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Does Time of Day Affect Quality of Breast Cancer Surgery?

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ABSTRACT

Background: There is a hypothesis that the time of day can affect the outcome of medical procedures and surgical operations. The current study was designed to assess whether time of day can influence the quality of breast cancer surgery or not.

Methods: Patients who underwent breast cancer surgery and axillary lymph node dissection in Tehran, Iran between March 2012 and March 2013 were enrolled. Surgeries were categorized into two groups based on the time of initiation (before and after 1 pm). We considered the number of dissected lymph node as an indicator of operation quality. In this way, dissection of at least six lymph nodes was considered as an adequate number of lymph node examinations.

Results: A total of 134 patients were enrolled. Median start time of surgery was 11 am. Surgeries were performed before and after 1 pm in 105 (78.4%) and 29(21.6%) patients, respectively. The association between time and the number of dissected lymph nodes was significant when they were considered either as a categorical (P = 0.002) or continuous variables (P = 0.039).

Conclusions: Based on our results, it can be suggested that breast surgeries with later start time might have lower quality.

Introduction

It has been suggested that working hour can influence outcomes of medical procedures.[1,2] Sleep deprivation can lead to decreased clinician competency and predispose one to errors that might influence both patients' and physicians' safety.[3,4] In addition, fatigue that may develop late on a working day is also hypothesized to be associated with more failure rates and errors.[5,6] Studies have demonstrated that colonoscopies that were performed in the afternoon had lower rate of adenoma detection in comparison to procedure conducted in the morning.[7,8] Moreover, it has been shown that cesarean deliveries performed during the night shift were associated with longer operative time and an increased risk for maternal morbidity.[9,10] It has been demonstrated that even among patients who have undergone elective operations, time of day was associated with morbidity after surgery.[11]

In an attempt to define indicators of the quality of breast surgeries, European Society of Breast Cancer Specialists (EUSOMA) has postulated that the number of axillary lymph nodes which is being examined during operation can be considered as an

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Table 1. Histopathological characteristics of tumor in study population.

	N (%)
Pathological type	
Invasive Ductal Carcinoma	128 (95.5%)
Invasive Lobular Carcinoma	6 (4.5%)
Tumor size	
⩽ 2cm	56 (41.8%)
> 2cm	78 (58.2%)
Histologic grade	
I and II	71 (53.0%)
III	44 (32.8%)
Unknown	19 (14.2%)
Lymphovascular Invasion	
Yes	92 (68.7%)
No	23 (17.2%)
Unknown	19 (14.1%)
Receptor status	
ER +	62 (46.3%)
PR +	52 (38.8%)
HER2 +	22 (16.4%)

indicator.[12] Axillary lymph node dissection (ALND) in breast cancer patients with clinical lymphadenopathy and also patients with a positive sentinel lymph node (SLN) is performed to remove level I and level II lymph nodes (LNs) in axilla. Removing adequate number of axillary LNs is of the therapeutic value by excising all involved LNs. It also provides a better prognostic stratification, since it has been shown that the ratio of positive Lns (lymph node ratio) is an independent predictor of overall survival and adequate ALND provides a more accurate lymph node ratio.[13,14]

Bearing in mind that time of operation may affect quality of medical procedures and the number of removed LNs can determine the adequacy of dissection, we compared number of harvested Lns in breast cancer patients who underwent ALND in the morning and the afternoon.

Methods

Study population

In a retrospective study, breast cancer patients who underwent ALND in a referral hospital affiliated to Tehran University of Medical Sciences between March 2012 and March 2013 were enrolled. All surgical procedures were performed by a single surgeon.

Procedure and definition of variables

Time of day was both analysed as continuous and categorical variable. In this regard surgeries were categorized into two groups; initiating before or after 1 pm. First LNs in lymphatic drainage route of axilla (SLN) were marked by injecting blue dye or radioisotope agent around the tumor or in subcutaneous tissue of periareolar region. By aid of a Gamma probe for detecting blue stained node(s), SLNs were harvested in axilla and sent to the lab for histopathologic examination. In case of involvement of any SLNs complete ALND was performed. For adequacy of dissection and quality of breast operation, EUSOMA has recommended removing at least 10 nodes, whereas others have suggested that harvesting more limited number of LNs (4 to 6) is sufficient.[12,15,16] We considered removing at least 6 lymph nodes as an indicator for acceptable dissection of axillary LNs and compared percent of surgeries with adequate dissection in different times of day. To ensure that the results are not affected with the chosen number of dissected LNs, analyses were repeated considering 10 LNs as adequate examined nodes.

In order to determine other factors which may correlate to the number of removed lymph nodes, relation between patients' general and pathologic characteristics and number of removed lymph nodes were also investigated.

Statistical analysis

Statistical analyses were done using SPSS software version 16. Continuous variables were described as mean and standard deviation (SD) and categorical ones were shown as percentage. Variables which did not have normal distribution were presented as median and range. A binary logistic regression was performed to assess the predictive role of variable of interest (time of surgery) on quality of surgery. Then to eliminate the effect of demographical and histopathological characteristics a multivariate analysis was conducted.

Result

A total of 134 patients were enrolled with mean age of 48.9 ± 11.4 years. Invasive ductal carcinoma (IDC) was the most frequent type of malignancy

Table 2. Multivariate analysis of factors predicting adequate lymph node dissection.

	Odds Ratio (95% CI)	P-value
Time (after 1 pm)	0.121 (0.027 – 0.538)	0.006
Age ⩾ 40 years	0.083 (0.004 – 1.672)	0.104
Lymphovascular invasion	0.203 (0.005 – 9.076)	0.411
Nuclear grade III	2.044 (0.276 – 15.161)	0.484
Tumor size ⩾ 2cm	0.262 (0.029 – 2.385)	0.235
Histologic grade III	0.409 (0.056 – 2.997)	0.379

which was detected in 128(95.5%) patients. Histopathological features of tumors are demonstrated in Table 1. All these patients underwent ALND, in 101 of whom sentinel lymph node biopsy was performed. Median number of removed lymph nodes was 10 ranging from 2 to 40. Adequate number of Lns (> 6) was harvested in 110 (82.1%) patients.

Median time for starting operations was 11 am ranging from 8 am to 4 pm. Surgeries were performed before and after 1 pm in 105 (78.4%) and 29(21.6%) patients, respectively. Since breast surgery is an elective surgery, no operation was performed at night and only 5(3.7%) of operations were initiated after 4 pm.

Among 105 of participants who underwent surgery before 1 pm, the median number of removed LNs was 10 ranging from 2 to 30 and adequate number of LNs was harvested in 92 (87.6%) patients. In contrary, among those whose surgery was performed after 1 pm, the median number of dissected LNs was 8 ranging from 2 to 40 and only in 18 (62.1%) of subjects adequate LNs was removed.

Time of surgery and number of dissected nodes had significant association when both were analysed as continuous variables (P = 0.039) (Figure 1). Also, both variables were considered as categorical variables and still time of surgery was significant predictor of adequate LN dissection (P = 0.002). In order to assess the impact of histopathological characteristics of tumor on number of harvested LN, a multivariate analysis was performed in which; four tumor features, age as the most important demographic data and time of surgery were considered as independent variables. As it has been delineated in table 2, time of surgery was the only independent predictor of adequate LN removal.

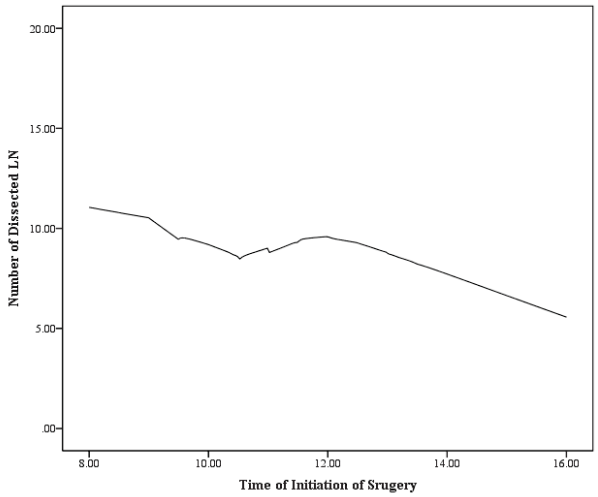

Figure 1. The association between time of surgery and number of dissected LNs. (The scatter plot has been smoothed by employing LOESS method).

Furthermore, all analyses were repeated while 10 LNs were considered as an indicator of adequate dissection and still the same results were obtained (data not shown).

Discussion

In the current study, quality of breast cancer operation was compared between those performed in the morning and in the afternoon. Number of dissected LNs during ALND was considered as an index of efficacy of surgery. The median number of LNs and the frequency of subjects with adequate LNs dissection were significantly lower in operations which were started after 1 pm.

Almost every clinician is conceived that fatigue develops as work time progresses and numerous investigations have confirmed significant influence of operating time on muscular fatigue and hand tremor of surgeons.[17,18] Dorion and Darveau quantitatively measured fatigue, comfort and accuracy of surgeons before and after prolonged surgeries and found that significant fatigue and loss of accuracy can ensue following long time of operation.[19] This can potentially alter clinician performance and outcome of surgical procedures. A previous study has shown that the number of dissected LNs during ALND is lower in patients with older age and smaller tumor size, but in our results the effect of time of surgery was independent of patients' demographic and tumors' histopathological characteristics.[20] Surgeons' experience for sure can be an important factor. In attempt to eliminate this effect, all dissections in our patients were performed by an experienced attending surgeon.

It should be noted that some controversies exist in the literature on the outcomes of surgeries performed

in different times. Some studies have reported that if procedures were performed afternoon or night time yielded less favourable outcomes, while others found no significant increase in complications.[21,22] Most studies evaluating the effect of time of day on surgery outcomes have assessed complication as the main determinant of performance.[11,23] Evaluating results that represent quality of procedures like adequacy of axillary dissection or success in finding polyps in colon during colonoscopy may be more sensitive in showing effect of time of day in clinician performance.

One important limitation of the current study was its retrospective design which can show an association between time and quality of surgery, however for exhibiting causative effect, studies with prospective design are needed. Furthermore, the impact of time on the rate of complications was not assessed in our study population. Determining both complications and indications of operation quality might help to further illustrate the mentioned effect.

Supported by our findings, we showed that time of day has significant effect in quality of breast surgeries. This is a single-institution study and multicenter studies recruiting large number of patients incorporating other factors such as achieving negative margin would better determine effect of time of day on quality of breast surgery.

Conflicts of interests

The authors declare no conflict of interest.

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