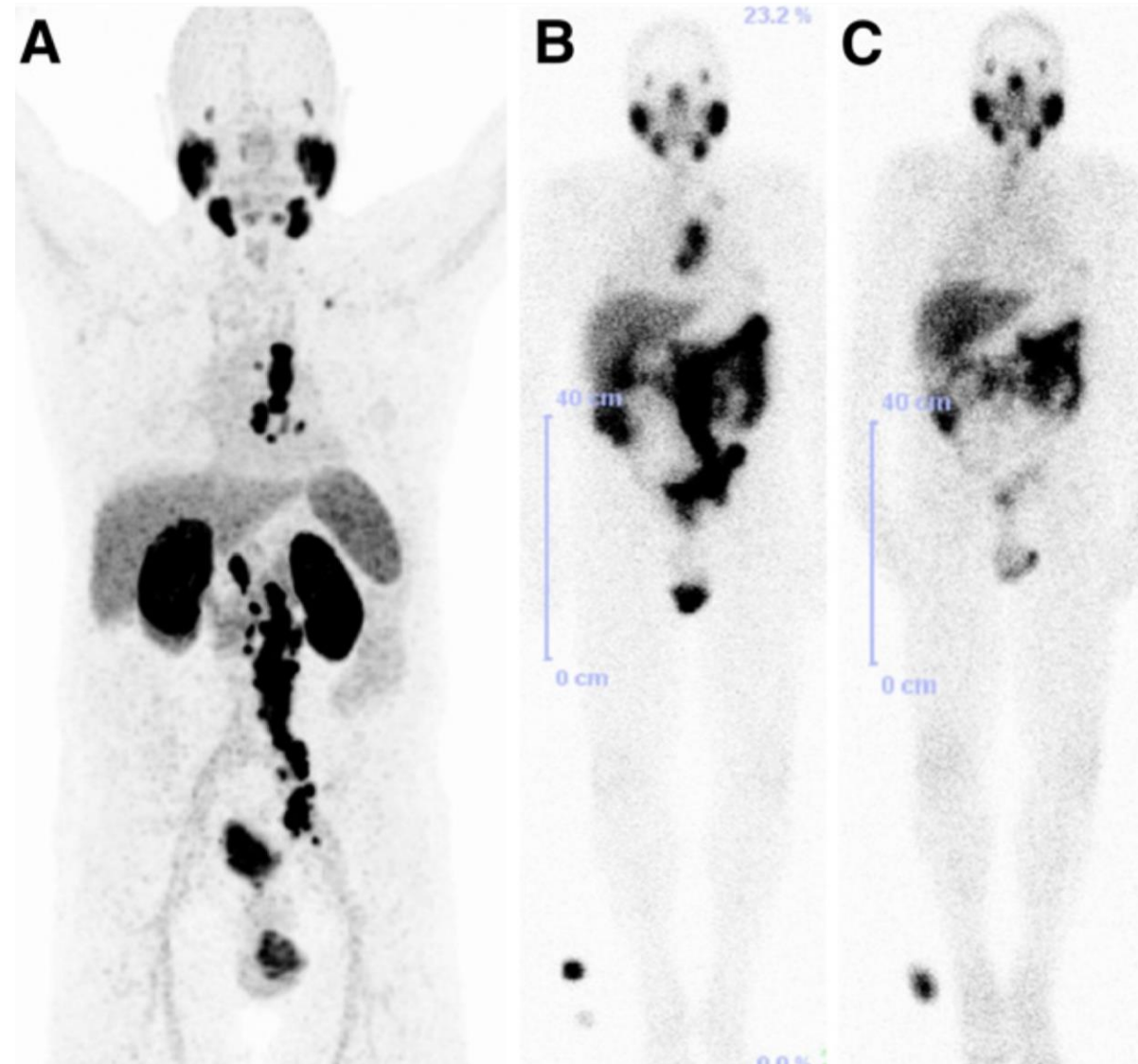
PSMA-Phenotyping

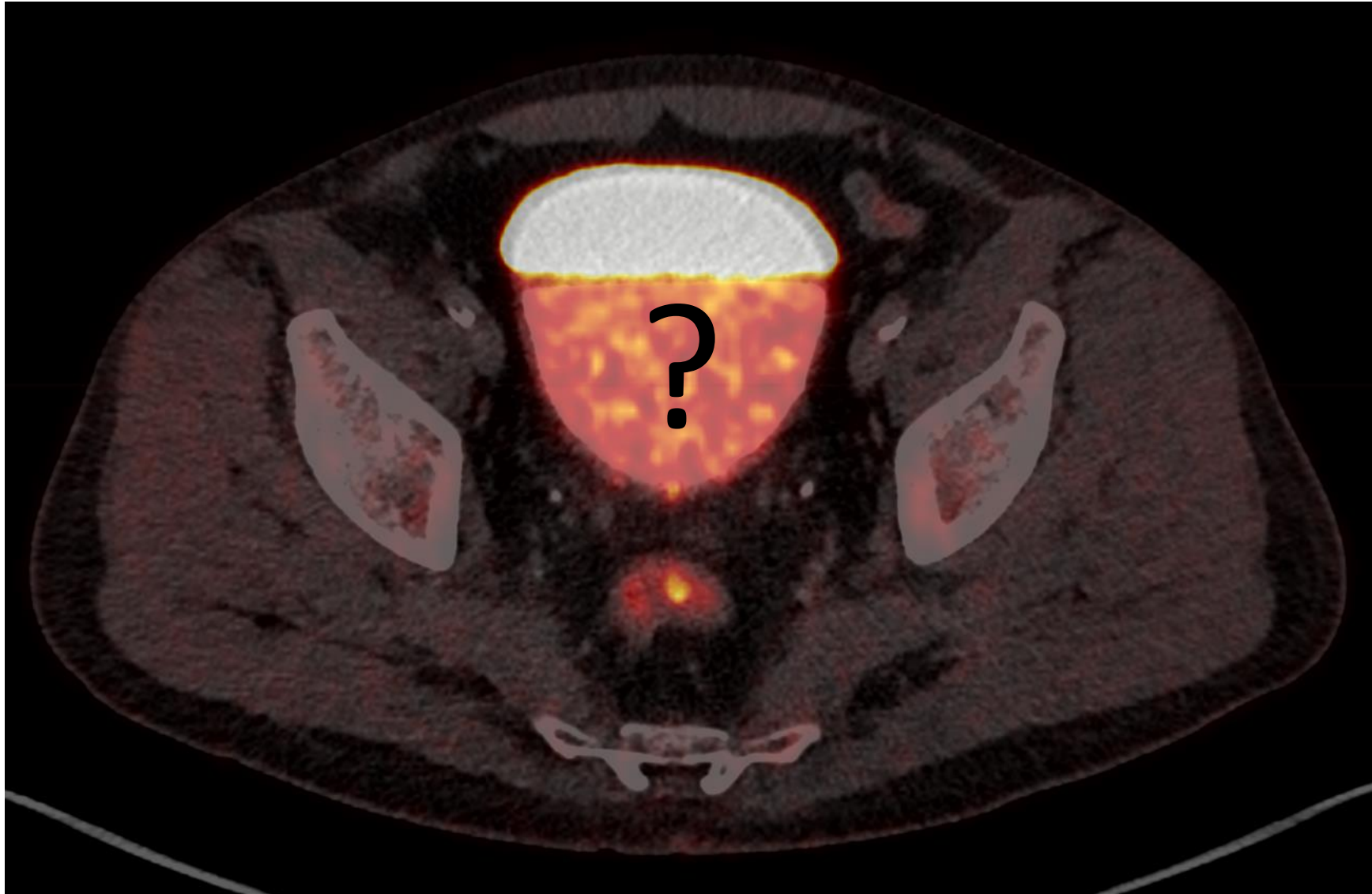
individual patient stratification



85% positive for target (PSMA)

Afshar-Oromieh et al EJNMMI 2017





Diskusjon Peptid Reseptor Ligand Terapi (PRLT)

Residiv/met.	n = 194
Negativ	32 (17%)
LR	54 (28%)
LR + LK	22 (11%)
LR + LK + SM	2 (1%)
LK	60 (31%)
LK + SM	10 (5%)
Lunge	8 (4%)
Lever	6 (3%)

Lokalt residiv (LR)

Lymfeknutemetastase (LK)

Skjelettmetastase (SM)

- Seleksjon for PRLT – hvem kan ikke forvente nytte av PRLT: Inhomogen/lavt opptak. Trenger vi en FDG PET? Hvilken plass har 223-Radium før PRLT?
- Dersom oligo M1 – heller SBRT og bekkenfelt utgår
Hvor hyppig er det tilfelle? Seleksjon?