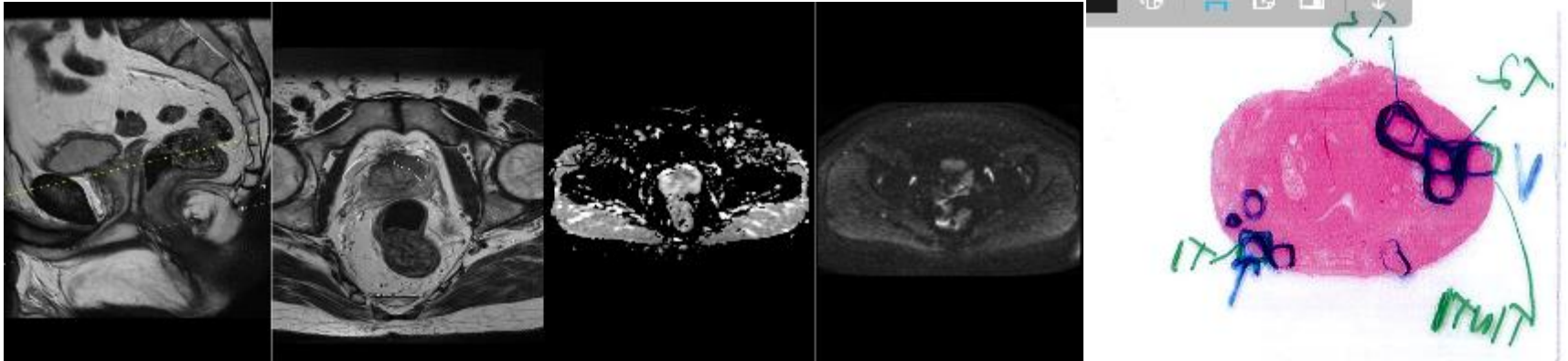


## Jonas Wallström, MD

- Consultant radiologist Sahlgrenska University Hospital, section of abdominal imaging
- Phd-student in the ongoing G2-screening study including 40000 men





UNIVERSITY OF  
GOTHENBURG

# PERFORMANCE CHARACTERISTICS OF PIRADSV2 AND PROSTATE MRI PRIOR TO RADICAL PROSTATECTOMY – WHICH PROSTATE CANCERS ARE MISSED?

JONAS WALLSTRÖM, MD, PHD STUDENT<sup>2</sup>, KIMIA KOHESTANI, MD, PHD STUDENT<sup>1</sup> NIKLAS DEHLFORS<sup>2</sup>, MD, OLE MARTIN SPONGA<sup>3</sup>, MD, MARIANNE MÅNSSON<sup>1</sup>, ANDREAS JOSEFSSON<sup>1</sup>, MD, SIGRID CARLSSON<sup>1,4</sup> MD, MIKAEL HELLSTRÖM<sup>2</sup>, MD, AND JONAS HUGOSSON<sup>1</sup>, MD

<sup>1</sup>Department of Urology, Institute of clinical sciences, Sahlgrenska Academy at University of Gothenburg <sup>2</sup>Department of Radiology, Institute of clinical sciences, Sahlgrenska Academy at University of Gothenburg <sup>3</sup>Department of Radiology, Carlanderska Hospital<sup>4</sup>Urology Service at the Department of Surgery and Department of Epidemiology and Biostatistics, Memorial Sloan Kettering Cancer Center, New York, USA)



# Introduction

- Prostate Cancer (PC) is the most common cancer among men in Europe
- PC is ideal for early detection with a long asymptomatic phase during which curative treatment is possible
- Overdiagnosis and overtreatment of low risk PC is a known problem with the standard diagnostic pathway of TRUS-guided biopsies
- MRI with targeted biopsies has been shown to have a higher detection rate of intermediate and high risk PC compared to standard TRUS-guided biopsies and also reduces the detection of low risk PC



# Purpose

There is now a rapidly growing trend to embrace pre-biopsy MRI in the diagnostic pathway for prostate cancer, however its performance and inter-observer variability outside high-volume centers remains uncertain.



# Materials and Methods

After ethical approval men who had a preoperative/prebiopsy MRI and underwent RP between Jan 2012-Dec 2014 at a single non-university hospital in Sweden were included.



## ***Retrospective reading***

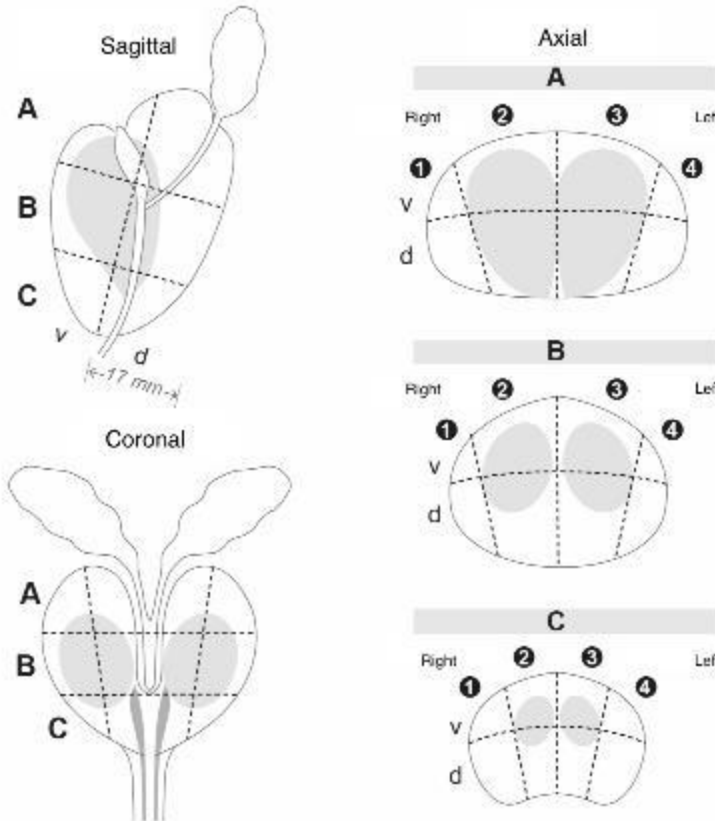
Retrospectively and blinded to clinical data two radiologists and one resident reviewed all images according to PIRADS v1.

The MRI findings of each reader were converted to PIRADS v2 overall scores using a computer based algorithm.

Lesions were localized according to a 24 sector prostate map adopted nationally in Sweden by pathology, urology and radiology.



# 24-sector Prostate Map



## ***Retrospective reading***

To reduce bias an undisclosed number of negative MRI:s (PIRADS 1-2, systematic Bx neg) were added to the retrospective review.

Lesions with PIRADsv2 score 3-5 = positive MRI





UNIVERSITY OF  
GOTHENBURG

ORGANIZATION NAME (CHANGE HEADER  
USE THE INSERT TAB-HEADER/FOOTER)

## ***Pathology***

Radical prostatectomy

Whole mount pathology specimens

Index tumor (GS, size) as described by the pathologist



## ***MRI/tumor correlation***

A tumor was considered detected if the overall PIRADS v2 score was 3-5 and there was an approximate match (same or neighboring sector) of tumor sector according to a 24 sector system used for both MRI and whole mount sections.



# Results

Final study population of 97 men

Median age: 61 ys

Median PSA: 6.4 ng/ml

MRI from 16 different hospitals. bpMRI: n=34; mpMRI: n=63

pT2: n=61 (63%)

pT3: n=36 (37%)



## ***Overall detection rate***

The average overall PIRADS score 3-5 index tumor detection rate for all 3 readers was 73.0 % and for PIRADS score 4-5 tumors it was 60.9%.

The average detection rate for the most aggressive tumors (GS  $\geq$  4+3) was higher; 83.1 % for PIRADS 3-5 and 79.2 % for PIRADS 4-5.



## ***Missed index tumors***

In eleven men the index tumor was not detected by any reader; of these three had GS 6, six had GS 3+4, one had GS 4+3 and one had GS 4+5.

Among the 8 men with GS  $\geq 7$  and missed index tumors all had multifocal disease. Another GS 7 tumor was correctly identified by all three readers in three out of these men.



## ***Interobserver agreement***

The agreement between pairs of readers according to Cohen's kappa showed average  $k$  values of 0.41 for PIRADS score 3-5 and 0.51 for PIRADS score 4-5.

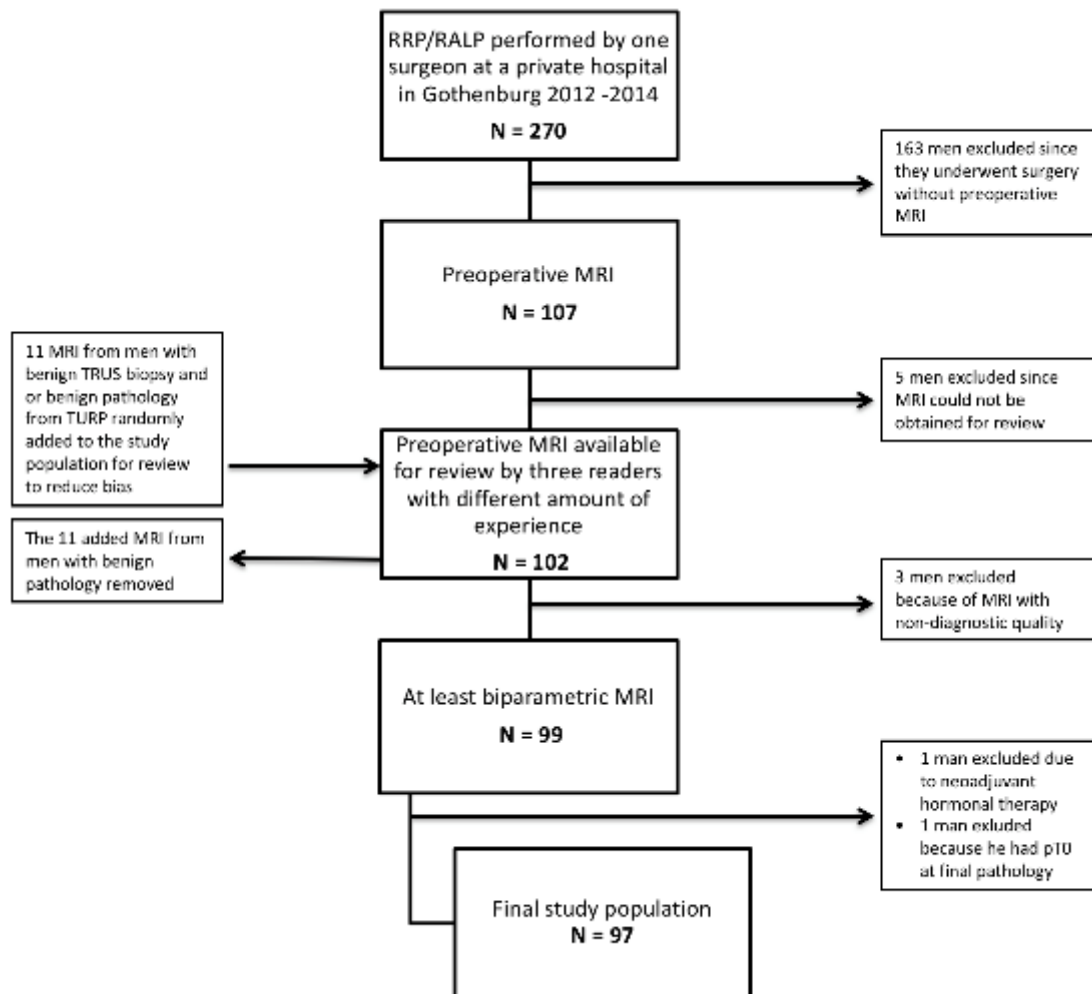


# Conclusions

Prostate MRI in an everyday setting has a moderate per lesion sensitivity, missing the index tumor in every sixth man.

Per patient sensitivity is higher compared to per lesion sensitivity, as a majority of missed index tumors in this study were part of multifocal disease.

The large inter-observer variability outside specialized units as in this study must be further evaluated before MRI safely can be used in clinical routine to exclude men from biopsies.







**Table 3a**  
**Index lesion correctly**  
**reported as PIRADS 3-5**  
**by the three readers**  
**separately and average**  
**sensitivity**  
 Numbers represents  
 percent (n)

Gleason score	Reader 1 (200 reports before review) Missing = 1	Reader 2 (50 reports before review) Missing = 1	Reader 3 (300 reports before review) Missing = 0	Average sensitivity
3+3 (< 10 mm) n=5	40% (2)	0% (0)	40% (2)	26.7%
3+3 (≥10 mm /unknown size) n=18	83.3% (15)	58.8% (10) missing=1	72.2% (13)	70.4%
3+4 n=48	70.8% (34)	70.8% (34)	77.1% (37)	72.9%
4+3 n=17	88.2% (15)	70.6% (12)	82.4% (14)	80.4%
≥4+4 n=9	87.5% (7) missing=1	88.9% (8)	88.9% (8)	88.4%
All GS pT2 n=61	75.0% (45) missing=1	61.7% (37) missing=1	73.8% (45)	70.2%
All GS pT3 n=36	77.8% (28)	75.0% (27)	80.6% (29)	77.8%
Total n=97	76.0% (73)	66.7% (64)	76.3% (74)	73.0%



**Table 3b**  
Index lesion **correctly**  
reported as PIRADS 4-5  
by the three readers  
separately and average  
sensitivity  
Numbers represents  
percent (n)

Gleason score	Reader 1 (200 reports before review) Missing=1	Reader 2 (50 reports before review) Missing=1	Reader 3 (300 reports before review) Missing=0	Average sensitivity
3+3 (< 10 mm) n=5	20.0% (1)	0% (0)	0% (0)	6.7%
3+3 (≥10 mm /unknown size) n=18	66.7% (12)	29.4% (5) missing=1	50.0% (9)	48.7%
3+4 n=48	54.2% (26)	60.4% (29)	68.8% (33)	61.1%
4+3 n=17	82.4% (14)	64.7% (11)	82.4% (14)	76.5%
≥4+4 n=9	87.5% (7) missing=1	77.8% (7)	88.9% (8)	84.7%
All GS pT2 n=61	55.0% (33) missing=1	48.3% (29) missing=1	60.7% (37)	54.7%
All GS pT3 n=36	75.0% (27)	63.9% (23)	75.0% (27)	71.3%
Total n=97	62.5% (60)	54.2% (52)	66.0% (64)	60.9%



**Table 4a –  
Characteristics of  
index tumors that  
no reader  
reported on MRI**

Age at surgery (years)	PSA (ng/mL)	Biopsy GS	Patho_ logical stage	Patho_ logical GS	Localization of index tumor	Size of index tumor(mm)	SVI	ECE	PSM	Tumor 2 or 3 detected
71	8	3+3	pT2c	3+4	4Cvd	10	No	No	No	
66	4	3+4	pT2c	3+4	1Cd	14x9	No	No	No	
67	5	3+3	pT2c	3+4	12BCvd	19x16	No	No	No	
65	8	3+4	pT3a	3+4	1234Cv	22x11	No	Yes	Yes	Yes, Gl 3+4
64	3	3+4	pT3a	3+4	1Avd	13x4	No	Yes	No	
63	22	3+4	pT3b	4+5	1Ad	Unknown	Yes	Yes	Yes	Yes, Gl 3+4
61	6	3+3	pT2a	3+3	1Cd	15x4	No	No	No	
59	4	3+3	pT2c	3+3	1Cd	8x5	No	No	No	
56	7	3+4	pT3a	3+4	4Bvd	16x8	No	Yes	No	Yes, Gl 3+4
56	4	3+3	pT2	4+3	4ABCv	18x8	No	No	No	
52	3	3+3	pT2a	3+3	1Avd	2	No	No	No	