The Breast 21 (2012) 444–448

Contents lists available at SciVerse ScienceDirect

The Breast

journal homepage: www.elsevier.com/brst

Original article

Lymphatic mapping after previous breast surgery

A.J.G. Maaskant-Braat [a,*], S.Z. de Bruijn [b], K. Woensdregt [c], H. Pijpers [d], A.C. Voogd [e,f], G.A.P. Nieuwenhuijzen [a]

[a] Department of Surgery, Catharina Hospital, PO Box 1350, 5602 ZA Eindhoven, The Netherlands
[b] Faculty of Health Medicine and Life Sciences, Maastricht University, Maastricht, The Netherlands
[c] Department of Surgery, Maastricht University Medical Center, Maastricht, The Netherlands
[d] Department of Nuclear Medicine, Catharina Hospital, Eindhoven, The Netherlands
[e] Eindhoven Cancer Registry, Comprehensive Cancer Center South, Eindhoven, The Netherlands
[f] Department of Epidemiology, Maastricht University, Faculty of Health Medicine and Life Sciences, Research Institute Growth and Development (GROW), Maastricht, The Netherlands

ARTICLE INFO

Article history:
Received 14 July 2011
Received in revised form
17 October 2011
Accepted 23 October 2011

Keywords:
Recurrent breast cancer
Repeat lymphoscintigraphy
Sentinel node biopsy

ABSTRACT

Background: To assess the feasibility of lymphatic mapping and determine the lymphatic drainage pathways in patients previously treated with breast conserving therapy (BCT).
Methods: We included patients without current breast cancer that previously received BCT with sentinel node biopsy (SNB) and/or axillary lymph node dissection (ALND) for primary breast cancer. The study population consisted of 44 patients and was divided into two groups according to previous surgical treatment of the axilla: 22 patients after previous SNB and 22 patients after previous ALND. Standard lymphatic mapping was performed and the lymphatic drainage pattern was registered. Drainage located outside the ipsilateral axilla was recorded as aberrant.
Results: Lymphoscintigraphy revealed a drainage pattern in 17 of 44 patients (39%). The identification rate in the SNB-group was 41% and 36% in the ALND-group ($P = 0.760$). 8 patients (18%) showed aberrant drainage, which tended to be more frequent in the ALND-group than in the SNB-group (27% versus 9%, $P = 0.122$). Lymphatic drainage to the contralateral axilla was observed in 2 patients, both previously treated with ALND.
Conclusions: Lymphatic mapping seems feasible after previous BCT with axillary treatment, in spite of a relatively low identification rate. Aberrant drainage tends to be more frequent after previous treatment with ALND.

Introduction

The axillary lymph node status is of critical importance in the management of patients with breast cancer, both for its prognostic value and for its role in deciding whether or not to administer adjuvant therapy.[1] Sentinel lymph node biopsy (SNB) has been shown to be an accurate procedure for axillary staging in patients with primary breast cancer.[2] An increasing number of patients is diagnosed with early-stage breast cancer.[3] Most of them are treated with breast conserving therapy (BCT) including SNB.[4] Unfortunately, approximately 10–15% of these patients will develop an ipsilateral breast tumour recurrence (IBTR) within 10 years after primary treatment.[5] Prognosis of recurrent breast cancer is, like in primary breast cancer, correlated with regional lymph node status.[6] Although axillary staging with SNB is generally implemented in the treatment of primary breast cancer, its role in management of recurrent breast cancer has yet to be elucidated. In patients with IBTR who underwent BCT with complete axillary lymph node dissection (ALND), salvage mastectomy without further lymph node dissection is considered to be standard of care.[7,8] When IBTR occurs in patients who had a previous negative SNB without a consecutive ALND, there is no consensus which axillary strategy should be followed. Currently however, for most clinicians an ALND will be the procedure of choice for staging and treatment of the axilla in these patients.[7] Unfortunately, long term complications of ALND are common including lymphoedema, seroma formation, shoulder dysfunction, pain and numbness.[9] SNB has been introduced as an alternative for ALND in primary breast cancer, since it has similar staging capacities but with markedly lower risk of morbidity.[1,9,10]

Because lymphatic pathways could have been altered due to prior surgery and/or radiotherapy, a previous procedure of the

* Corresponding author. Tel.: +31 40 2399111; fax: +31 40 2443370.
E-mail address: sabrinamaaskant@gmail.com (A.J.G. Maaskant-Braat).

0960-9776/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.breast.2011.10.007

axilla either by SNB or ALND is considered to be a relative contra-indication for performing a repeat SNB. Data available from experimental studies show that this disruption of lymphatic vessels may only be temporary and lymphatics are able to regenerate within a certain period from surgery.[11] Furthermore, when the original lymphatic vessels are interrupted due to surgery or radiotherapy, the lymphatic drainage may even follow collateral lymphatic channels to an alternative lymph node basin.[12,13] These drainage patterns could be different when compared to primary surgery and may thus result in unexpected aberrant lymphatic drainage.[13–17] Several case reports and small heterogeneous series of patients suggest that it might be feasible to perform a repeat SNB in patients with IBTR after prior BCT with axillary surgical staging and adjuvant radiotherapy.[18–25] The aim of this study was to assess the feasibility of lymphatic mapping and describe lymphatic drainage pathways in a more homogeneous population consisting exclusively of patients previously treated with breast conserving therapy with SNB and/or ALND.

Patients and methods

Patients

Patients who underwent BCT with SNB and/or ALND between January 2000 and December 2006 in the Catharina Hospital Eindhoven were evaluated. The medical records were used to collect detailed information on the treatment of the primary breast cancer. We included patients without current breast cancer who were treated with BCT with SNB and/or ALND for primary breast cancer located in the upper-outer quadrant of one breast at least 3 years before the analysis, with or without adjuvant chemo- or hormonal therapy. We chose to include only patients with breast cancer in the upper-outer quadrant to create a homogeneous group of patients in which quadrant of the tumour would not be a possible interfering factor in the interpretation of the data. Furthermore, the timeframe of 3 years was chosen arbitrarily in order for lymphatic drainage pathways to have sufficient time to regenerate. Patients were excluded if they had breast surgery for other reasons than breast cancer, if they had recurrent breast cancer or if they had a former allergic reaction to ^{99m}Tc-colloidal albumin. The study population based on these in- and exclusion criteria consisted of 44 patients. The patients were divided into two groups according to previous surgical treatment of the axilla: 22 patients after previous SNB and 22 patients after previous ALND. A formal study protocol consisting of the study objectives, study design, study population and study procedures was reviewed and approved by the ethical committee of the Catharina Hospital Eindhoven. Radiation exposure due to lymphatic mapping consists of a dose of 0.46 mSV, which is well under the constraint of 5 mSV/year which is documented in the code of practice involving human research. The study was conducted according to the principles of the Declaration of Helsinki and in accordance with the Medical Research Involving Human Subjects Act (WMO). After informing the patients according to good clinical practice guidelines a written informed consent was obtained. The results were summarised and disclosed to the participating patients by means of a letter.

Methods

To assess the technical feasibility of lymphatic mapping and determine lymphatic drainage pathways, lymphatic mapping was performed. A dose of 60 MBq ^{99m}Tc-colloidal albumin (Nanocoll®, GE-healthcare, Eindhoven, The Netherlands) in a volume of 1ml was injected deep in the breast parenchyma on both sides along the location of the previous lumpectomy. All injections were performed by the same physician. Images were obtained two hours after injection in 3 projections (anterior, anterior-oblique and lateral view) with the patient in supine position under a Siemens Ecam gamma camera. The imaging procedure is similar to the sentinel node procedure executed in our patients with primary breast cancer. Lymphatic drainage pathways and/or the location of the sentinel node(s) were registered. Lymphatic drainage outside the ipsilateral axilla was recorded as being aberrant. All lymphoscintigrafic studies were reviewed by the same nuclear medicine physician and researcher. Patients with previous SNB and ALND were compared with respect to identification rate and aberrant drainage pattern by using the Mann–Whitney *U* test, with a statistically significant difference defined as a two-tailed *P*-value < 0.05.

Results

The study population consisted of 44 patients. Patient and disease characteristics of 22 patients with BCT and SNB and 22 patients with BCT and ALND are presented and compared in Table 1. The mean age of participants in the SNB-group was 60.3 years (range 36–76) and 60.1 years (range 36–79) in the ALND-group. Treatment characteristics are outlined in Table 2. A mean number of 2 nodes was removed in primary surgery in the SNB-group and a mean number of 12 nodes was removed in the ALND-group ($P = 0.0001$). The mean time interval between primary surgery and the current study was 64.8 months in the SNB-group and 75.1 months in the ALND-group ($P = 0.167$). All patients received irradiation of the breast after their primary surgery. The mean interval between administration of the radiotherapy and the current study was 63.4 months (range 37–93 months) in the SNB-group, and 71.6 months (range 33–113 months) in the ALND-group ($P = 0.268$). The average dose of radiotherapy was 59 Gy. In 5 patients the axilla was included in the radiation field with an average dose of 34 Gy. 4 of these patients had a previous ALND, 1 patient underwent previous SNB. This patient received intra-operative axillary radiotherapy, because she had a palpable lesion in the axilla.

There was a significant difference in the administration of adjuvant chemotherapy between the two groups. In the SNB-group, three patients received adjuvant chemotherapy. Sixteen patients received adjuvant chemotherapy in the ALND-group ($P = 0.0001$). Furthermore, a significant difference was present between the two groups regarding the administration of adjuvant hormonal treatment. Four patients in the SNB-group versus 18 patients in the ALND-group received adjuvant hormonal treatment ($P = 0.0001$).

Table 1
Patient Characteristics of patients receiving repeat lymphatic mapping. (BCT = Breast Conserving Therapy, SNB = Sentinel Node Biopsy, ALND = Axillary Lymph Node Dissection, ER = Estrogen Receptor positive, PR = Progesterone Receptor positive).

Patient characteristics			
	BCT + SNB	BCT + ALND	*P*-value
Total *N*	22	22	
Mean age, y (range)	60.5 (36–77)	60.1 (37–79)	0.894
Tumour localisation *N*, (%)			
Left breast	10	16	0.069
Right breast	12	6	
Original tumour size, cm (range)	1.3 (0.2–2.5)	1.9 (0.6–3,6)	0.005
Histology, *N*			
Ductal carcinoma in situ	0	1	0.712
Infiltrating ductal carcinoma	18	16	
Infiltrating lobular carcinoma	4	5	
Mean number of nodes removed in primary surgery	1.7 (1–6)	11.7 (4–20)	0.0001
ER	19	20	0.953
PR	18	17	0.663