

Original Article / Orijinal Araştırma

Indications for sentinel lymph node biopsy in patients with ductal carcinoma in situ

Emel Canbay^{1,1}, Ali Cercel², Fatih Aydoğan², Ertuğrul Gazioğlu², Mehmet Ferahman², Ahmet Kocael², Övgü Aydın³, Zerrin Calay⁴, Varol Çelik²

¹*Department of General Surgery, Kocaeli-Derince Education and Research Hospital, Kocaeli; Departments of ²General Surgery and ⁴Pathology, Istanbul University Cerrahpasa Faculty of Medicine, Istanbul, ³Eta Pathology Laboratory, Nisantasi, Istanbul*

Abstract

Background. Sentinel lymph node biopsy (SLNB) for ductal carcinoma *in situ* (DCIS) is still controversial. **Methods.** Between 2002 and 2008, retrospective analysis was performed in patients (n=53) with an initial diagnosis of DCIS who underwent to SLNB and primary surgical procedure. **Results.** Median age was 52.4 (range, 30-70). Of the 53 patients, 19 (35.8%) cases were upstaged into invasive cancer and 34 (64.2%) cases were diagnosed as pure DCIS in the final diagnosis. Two of 34 (5.8%) patients with pure DCIS and 2 of 19 (10.5%) patients with invasive component had a positive sentinel lymph node. Multivariate logistic regression analysis identified presence of mass (OR: 4.76; 95% CI: 1.57-14.43; p=0.001), larger tumor size (OR: 5.33; 95% CI: 1.31-21.72; p=0.013) were predictive factors of invasive focus in tumor. **Discussion.** The rates of SLNB positivity in pure DCIS (5.8%) are high in our series. SLNB might be considered to perform as part of primary surgical procedure when the DCIS patients are under suspicious of upstaging to invasive carcinoma because of palpable mass and tumor larger than 3 cm.

Keywords: Ductal carcinoma *in situ*, sentinel lymph node biopsy

Özet

Amaç. Sentinel lenf nodu biyopsisi (SLNB) ductal karsinoma *in situ* (DKİS) için hala tartışmalıdır. **Yöntem.** Başlangıç tanısı DKİS olan ve 2002-2008 yıllarında SLNB ve primer cerrahi işlem uygulanan hastalar (n=53) retrospektif olarak değerlendirildi.

Corresponding author:

Dr. Emel Canbay, Genel Cerrahi Kliniği, Kocaeli Derince EAH, İbni Sina Bulvarı, Kocaeli.
Email: drecanbay@gmail.com

Canbay et al.: Sentinel lymph node biopsy in DCIS

47

This is an open-access article distributed under the terms of the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

This article may be cited as: Canbay E, Cercel A, Aydoğan F, Gazioğlu E, Ferahman M, Kocael A, Aydın Ö, Calay Z, Çelik V. Indications for sentinel lymph node biopsy in patients with ductal carcinoma *in situ*. *Basic Clin Sci* 2013; 2: 47-56. Available from: www.bcsiences.com.

Bulgular. Ortanca yaş 52,4 (aralık 30-70) bulundu. Elli üç olgunun, 19'unda (%35,8) invaziv kansere evre yükseltmesi yapıldı ve 34'ü (%64,2) saf DKİS olarak tanımlandı. Bu 34 olgunun 2'si (%5,8) ve diğer 19 olgunun ikisi (%10,5) sentinel lenf nodu pozitif idi. Multivariate lojistik regresyon analizi kitle bulunması (OR: 4,76; 95% CI: 1,57-14,43; p=0,001) ve büyük tümör çapı (OR: 5,33; 95% CI: 1,31-21,72; p=0,013) bulgularını tümörde invaziv fokus açısından prediktif faktör olarak gösterdi. **Sonuçlar.** Saf DKİS olgularında SLNB pozitifitesi (%5,8) serimizde yüksek bulundu. SLNB palpabl kitle ve >3 cm tümör çapı nedeniyle invaziv kansere evre yükseltme olasılığı olan DKİS olgularında primer cerrahi işlemin bir parçası olarak değerlendirilmelidir.

Anahtar sözcükler: Duktal karsinoma *in situ*, sentinel lenf nodu biyopsisi

Introduction

Ductal carcinoma *in situ* (DCIS) is defined as the proliferation of malignant epithelial cells in the ductal units of mammary gland without evidence of invasion of the basement membrane and theoretically metastasis to the regional lymph nodes and distant sites in DCIS should not be expected. Axillary lymph node staging generally discouraged in patients with DCIS without evidence of invasive tumor [1-4] and the level of evidence for recommending SLNB in DCIS without mastectomy is considered insufficient in ASCO 2005 Guideline recommendations [5]. However, there is definitely subgroup of DCIS patients at high risk for invasive disease and subsequent axillary metastasis who will benefit from SLNB [6]. The studies based on DCIS reported sentinel lymph node (SLN) metastasis rates ranging from 0% to 22% [7-15]. More recently, the meta-analysis included 22 published studies reported that rates of SLN metastasis in patients with DCIS was 7.4% [16]. Therefore, factors predict to DCIS patients with invasive components who can benefit and undergo SLNB prior to definitive surgery need to be defined. In previous studies, presence of palpable mass, tumor size, high grade or comedonecrosis have been identified an independent predictive factors for invasive component in patients with DCIS [17-19].

We retrospectively evaluated SLNB results in our patients with an initial diagnosis of DCIS. We also assessed the clinicopathological factors of these patients to identify predictive factors of upstaging invasive tumor which SLNB can be performed in patients with DCIS during the primary surgical procedure.

Material and Methods

Of 577 patients operated for breast cancer at Istanbul University, Cerrahpasa Medical Faculty, Breast Services between May 2002 and August 2008, 53 patients (9.1%) were initially diagnosed as DCIS based on clinical examination, radiological imaging and pathological examination of core needle biopsy. Bilateral breast cancer patients were excluded from the study. Patient characteristics are summarized in Table 1. The data

Canbay et al.: Sentinel lymph node biopsy in DCIS

48

This is an open-access article distributed under the terms of the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

This article may be cited as: Canbay E, Cercel A, Aydoğlan F, Gazioğlu E, Ferahman M, Kacael A, Aydın Ö, Calay Z, Çelik V. Indications for sentinel lymph node biopsy in patients with ductal carcinoma *in situ*. Basic Clin Sci 2013; 2: 47-56. Available from: www.bcsiences.com.

regarding patient and tumor characteristics were collected from medical records: age at diagnosis, tumor size, menopausal status, presence of comedo necrosis, radiological features, tumor harboring invasive component, SLNB status, estrogen (ER), progesterone (PR) receptors status and HER2/neu expression. All patients underwent mastectomy or breast conserving surgery with SLNB following they had given their written informed consent, and had decided whether they would undergo a completion ALND if SLNB results were found to be positive.

Sentinel lymph node procedure

The technique introduced for visualizing the SLN and its identification during surgery has been according to accepted standard as extensively described by Uren et al [20]. Identification of SLN was made intraoperatively with lymphatic mapping using blue dye or measurement using a handle gamma probe (USSC®, Navigator, and Norwalk, USA). Subareolar and intradermal or peritumoral and deep parenchymal injection of methylene blue dye with or without the administration of technetium-99m-labeled sulphur colloid (Nanocis®, Cis-Bio International, Schering) 3-18 hours prior to surgery and preoperative lymphoscintigraphy were performed. All lymph nodes colored with blue dye and/or showed radioactivity with gamma probe were excised and sent to pathologist for preoperative evaluation.

Surgical procedure

Primary tumor resection with simultaneous SLNB was performed in patients with a preoperative diagnosis of DCIS made stereotactically-guided biopsy or radioguided occult lesion localization (ROLL) in those patients with mammographical finding pathognomonic of DCIS, with or without a preoperative pathological diagnosis of DCIS. A diagnostic excisional biopsy was performed in patients with a doubtful preoperative diagnosis, and SLNB was performed as a second operation in those patients with a final pathological diagnosis of DCIS. As a rule, in patients undergoing breast conserving surgery (BCS) for non-palpable lesions, an intraoperative x-ray examination of the resected specimen was performed to confirm the complete tumor excision had been achieved.

Table-1. Clinicopathological characteristics of 53 patients with DCIS.

Parameters	Patients with initial diagnosis of DCIS (n=53) (%)
Age (y, range)	52.4 (30-70)
Tumor size (mm)	26 (10-48)
Menopausal status	
Premenopausal	21 (39.6%)
Postmenopausal	32 (60.4%)
DCIS classification	
Comedo	33 (62.3%)
Non-comedo	20 (37.7%)
Radiological features	
Microcalcification	29 (54.7%)
Tumor mass	22 (41.5%)
Radial scar	1 (1.9%)
Density	1 (1.9%)
Upstaging carcinoma	
Invasive focus	19 (35.8%)
Pure DCIS	35 (66.2%)
SLNB	
Positive	4 (7.5%)
Negative	49 (92.5%)
Estrogen receptor status	
Present	30 (56.6%)
Absent	23 (34.4%)
Progesterone receptor status	
Present	34 (64%)
Absent	19 (36%)
HER2 receptor status	
Present	24 (45.3%)
Absent	29 (54.7%)

Histopathological examination

The excised breast lesions were sampled with a serial cuts and the margins were identified by ink. The search for microinvasive foci and invasive foci was performed in selected cases both with hemotoxylin-eosin (H&E) serial sections and immunostaining. Tumor size and margin status were specified in pathology report.

Intraoperatively, SLNBs were examined by imprint-cytology: the cut surfaces of the bisected SLNBs were touched on slides or the excised SLNs were measured and frozen and 2 mm serial sections were prepared from part of the specimen. After pathologic evaluation of the sections, the remaining tissue was fixed in 10% formalin, embedded in paraffin blocks, and hematoxylin-eosin (H&E) stained sections were prepared. If the H&E sections were negative for malignancy, other sections were cut and stained for cytokeratin with

monoclonal anti-human cytokeratin (clone AE1/AE3; Dako, Carpinteria, CA, USA). SLN metastases were classified according to the 7th edition of the American Joint Committee on Cancer (AJCC) staging system [21] as follows: isolated tumor cells or clusters ≤ 0.2 mm in maximum diameter were defined as isolated tumor cells; metastases 0.2-2.0mm were defined as micrometastases; metastases ≥ 2.0 mm were defined as macrometastases. Removed breast tissue was fixed in 10% buffered formalin. For BCS, a whole specimen removed was sliced at 5-mm intervals and examined by H&E staining. For mastectomy material, suspected area was examined in the same day. Diagnosis of DCIS was established according to the criteria of the Consensus Conference on the Classification of DCIS (Philadelphia, 1997)[22] and all DCIS patients were divided into 3 groups based on the Van Nuys prognostic classification of DCIS [23].

Statistical analysis

Predictive factors of patients upstaged to invasive cancer were investigated by univariate analyses using Fisher's exact test. Logistic regression model was used for multivariate analysis. A *p*-value of less than .05 was considered significant.

Results

Fifty-three patients with DCIS were reviewed in this study. Characteristics of patients are given in Table-1. Median age was 52.4 (range 30-70). Twenty-nine patients (54.8%) presented with pleomorphic calcifications, 22 (41.6%) with tumor mass, one patient (1.8%) with an asymmetric density and one patient (1.8%) with a radial scar in ultrasound or mammographic examinations. Thirteen patients (24.5%) by wire-guided localization, 34 (64.1%) by ROLL, 6 patients (11.4%) by excisional biopsy underwent to diagnosis. Mastectomy was performed in 32 (60%) due to multicentric and/or multifocal disease, whereas 21 (40%) underwent breast conserving surgery. Of the 53 patients diagnosed with DCIS preoperatively, thirty-four (64%) patients with pure DCIS and 19 (35.8%) patients were upstaged to invasive cancer underwent SLNB, a median number of 2 SLNs (range 1-8) were harvested the procedure. Because of very small study group of DCIS microinvasion ($n=4$), we have evaluated the results in comparison with pure DCIS group and DCIS-invasive carcinoma group that including patients with DCIS microinvasion. Two patients (5.8%) with pure DCIS and 2 patients (10.5%) with invasive cancer have found to have a positive SLNB. Of patients with pure DCIS, one had an isolated tumor cells (ITC), whereas others had macrometastasis in the SLN. Only sentinel lymph node was involved with tumor cells in each group. The patients with macrometastasis underwent complete axillary lymph node dissections and received adjuvant chemotherapy with hormone therapy. The patient with ITC underwent breast conserving surgery, axillary radiation and received tamoxifen. All patients with SLNB positive had high grade tumors with comedonecrosis and a palpable mass bigger than 3 cm.

Canbay et al.: Sentinel lymph node biopsy in DCIS

51

This is an open-access article distributed under the terms of the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

This article may be cited as: Canbay E, Cercel A, Aydođan F, Gaziođlu E, Ferahman M, Kacael A, Aydın Ö, Calay Z, Çelik V. Indications for sentinel lymph node biopsy in patients with ductal carcinoma in situ. *Basic Clin Sci* 2013; 2: 47-56. Available from: www.bcsiences.com.

Univariate analysis showed significant correlation of the existence of invasive focus in the tumor with two factors, the presence of palpable mass ($p=0.001$) and lesion size of ≥ 3 cm or larger on radiographic imaging ($p=0.014$), but with no other factors such as grade, comedonecrosis, nuclear grade, Van Nuys DCIS classification and receptor and HER2 status (Table-2). Multivariate analysis showed that those 2 factors, the presence of a palpable tumor (OR: 4.762; 95% CI: 1.571-14.434, $p=0.000$) and tumor size of greater than 3cm (OR: 5.33; 95% CI: 1.309-21.72, $p=0.013$) were independent predictor of tumor comprising invasive components.

Table-2 Assessment of predictive factors of invasive component in tumors diagnosed as DCIS preoperatively.

Characteristics	Total patients (n)	Patients with invasion (n)	Significance with univariate analysis	Significance with multivariate analysis (OR [CI])
Mass in imaging				
Positive	34	16	0.001	0.001 (4.762; [1.571-14.434])
Negative	19	3		
Tumor size				
<3cm	33	16	0.014	0.013 (5.33 [1.309-21.72])
≥ 3 cm	20	2		
Comedonecrosis				
Positive	18	12	0.741	
Negative	35	7		
Nuclear grade				
Grade 1&2	38	13	0.524	
Grade 3	15	6		
Van Nuys classification				
Group 1&2	39	13	0.637	
Group 3	14	6		
Estrogen receptor				
Positive	34	12	0.570	
Negative	19	7		
Progesterone receptor				
Positive	31	11	0.587	
Negative	22	8		
HER2 receptor				
Positive	19	7	0.910	
Negative	34	12		

Canbay et al.: Sentinel lymph node biopsy in DCIS

This is an open-access article distributed under the terms of the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

This article may be cited as: Canbay E, Cerel A, Aydođan F, Gaziođlu E, Ferahman M, Kacael A, Aydın Ö, Calay Z, Çelik V. Indications for sentinel lymph node biopsy in patients with ductal carcinoma in situ. *Basic Clin Sci* 2013; 2: 47-56. Available from: www.bcsiences.com.

Discussion

SLNB is currently the standard approach for axillary staging in breast cancer patients with clinically negative axilla. Although the incidence of axillary metastases in patients with an initial diagnosis of DCIS is considered to be low, DCIS may have a microinvasive foci and progress to invasive carcinoma. Occult invasion in ipsilateral breast may also present and undertreatment in patients with DCIS could be possible without assessment of SLN. Therefore, indications for SLNB in patients with DCIS need to be defined.

In our study, positive SLNB was identified in 5.8% of patients with pure DCIS and in 10.5% of patients DCIS harboring invasive component. In concordance with our results, Cox et al. [10] reported a higher percentage of positive SLN metastases in DCIS-harboring invasive component (20%) compared to pure DCIS group (13%). However, Kaluber-DeMore et al. [12] reported an almost equal rate of SLN involvement between the DCIS and DCIS with invasive component (12% and 10%, respectively). Pendas et al. [9] found positive SLNs in 4.5% of pure DCIS patients. Mittendorf et al. [7] found the highest percentage of positive SLN as 22% in patients with DCIS. Recent meta-analysis included 22 studies reported that rate of SLN metastases in patients with DCIS was 7.4% [16] and they concluded that patients with DCIS should be considered for SLNB. In contrast to these studies, Intra et al. [4] reported the rate of positive SLNs as 1.9% in pure DCIS patients and even decreased to 1.4% when the SLNs with it considered negative. They have concluded that SLNB should not be performed as a standard procedure in the treatment of all patients with DCIS because of low prevalence of metastatic involvement.

The sole criteria for proposing SLNB in DCIS seem to be suspicion of invasive foci at definitive histology. We have found that the mass on imaging and larger tumor size bigger than 3 cm were positive predictive factor for invasive focus in DCIS patients. According to previous studies, factors predicting the presence of invasive component in tumor tissues of patients with DCIS are palpable or large tumors on imaging studies, high-grade, tumor with comedo-type necrosis, HER2 positivity [17,18,22,25-29]. Intra et al. [11] in their previous report, they also have found the SLN metastasis in patients with solid cribriform pattern and they have pointed out the importance of age, clinical presentation and tumor size in predicting the risk of SLN involvement. However, they have found no correlation between the SLN metastasis and clinicopathological parameters in DCIS patients as a result of larger series of DCIS [4]. There are also other studies in which no high risk group could be identified [7, 10]. In our study group, 35.8% of the patients with DCIS were upstaged to invasive carcinoma and/or microinvasion. Moran et al. [30] reported ratio of upstaging to carcinoma of DCIS was as higher as our result (32%). Moreover, Sakr et al. [15] reported the rate of upstaging to DCIS microinvasion or invasive carcinoma was 44%, in their recent published data.

Canbay et al.: Sentinel lymph node biopsy in DCIS

53

This is an open-access article distributed under the terms of the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

This article may be cited as: Canbay E, Cercel A, Aydođan F, Gaziođlu E, Ferahman M, Kacael A, Aydın Ö, Calay Z, Çelik V. Indications for sentinel lymph node biopsy in patients with ductal carcinoma in situ. *Basic Clin Sci* 2013; 2: 47-56. Available from: www.bcsiences.com.

Our higher rate of upstaged disease could be depend on our small size of study group, compare to lower rate of upstaging of DCIS reported previous studies. Our result can be explained by the fact that invasive disease could be missed or underestimated with biopsies as previously reported [3, 31].

In conclusion, our results support routine use of SLNB at least in selected DCIS patients who are under suspicious of upstaging to invasive carcinoma. Studies included larger study group need to be performed for preoperative definition of predictive factors for invasive focus in patients with DCIS who may benefit from SLNB.

Conflict of Interest

Authors declare no conflict of interest.

Acknowledgement

Emel Canbay MD, PhD, was an attending surgeon at the Department of General Surgery, Istanbul University Cerrahpasa Faculty of Medicine during this manuscript preparation for submission.

References

1. Burstein HJ, Polyak K, Wong JS, Lester SC, Kaelin CM. Ductal carcinoma in situ of the breast. *N Engl J Med*. 2004;350(14):1430-41.
2. Lagios MD, Silverstein MJ. Sentinel node biopsy for patients with DCIS: a dangerous and unwarranted direction. *Ann Surg Oncol*. 2001;8(4):275-7.
3. Intra M, Rotmensz N, Veronesi P, Colleoni M, Iodice S, Paganelli G, Viale G, Veronesi U. Sentinel node biopsy is not a standard procedure in ductal carcinoma in situ of the breast: the experience of the European institute of oncology on 854 patients in 10 years. *Ann Surg*. 2008;247(2):315-9.
4. Zavagno G, Carcoforo P, Marconato R, Franchini Z, Scalco G, Burelli P, Pietrarota P, Lise M, Mencarelli R, Capitanio G, Ballarin A, Pierobon ME, Marconato G, Nitti D. Role of axillary sentinel lymph node biopsy in patients with pure ductal carcinoma in situ of the breast. *BMC Cancer*. 2005 Mar 11;5:28.
5. Lyman GH, Giuliano AE, Somerfield MR, Benson AB 3rd, Bodurka DC, Burstein HJ, Cochran AJ, Cody HS 3rd, Edge SB, Galper S, Hayman JA, Kim TY, Perkins CL, Podoloff DA, Sivasubramaniam VH, Turner RR, Wahl R, Weaver DL, Wolff AC, Winer EP; American Society of Clinical Oncology. American Society of Clinical Oncology guideline recommendations for sentinel lymph node biopsy in early-stage breast cancer. *J Clin Oncol*. 2005 Oct 20;23(30):7703-20.
6. Virnig BA, Tuttle TM, Shamliyan T, Kane RL. Ductal carcinoma in situ of the breast:

Canbay et al.: Sentinel lymph node biopsy in DCIS

54

This is an open-access article distributed under the terms of the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

This article may be cited as: Canbay E, Cercel A, Aydođan F, Gaziöđlu E, Ferahman M, Kacael A, Aydın Ö, Calay Z, Çelik V. Indications for sentinel lymph node biopsy in patients with ductal carcinoma in situ. *Basic Clin Sci* 2013; 2: 47-56. Available from: www.bcsiences.com.

- a systematic review of incidence, treatment, and outcomes. *J Natl Cancer Inst.* 2010;102(3):170-8.
7. Mittendorf EA, Arciero CA, Gutchell V, Hooke J, Shriver CD. Core biopsy diagnosis of ductal carcinoma in situ: an indication for sentinel lymph node biopsy. *Curr Surg.* 2005;62(2):253-7.
 8. Schrenk P, Woelfl S, Bogner S, Moser F, Wayand W. The use of sentinel node biopsy in breast cancer patients undergoing skin sparing mastectomy and immediate autologous reconstruction. *Plast Reconstr Surg.* 2005;116(5):1278-86.
 9. Pendas S, Dauway E, Giuliano R, Ku N, Cox CE, Reintgen DS. Sentinel node biopsy in ductal carcinoma in situ patients. *Ann Surg Oncol.* 2000;7(1):15-20.
 10. Cox CE, Nguyen K, Gray RJ, Salud C, Ku NN, Dupont E, Hutson L, Peltz E, Whitehead G, Reintgen D, Cantor A. Importance of lymphatic mapping in ductal carcinoma in situ (DCIS): why map DCIS? *Am Surg.* 2001;67(6):513-9.
 11. Intra M, Veronesi P, Mazzarol G, Galimberti V, Luini A, Sacchini V, Trifirò G, Gentilini O, Pruneri G, Naninato P, Torres F, Paganelli G, Viale G, Veronesi U. Axillary sentinel lymph node biopsy in patients with pure ductal carcinoma in situ of the breast. *Arch Surg.* 2003;138:309-13.
 12. Klauber-DeMore N, Tan LK, Liberman L, Kaptain S, Fey J, Borgen P, Heerdt A, Montgomery L, Paglia M, Petrek JA, Cody HS, Van Zee KJ. Sentinel lymph node biopsy: is it indicated in patients with high-risk ductal carcinoma-in-situ and ductal carcinoma-in-situ with microinvasion? *Ann Surg Oncol.* 2000;7:636-42.
 13. Kelly TA, Kim JA, Patrick R, Grundfest S, Crowe JP. Axillary lymph node metastases in patients with a final diagnosis of ductal carcinoma in situ. *Am J Surg.* 2003;186:368-70.
 14. Buttarelli M, Houvenaeghel G, Martino M, Rossi I, Ronda I, Ternier F, Tallet A, Jacquemier J. Interest of sentinel lymph node biopsy for the staging of ductal carcinoma in situ. *Ann Chir.* 2004;129(9):508-12.
 15. Sakr R, Barranger E, Antoine M, Prugnon H, Daraï E, Uzan S. Ductal carcinoma in situ: value of sentinel lymph node biopsy. *J Surg Oncol.* 2006;94:426-30.
 16. Ansari B, Ogston SA, Purdie CA, Adamson DJ, Brown DC, Thompson AM. "Meta-analysis of sentinel node biopsy in ductal carcinoma in situ of the breast. *Br J Surg.* 2008;95:547-54.
 17. Miyake T, Shimazu K, Ohashi H, Taguchi T, Ueda S, Nakayama T, Kim SJ, Aozasa K, Tamaki Y, Noguchi S. Indication for sentinel lymph node biopsy for breast cancer when core biopsy shows ductal carcinoma in situ, *Am J Surg.* 2012; 202:59-65.
 18. Yen TW, Hunt KK, Ross MI, Mirza NQ, Babiera GV, Meric-Bernstam F, Singletary SE, Symmans WF, Giordano SH, Feig BW, Ames FC, Kuerer HM. Predictors of invasive breast cancer in patients with an initial diagnosis of ductal carcinoma in situ: a guide to selective use of sentinel lymph node biopsy in management of ductal carcinoma in situ. *J Am Coll Surg.* 2005;200(4):516-26.

Canbay et al.: Sentinel lymph node biopsy in DCIS

55

This is an open-access article distributed under the terms of the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

This article may be cited as: Canbay E, Cercel A, Aydođan F, Gaziođlu E, Ferahman M, Kacael A, Aydın Ö, Calay Z, Çelik V. Indications for sentinel lymph node biopsy in patients with ductal carcinoma in situ. *Basic Clin Sci* 2013; 2: 47-56. Available from: www.bcsiences.com.

19. Tan JC, McCready DR, Easson AM, Leong WL. Role of sentinel lymph node biopsy in ductal carcinoma-in-situ treated by mastectomy. *Ann Surg Oncol.* 2007;14(2):638-45.
20. Uren RF, Howman-Giles R, Chung D, Thompson JF. "Nuclear medicine aspects of melanoma and breast lymphatic mapping,". *Semin Oncol.* 2004;31: 338-48.
21. Edge SB, Byrd DR, Compton CC, Fritz AG, Greene FL, Trotti A, Eds., *AJCC Cancer Staging Handbook*, Springer, 2010, 7th Edition.
22. Consensus conference on the classification of ductal carcinoma in situ. The consensus conference committee. *Cancer.*1997;80:1798-1802
23. Silverstein MJ, Poller DN, Waisman JR, Colburn WJ, Barth A, Gierson ED, Lewinsky B, Gamagami P, Slamon DJ. Prognostic classification of breast ductal carcinoma-in-situ. *Lancet.* 1995;345(8958):1154-7.
24. Son BK, Bong JG, Park SH, Jeong YJ. Ductal carcinoma in situ and sentinel lymph node biopsy. *J Breast Cancer.* 2011;14(4):301-7.
25. Meijnen P, Oldenburg HS, Loo CE, Nieweg OE, Peterse JL, Rutgers EJ. Risk of invasion and axillary lymph node metastasis in ductal carcinoma in situ diagnosed by core needle biopsy. *Br J Surg.* 2007;94(8):952-6.
26. King TA, Farr GH Jr, Cederbom GJ, Smetherman DH, Bolton JS, Stoler AJ, Fuhrman GM. A mass on breast imaging predicts coexisting invasive carcinoma in patients with a core biopsy diagnosis of ductal carcinoma in situ. *Am Surg.* 2001;67(9):907-12.
27. Wilkie C, White L, Dupont E, Cantor A, Cox CE. An update of sentinel lymph node mapping in patients with ductal carcinoma in situ. *Am J Surg* 2005;190:563-6.
28. Goyal A, Douglas-Jones A, Monypenny I, Sweetland H, Stevens G, Mansel RE. Is there a role of sentinel lymph node biopsy in ductal carcinoma in situ? Analysis of 587 cases. *Breast Cancer Research Treat.* 2006;98(3):311-4.
29. Huo L, Sneige N, Hunt KK, Albarracin CT, Lopez A, Resekova E. Predictors of invasion in patients with core needle biopsy-diagnosed ductal carcinoma in situ and recommendations for a selective approach to sentinel lymph node biopsy in ductal carcinoma in situ. *Cancer* 2006;107(8):1760-8.
30. Moran CJ, Kell MR, Flanagan FL, Kennedy M, Gorey TF, Kerin MJ. Role of sentinel lymph node biopsy in high-risk ductal carcinoma in situ patients. *Am J Surg.* 2007 Aug;194(2):172-5.
31. Bagnall MJ, Evans AJ, Wilson AR, Pinder SE, Denley H, Geraghty JG, Ellis IO. Predicting invasion in mammographically detected microcalcification. *Clin Radiol.* 2001;56:828-32.

Canbay et al.: Sentinel lymph node biopsy in DCIS

56

This is an open-access article distributed under the terms of the Creative Common Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

This article may be cited as: Canbay E, Cercel A, Aydođan F, Gaziođlu E, Ferahman M, Kacael A, Aydın Ö, Calay Z, Çelik V. Indications for sentinel lymph node biopsy in patients with ductal carcinoma in situ. *Basic Clin Sci* 2013; 2: 47-56. Available from: www.bcsiences.com.