CT Texture analysis of epithelial ovarian cancer : Correlation with BRCA mutation status and survival

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Introduction

- Ovarian cancer, a silent killer, has the highest mortality rate of all gynaecologic cancers.
- Texture analysis, a non invasive biomarker has recently been used[1-3] in ovarian cancer.

Objective

To evaluate the association of CT texture features of ovarian cancer with BRCA mutation status and progression free survival (PFS).

Methods

- Study site - Department of Radiology & Department of Gynae Oncology,Tata Medical Center, Kolkata.
- Prospective and retrospective Observational study.
- 109 patients with ovarian cancer recruited under the DST UKIERI project.
- CT images were obtained at diagnosis prior to any treatment.
- TEXRAD Software (Cambridge Computed Imaging Ltd., version 3.9) was uesd for analysis of images.
- Region of interest(ROI) was drawn by the radiologist where the tumour was best delineated.
- Tumour regions were described in terms of small scale filtration(SSF) where SSF=0 refers no filter, SSF=2 refers fine texture, SSF=3-5 refers medium texture and SSF=6 refers course texture.
- After processing of images with some inbuild algorithms,TEXRAD produced six types of parameters namely mean, standard deviation, entropy, mpp,skewness and kurtosis with their respective values.
- Total number of pixels were also given by TEXRAD.
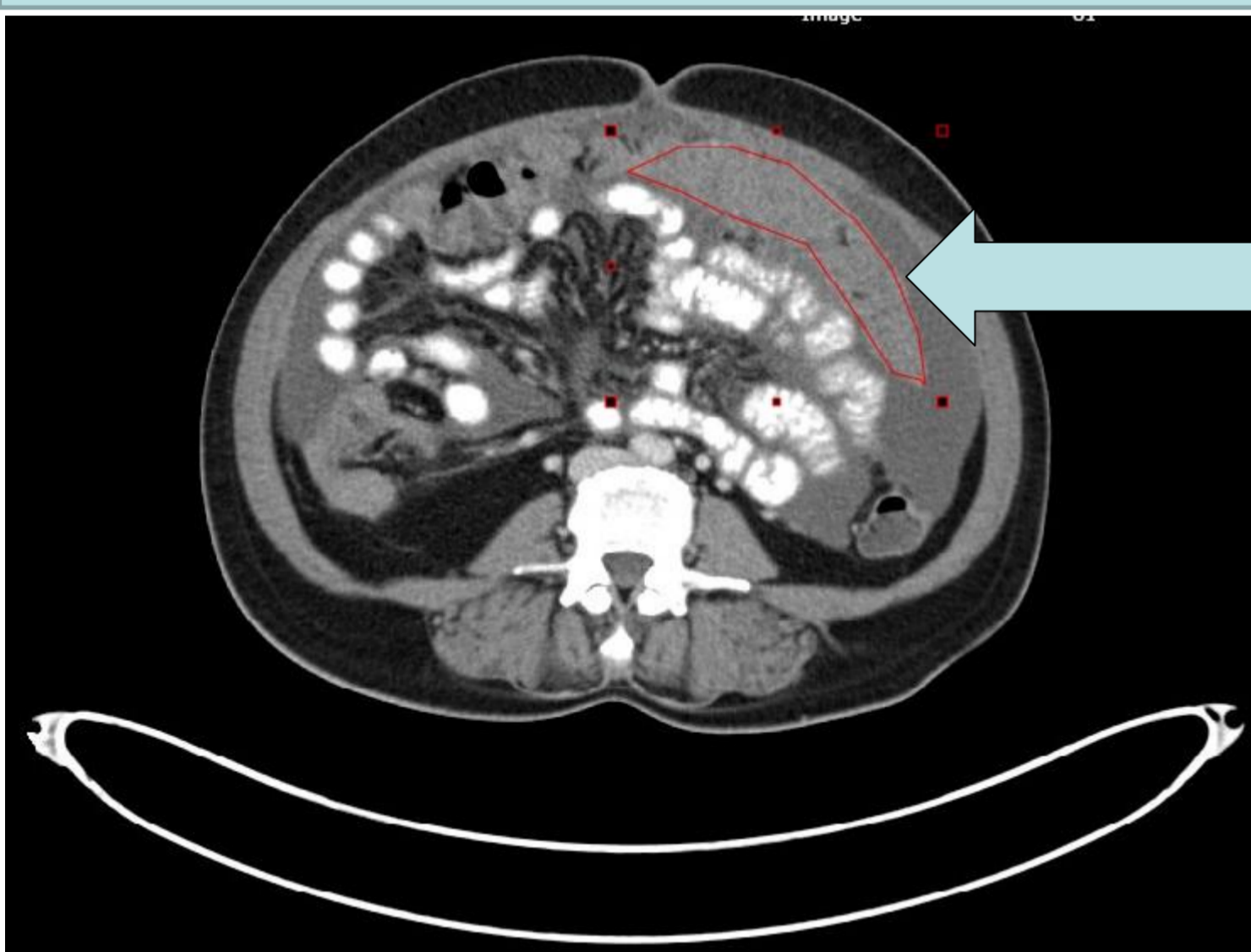- SPSS was used for statistical analysis.

Figure :Region of interest (ROI) was drawn on CT Contrast image.

Conclusions

- CT texture may be used as a predictive biomarker.
- Texture parameters like kurtosis on CT images correlate with BRCA status.
- We have shown that tumor heterogeneity as measured by lower kurtosis on CT texture is more frequently seen in BRCA[-] patients compared with BRCA mutation carriers which correlate poorer prognosis.
- Survival analysis results show the good survival with BRCA mutation and Platinum sensitivity.

Acknowledgement

Results

DEMOGRAPHIC TABLE

CHARACTERISTICS	NO. OF PATIENTS (%)
AGE(YEARS)	
MEAN, RANGE	54.94 , 31 to 72
STAGE	
IA	1(0.91%)
IC	2(1.83%)
IIB	2(1.83%)
IIIA	3(2.75%)
IIIB	3(2.75%)
IIIC	56(51.38%)
IV	1(0.91%)
IVA	17(15.69%)
IVB	24(22.02%)
BMI	
MEAN	28.57224
BASELINE CA125	
MEAN	1954.83206
BRCA MUTATIONS	
POSITIVE	62(56.88%)
NEGATIVE	47(43.12%)
RECURRENCE STATUS	
SENSITIVE	74(67.89%)
RESISTANT	35(32.11%)

The following parameters showed significant association between CT texture and BRCA status
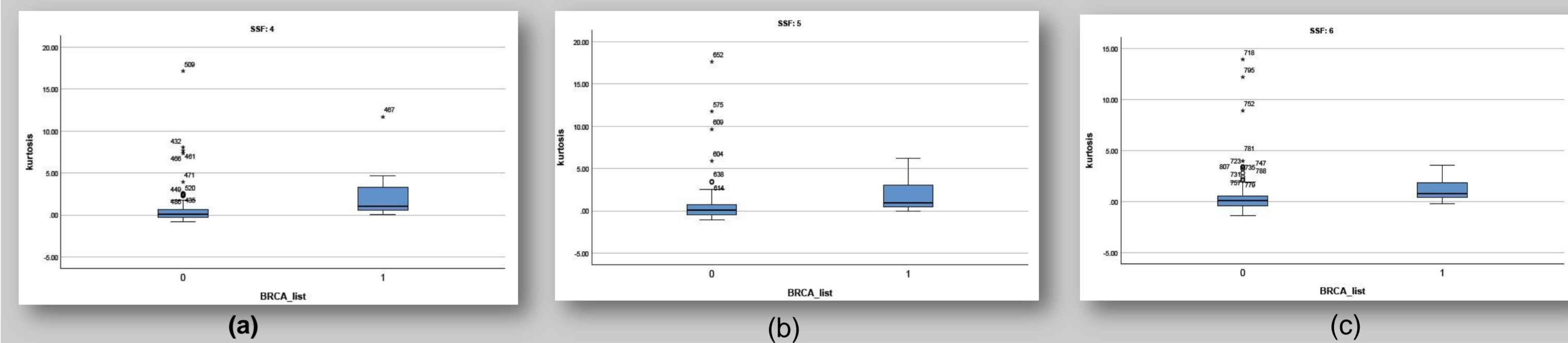

(a) (b) (c)

Figure: Box-whisker plot shows differentiation of BRCA[-] (0) from BRCA[+] (1) according to kurtosis on CT contrast images with use of (a) & (b) medium (SSF=4,5) and (c) course(SSF=6) filter settings with p=0.05,CI = 95%
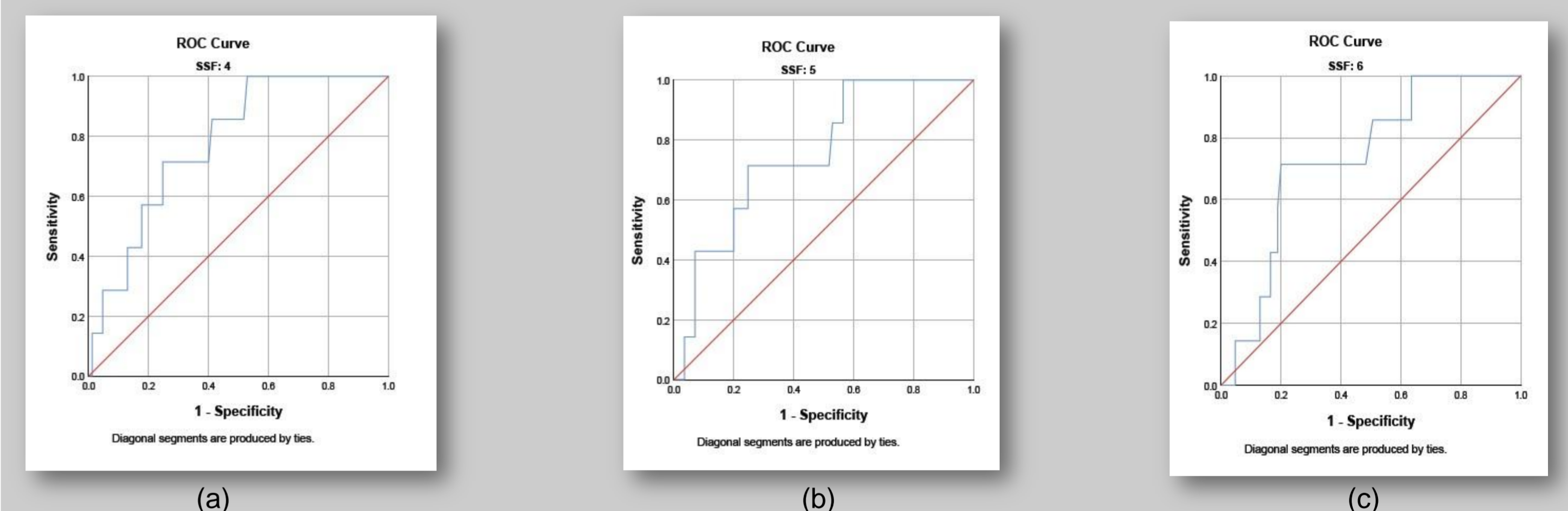

(a) (b) (c)

Figure: ROC analysis shows good correlation between BRCA status and kurtosis noted on CT contrast images obtained with medium and coarse filtered settings (SSF=4,5 and SSF=6) with AUC of 0.780 for SSF4,0.755 for SSF5, 0.735 for SSF6 (95% CI, 0.573 – 0.922) noted.

The following parameters showed significant association between BRCA status and Platinum sensitivity with PFS
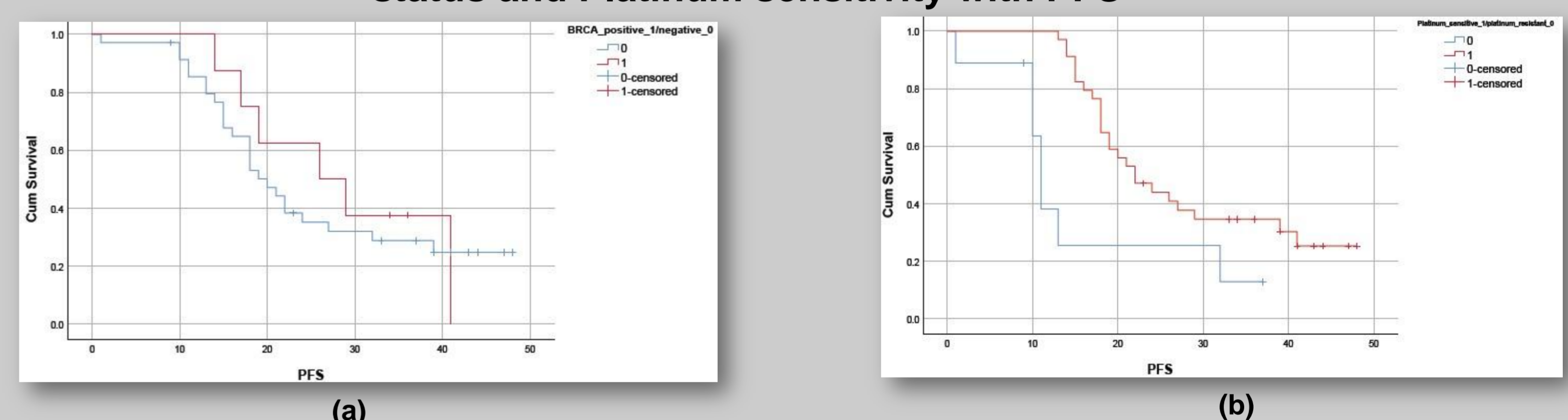

(a)

(b)

Figure (a) : Kaplan-Meier survival plot shows the relation of BRCA status with progression free survival (PFS) . BRCA mutation and BRCA negative show median PFS of 26 months and 20 months respectively

Figure (b) : Kaplan-Meier survival plot shows the relation of BRCA status with progression free survival (PFS). Platinum sensitivity and Platinum resistant show median PFS of 22 months and 11 months respectively

Future directions

- Study with larger number of patient data.
- Study more texture parameters for analysis.
- Correlations with texture parameters and BRCAness or homologous recombination deficiency.

References:
1. Wen BL et.al. 2014. Texture analysis applied to second harmonic generation image data for ovarian cancer classification.
2. Neil Pugh et. al. 2016. Texture analysis of transvaginal images in the diagnosis of ovarian cancer.
3. Bruce Wen et. Al. 2016. 3D texture analysis for classification of second harmonic generation images of human ovarian cancer.

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