Prediction of pathological complete response to neoadjuvant chemotherapy in early triple negative breast cancer patients by serial breast ultrasound examination.

BL Rapoport [1], T Smit [1], L Heyman [1], F Moosa [1], S Nayler [2,3], CA Benn [4,5,6]

[1] The Medical Oncology Centre of Rosebank, Johannnesburg, South Africa; [2] Gritzman and Thatcher Inc. Laboratories, Johannesburg, South Africa; [3] Wits Donald Gordon Medical Centre, Johannesburg, South Africa; [5] Breast Care Centre, Head of Helen Joseph Hospital Breast Centre, Johannnesburg, South Africa; [5] Department of Surgery, University of Witwatersrand; [6] Head of Netcare Breast Care Centre, Johannesburg, South Africa

SAN ANTONIO BREAST CANCER SYMPOSIUM® SABCS 43RD ANNUAL BREAST CANCER SYMPOSIUM December 8-11, 2020 Virtual Symposium San Antonio, TX U.S.A.

The Medical Oncology Centre of Rosebank Personalised Cancer Care

Background

- Pathological complete response (pCR) following neoadjuvant chemotherapy is associated with a good prognosis and long term survival in patients with triple negative breast cancer (TNBC).
- Imaging offers significant information in monitoring response to neoadjuvant chemotherapy as a complement to conventional tumor assessment by physical examination.

Methods

- This is a single institution, retrospective cohort study.
- The primary objective was to determine whether volumetric measurement by ultrasound examination of the pre-treatment breast tumor size, post-cycle two, post-cycle four and at completion of neoadjuvant chemotherapy predicted pCR.
- Tri-dimensional measurements were used to calculate the volume index. The percentage change between pre-treatment and cycle 2, pre-treatment and cycle 4, and pre-treatment and completion of treatment was calculated.
- Patients were treated with taxane, anthracycline, and alkylating agents based neoadjuvant chemotherapy.
- A pCR was defined as the complete disappearance of the invasive cancer in the breast and absence of tumor in the axillary lymph nodes.
- A radiological complete response (rCR) was defined as no malignant legions detected by ultrasound (0mm).
- Receiving operating characteristics (ROC) analysis was used to determine the association between pCR and percentage of tumor shrinkage.
- Specificity was defined as the proportion of patients with a non-pCR that were correctly classified as non-responders by ultrasound measurement.
- Sensitivity was defined as the proportion of patients with a pCR that were correctly classified as complete responders by ultrasound assessment.
- Statistical analysis was performed using NCSS version 11 and statistical tests used the significance level of 0.05.
- Ethics approval was obtained from Pharma-Ethics, Pretoria, South Africa (ethics committee working according to the South African Ethics regulations).

Patient Characteristics

Table 1. Patient Characteristics.

Mean Age 50 years (27-85 years)		
Tumor Size (n=78)		
	Total	%
1	18	23%
2	54	69%
3	6	8%
4	0	0%
Nodal Involvement		
	Total	%
Yes	33	43%
No	38	50%
Unknown	7	7%
Stage		
	Total	%
IA	9	12%
IB	2	3%
IIA	40	51%
IIB	22	28%
IIIA	4	5%
IIIB	0	0%
IIIC	1	1%
Tumor Volume (mm^3) [Mean (min - max)]		Standard Deviation (mm^3)
Pre-Treatment	18624 (144 - 323700)	41284
Volume 2	5504 (0 - 68819)	11506
Volume 4	2075 (0 - 50744)	6516
Post Treatment	1027 (0 - 26712)	3583

Results

ROC Curves for prediction of pCR

Figure 1a. pCR rate by percentage shrinkage after cycle 2.

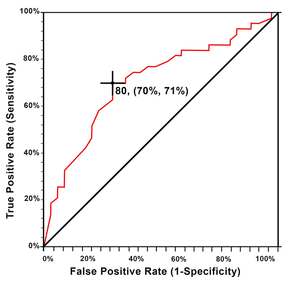


Figure 2a. pCR rate by percentage shrinkage after cycle 4.

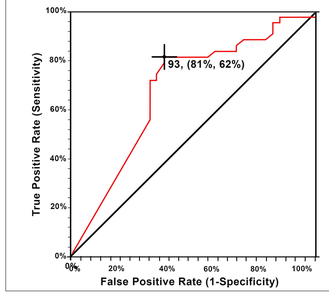
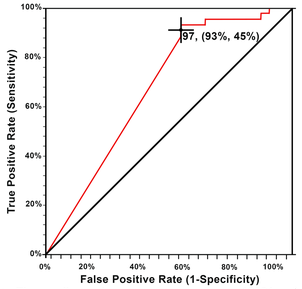


Figure 3a. pCR rate by percentage shrinkage post treatment.



- The median volume pre-treatment was 18624mm^3 (SD = 41284mm^3).
- A pCR rate of 57% was documented.

Waterfall plot for prediction of pCR

Figure 1b. Percentage shrinkage from baseline after cycle 2.

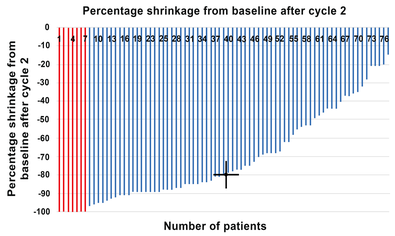


Figure 2b . Percentage shrinkage from baseline after cycle 4.

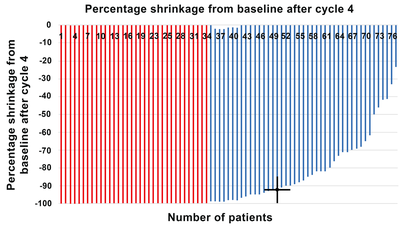
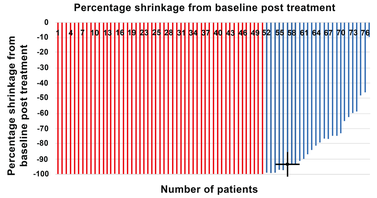


Figure 2c. Percentage shrinkage from baseline post treatment.



Bar chart for prediction of pCR

Figure 1c. pCR rate by shrinkage of ≥ 80% after cycle 2.

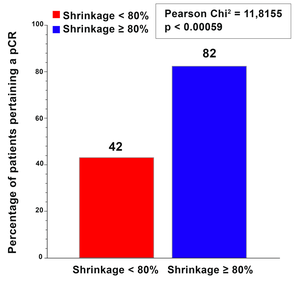


Figure 2c. pCR rate by shrinkage of ≥ 93% after cycle 4.

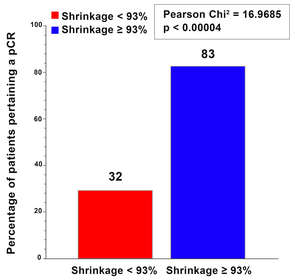


Figure 3c. pCR rate by shrinkage of ≥ 97% post treatment.

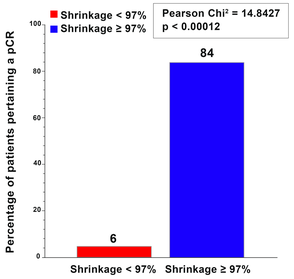


Figure 4. pCR by Tumor Size.

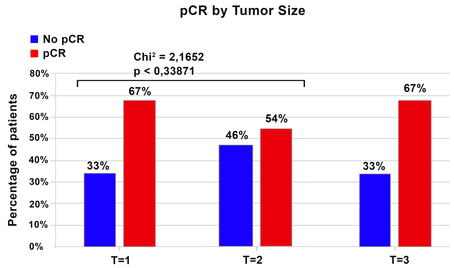


Figure 5. pCR by Lymph Nodes.

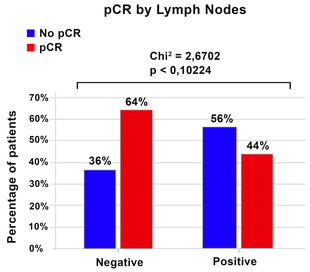
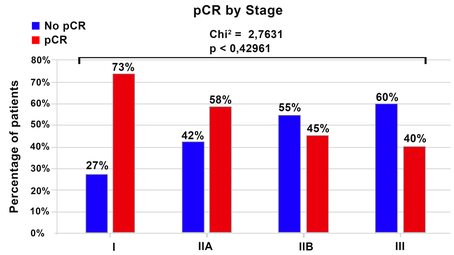


Figure 6. pCR by Stage.



Conclusions

- The breast ultrasound is a useful, non-expensive, non-invasive test to monitor TNBC patients undergoing neoadjuvant chemotherapy.
- Measurement of the tumor by serial ultrasound is a useful predictor of pCR in these patients.
- Percentage shrinkage of more than 90% of the tumor at the completion of treatment, is more accurate in predicting pCR compared to radiological complete response.

Corresponding author: bernardo.rapoport@up.ac.za