Effect of Hospital Volume on Overall Survival after Surgery in Elderly Breast Cancer Patients

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BACKGROUND AND AIMS

- Higher hospital volume has been shown to be associated with improved outcomes and increased overall survival following treatment for certain cancers.
- In breast cancer, high-volume centers are associated with differences in patterns of multi-modal care that may explain their associated overall survival advantage.
- There remains a paucity of data examining treatment-related outcomes specifically in breast cancer patients age 80 and older.

- Primary Aim
  Determine the association between hospital volume and overall survival following surgery for breast cancer in patients 80 years of age and older.

- Secondary Aim
  Determine patient and treatment-related characteristics associated with high volume centers.

METHODS

Dataset
- National Cancer Database 2005-2014

Inclusion Criteria
- Women aged 80 years and older
- Underwent surgery for stage I – III invasive breast cancer
- All or most treatment at the reporting facility

Exclusion Criteria
- Metastatic or concurrent primary cancers
- Incomplete staging data
- Missing tumor characteristics
- Histology other than invasive breast cancer

METHODS

Determination of Volume Cut-point
- Hospital Volume defined as average cases over two years
  - Year of patient index operation and the year prior
- Multivariate (MV) Cox proportional Hazards model with Penalized Cubic Splines
- Analysis of log hazard ratio (HR) of overall survival (OS) for point of maximal change
  - Cut-point for OS based on Hospital Volume : **≥ 270 cases/year**

Statistical Analysis
- X^2 univariate analysis of patient/tumor factors, Kaplan Meier method, Log-Rank test for OS by Hospital Volume
- Cox proportional Hazards model of patient/tumor factors for OS

RESULTS

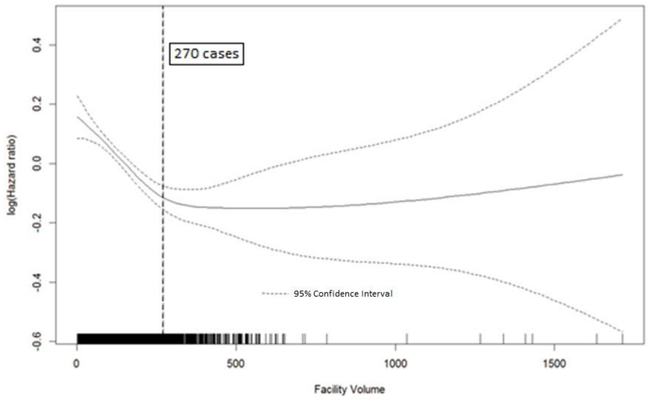
Univariate Comparison of Demographics and Clinicopathological Characteristics by Hospital Volume

	Low Volume (< 270 cases/yr) N=49,933	High Volume (≥ 270 cases/yr) N=9,110	P value
Age			<0.001
80-84 yrs	29,511 (59.10%)	5,546 (60.88%)	
85-89 yrs	15,113 (30.27%)	2,710 (29.75%)	
≥ 90 yrs	5,309 (10.63%)	854 (9.37%)	
Race			<0.001
Non-Hispanic White	40,949 (82.01%)	7,284 (79.96%)	
Non-Hispanic Black	3,169 (6.35%)	745 (8.18%)	
Hispanic	1,249 (2.50%)	363 (3.98%)	
Other/Unlisted	4,566 (9.14%)	718 (7.88%)	
Co-Morbidities			0.004
None	38,191 (76.48%)	7,085 (77.77%)	
1	9,111 (18.25%)	1,615 (17.73%)	
2	2,043 (4.09%)	330 (3.62%)	
≥ 3	588 (1.18%)	80 (0.88%)	
Tumor Size			0.036
≤ 2 cm	30,097 (60.65%)	5,580 (61.81%)	
2 to 5 cm	16,507 (33.26%)	2,878 (31.88%)	
> 5 cm	3,024 (6.09%)	569 (6.30%)	
Tumor Stage			<0.001
I	26,267 (54.32%)	4,997 (56.58%)	
II	16,970 (35.09%)	3,007 (34.05%)	
III	5,123 (10.59%)	827 (9.36%)	
Type of Surgery			<0.001
Lumpectomy	30,659 (61.62%)	6,218 (68.59%)	
Mastectomy	18,871 (37.93%)	2,791 (30.79%)	
Mast + Recon	222 (0.45%)	57 (0.63%)	
Radiation Therapy			0.004
Yes	18,019 (36.56%)	3,420 (38.17%)	
Chemotherapy			0.409
Yes	2,891 (6.02%)	549 (6.25%)	
Hormone Therapy			0.029
Yes	26,372 (54.79%)	4,687 (53.52%)	

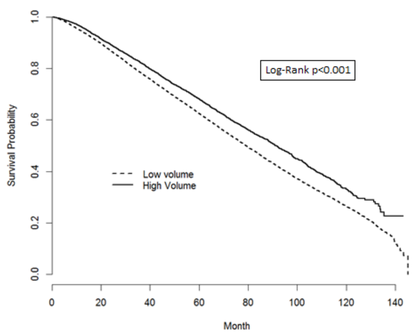
*No significant differences in tumor ER, PR, or HER2 status

RESULTS

Multivariable Cox Proportional Hazards Model with Penalized Cubic Spline Fit



KM Survival Curve by Hospital Volume



Multivariable Cox Proportional Hazards Model for Overall Survival

	Overall Survival		
	Hazard Ratio	95% Confidence Interval	P value
Centers by Volume			
Low Volume	Ref	-	-
High Volume	0.84	0.80 – 0.87	<0.001
Age			
80-84 yrs	Ref	-	-
85-89 yrs	1.52	1.47 – 1.56	<0.001
≥ 90 yrs	2.29	2.19 – 2.38	<0.001
Co-Morbidities			
None	Ref	-	-
1	1.36	1.32 – 1.41	<0.001
2	1.85	1.74 – 1.96	<0.001
≥ 3	2.60	2.35 – 2.88	<0.001
ER Status			
Positive	Ref	-	-
Negative	1.07	1.02 – 1.13	0.006
PR Status			
Positive	Ref	-	-
Negative	1.09	1.05 – 1.13	<0.001

	Overall Survival		
	Hazard Ratio	95% Confidence Interval	P value
Tumor Size			
≤ 2 cm	Ref	-	-
2 to 5 cm	1.27	1.21 – 1.34	<0.001
> 5 cm	1.52	1.42 – 1.63	<0.001
Tumor Grade			
I	Ref	-	-
II	1.06	1.02 – 1.10	0.001
III	1.29	1.24 – 1.34	<0.001
IV	1.39	1.12 – 1.73	0.003
Tumor Stage			
I	Ref	-	-
II	1.23	1.17 – 1.30	<0.001
III	2.14	2.01 – 2.28	<0.001
Radiation Therapy	0.69	0.67 – 0.71	<0.001
Chemotherapy	0.72	0.68 – 0.77	<0.001
Hormone Therapy	0.71	0.68 – 0.73	<0.001

SUMMARY AND CONCLUSIONS

- Among elderly **breast cancer patients age 80 and above**, there is a significant association between undergoing surgery at a **high-volume center** and **improved survival**.
- Overall survival improves with increasing Hospital Volume up to **270 cases per year**, above which these high-volume centers share an equal survival benefit.
- Patients in this population who undergo surgery at **high-volume centers** are characterized by an **earlier stage of disease** and more commonly receive **breast-conserving surgery**, as well as subsequent **adjuvant radiation**.

Next Steps
- Identify systems in place at high-volume centers that may result in more consistent and comprehensive multi-modal therapy for breast cancer.
- Develop actionable strategies to improve care at all institutions that treat breast cancer.