Utility of a multivariate logistic regression model for the prediction of prostate cancer extracapsular extension based on 3TmpMRI, clinical, and biopsy

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Background:

- Extracapsular extension (ECE):
  - Poor prognostic factor
  - Associated with progression, recurrence and mortality
- Accurate staging:
  - Avoidance of positive margins
  - Planning nerve-sparing procedures
- Pre-operative MRI:
  - A guide for surgical planning

Objectives:

- To investigate the predictive value of clinical, biopsy & 3TmpMRI parameters using a multivariate logistic model for per-lesion detection of PCa ECE with wholemount histopathology (WMHP) as reference.

Methods:

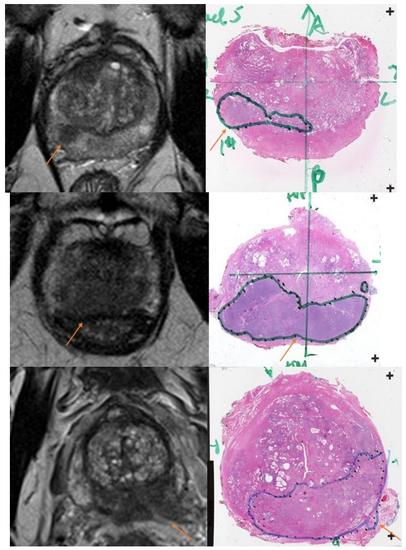
- IRB approved, HIPAA compliant observational study
- 575 patients with 774 true positive prostate cancer lesions
- July 2010 to February 2019.
- Clinical parameters:
  - Age
  - Prostate specific antigen (PSA)
  - PSA density (PSAD)
- Biopsy
  - % of positive systematic cores
  - Gleason score (GS)
- 3T mpMRI
  - Prostate volume
  - Number of lesions per patient
  - Size
  - Location
  - Level
  - PIRADSv2 score
  - Laterality
  - Apparent diffusion coefficient (ADC)

- MRI risk assessment for ECE
  - Low risk: doesn't abut capsule, may abut capsule and abuts ≤1cm of capsule
  - Moderate risk: : abuts >1cm of capsule, broad contact and bulging capsule
  - High risk: capsular irregularity, involving anterior fibromuscular stroma and gross extra-prostatic extension

Statistical analysis:
- Bivariate and multivariate analysis
- ROC analysis for accuracy

Results:

Variable	N (%)
PSA[a] (ng/ml), mean ± SD	8.4±9.2
Age (years), mean ± SD	61.6±6.9
Endorectal coil (lesions)	375/774 (48.5%)
PI-RADS category	
3	215/774 (27.8%)
4	332/774 (42.9%)
5	227/774 (29.3%)
MRI risk assessment for ECE	
3+3	464/774 (59.9%)
3+4	191/774 (24.7%)
4+3	137/774 (17.7%)
ECE in final pathology	183/774 (23.6%)



Patient information

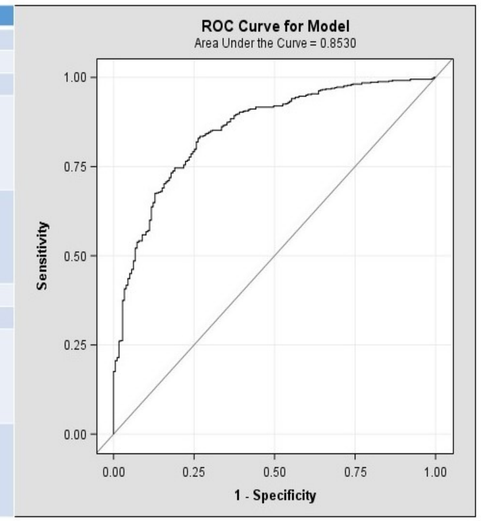
Bivariate Analysis

- Higher PSA, PSAD, percentage of positive biopsy cores, biopsy GS, lesion size, PIRADSv2 score, bilaterality, ADC value, MRI risk assessment for ECE, location (posterior), level (midgland and base), and lower number of lesions per patient were significant for ECE prediction.

Multivariate Analysis

Multivariate regression model for pathology extracapsular detection and the ROC for its performance

Effect	OR	P-value
Age (year)	1.04	0.006
PSA density (log)	3.78	0.001
Radiology size (cm)	1.91	<0.001
Number of lesions		
▪ 1	1	-
▪ 2	0.74	0.164
▪ 3	0.34	0.054
Location		
Anterior	1	-
Posterior	1.83	0.028
Anterior+posterior	1.63	0.167
Midgland	1.53	0.112
Base	2	0.001
PIRADSv2 score		
▪ 3	1	-
▪ 4	3.05	0.001
▪ 5	3.85	<0.001
MRI ECE Risk		
▪ Low	1	-
▪ Intermediate	1.51	0.095
▪ High	1.16	0.602



Conclusions:

- The multivariate regression model in this study based on clinical, biopsy and 3T mpMRI parameters have a high predictive value for pathology ECE detection

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