Breast Cancer Res Treat (2012) 131:987–992
DOI 10.1007/s10549-011-1805-7

EPIDEMIOLOGY

Incidence and risk factors for axillary web syndrome after breast cancer surgery

Anke Bergmann · Valéria Vasconcellos Mendes · Ricardo de Almeida Dias · Blenda do Amaral e Silva · Maria Giseli da Costa Leite Ferreira · Erica Alves Nogueira Fabro

Received: 8 September 2011 / Accepted: 26 September 2011 / Published online: 11 October 2011

Abstract The objective of the study is to estimate the incidence and risk factors of axillary web syndrome (AWS) in early postoperative period (45 days). From the prospective cohort of women undergoing breast cancer surgery, we collected the variables related to patient characteristics, treatment, tumor, and postoperative complications. We performed bivariate and logistic regression. A total of 193 patients are included with a mean age of 58.26 years, majority of which are women who are overweight or obese (72.3%). The incidence of AWS was 28.1%. The presence of pain in the ipsilateral upper-limb associated with AWS was reported in 5.4% of the patients, and the shoulder joint restriction was observed in 11.4%. When controlling for confounding between AWS and the factors that showed statistical significance in bivariate analysis, the variables that explain the occurrence of the AWS were the type of axillary surgery, where women who underwent sentinel lymph node biopsy showed 68% less risk compared with those that underwent axillary lymphadenectomy (AL) (RR = 0.32; 95% CI, 0.13−0.79; P value = 0.014) and numbness in the arm after an injury of the intercostobrachial nerve, which is 3.19 times the risk of the AWS (RR = 3.19; 95% CI, 1.40−7.29, P value = 0.006). From the above findings, we concluded that the incidence of AWS was 28.1%, and it was associated with AL and numbness in the arm after injury of the intercostobrachial nerve.

Keywords Breast neoplasm · Lymph node excision · Axillary web syndrome · Incidence

A. Bergmann (✉) · V. V. Mendes · R. de Almeida Dias · B. do Amaral e Silva
Augusto Motta University Center, Av. Paris, 72 - Bonsucesso, Rio de Janeiro, RJ 21041-020, Brazil
e-mail: abergmann@inca.gov.br

V. V. Mendes
e-mail: fisiorj2008@gmail.com

R. de Almeida Dias
e-mail: ryckdiasfisio@yahoo.com.br

B. do Amaral e Silva
e-mail: blendafisio@yahoo.com.br

A. Bergmann · V. V. Mendes · R. de Almeida Dias · B. do Amaral e Silva · M. G. da Costa Leite Ferreira · E. A. N. Fabro
National Cancer Institute, Rua Visconde de Santa Izabel, 274, Rio de Janeiro, RJ 20560-120, Brazil
e-mail: magiseli@hotmail.com

E. A. N. Fabro
e-mail: efabro@inca.gov.br

Introduction

The breast cancer is the most frequent type of cancer and the leading cause of cancer death among females [1]. Surgery has been the treatment of choice and often is followed by sentinel lymph node biopsy (SLNB) or by axillary lymphadenectomy (AL). These procedures are important for the prognosis and definition of the best adjuvant therapy [2]. As much SNL as AL has adverse effects that meaningfully change the quality of life of these patients [3].

The axillary web syndrome (AWS) had been one of the complications that takes place between the fifth and eighth weeks and is characterized by palpable cords in the breast, underarm, medial arm, antecubital space, forearm, or abdominal wall and is clinically associated with pain and limited shoulder range of motion [4–7]. After SLNB, the incidence of AWS was reported by 20% of women and, after AL, varies considerably between 38 and 72% [5, 8, 9].

The AWS pathophysiology is not well established. However, studies have suggested that surgery treatment is the first mechanism of the lymphatic injury [10]. In this context, the general goal of this study was to evaluate the incidence and risk factors for AWS after breast cancer surgery.

Materials and methods

This is a prospective cohort study of women who underwent surgical treatment of breast cancer in the Cancer Hospital III of the National Cancer Institute, Rio de Janeiro Brazil, in the period September 2008–June 2009.

Women were evaluated preoperatively by physical therapists, being excluded those who had musculoskeletal disorders and pain during the preoperative evaluation, which are an indication of immediate reconstruction, bilateral breast cancer, clinic staging cancer IV, incapacity disorders without correlation to cancer, and difficulties in answering the survey questions. The eligible patients were invited to participate in this research and submitted an informed consent. This study obtained approval from the National Cancer Institute research ethics committee. On the first day after surgery, the women were treated according to institutional routines and received guidance to early mobilization limited to 90 degrees in flexion of the arm during a homolateral surgery [11]. Those patients were followed until the 45th postoperative day, when a new evaluation was carried out.

The diagnosis of AWS was performed through a physical examination; the symptoms considered positive are as follows: palpable cords in the breast, underarm, medial arm, antecubital space, and forearm or abdominal region and underwent a homolateral surgery. As a secondary outcome, we assessed arm pain and limited shoulder/elbow range of motion.

For descriptive analysis of the population included in this study and evaluation of risk factors for AWS, we collected independent variables related to sociodemographic characteristics (marital status, education, and occupation), personal characteristics (age, dominant limb, and body mass index), treatment characteristics (type of breast and axillary surgery, number of lymph nodes removed, chemotherapy, and radiotherapy), tumor characteristics (positive lymph nodes and histopathological staging), and characteristics of the surgical complications that included subjective self-report of arm edema, early edema (volume measurements were calculated using the frustrum sign method, and edema was defined as a 200 ml or greater difference in volume compared with the unaffected limb), numbness in the intercostobrachial nerve, winged scapula (access by a physical examination, when the patient was asked to push on a wall in a push-up motion), scar infection, hematoma that needed surgical exploration for hemostasis, tissue necrosis (clinically tissue death of part of the skin), and clinically significant seroma (defined as a symptomatic non-infectious fluctuation area requiring multiple aspirations biopsy).

The descriptive analysis of the study population was made using measures of central tendency for continuous variables and frequency for categorical variables. To assess risk factors for the development of AWS, the relative risk was calculated with the respective confidence interval of 95%. With the statistically significant variables in the bivariate analysis, we developed a multivariate logistic regression (Enter method). The final model of risk for AWS was obtained considering the statistical and clinical significance between the variables.

Results

About 193 patients (72.3%) composed of obese or overweight (body mass index as a 25.0 or greater) and right-handed (93.3%) women with a mean age of 58.26 years (DP 12.98) were included. Among this population analyzed, 52.9% were married or had stable union, 46.6% had incomplete basic education, and 59.1% were housewives.

Considering the oncologic treatment, 73.6% of the patients underwent mastectomy and 67.6% underwent AL. The mean of 13.26 lymph nodes was identified, and these 2.38 (SD 4.73) were positive for malignancy, which represents 44.6% of women with positive lymph nodes. Concerning the histopathology of breast cancer staging, most women were classified under stage IIA (55.1%).

In the postoperative evaluation, 45th postoperative day, eight women did not attend, resulting in a loss to follow-up of 4.1%.

The incidence of AWS was 28.1%, pain in the homolateral upper-limb was reported for 13.5%, and limited shoulder range of motion was observed at 23.2% of women. Among those with AWS, the presence of pain in the homolateral upper-limb was reported for 5.4%, and the limited shoulder range of motion was observed for 11.4% (Table 1).

When evaluating the characteristics of women and the risk for AWS before breast cancer surgery, younger women showed 42% more AWS risk and obese women showed 15% less AWS risk but both without statistical significance (Table 2).

In terms of the oncology treatment that was realized, neoadjuvant chemotherapy and radiotherapy not increased the risk of development AWS in this population study. However, surgical treatment at the breast and in the axilla was statistically associated with AWS risk. The women who

Table 1 Axillary web syndrome incidence, pain, and limited shoulder range of motion ($n = 185$)

Clinical	Axillary web syndrome			
	Yes (%)	No (%)	Total (%)	*P* value
Arm pain				
Yes	10 (5.4)	15 (8.1)	25 (13.5)	0.120
No	42 (22.7)	118 (63.2)	160 (86.5)	
Limited shoulder range of motion				
Yes	21 (11.4)	22 (11.9)	43 (23.2)	0.001
No	31 (16.8)	111 (60)	142 (76.8)	
Total	52 (28.1)	133 (71.9)	185 (100)	

Table 2 Bivariate analysis of the women characteristic and the occurrence of axillary web syndrome ($n = 185$)

Characteristics	Axillary web syndrome			RR	CI 95%	*P* value
	Yes (*n*)	No (*n*)	Total (%)			
Dominant side (surgery)						
Homolateral	26	67	50.3	0.99	0.62–1.57	0.547
Contralateral	26	66	49.7			
Age at surgery						
Until 59 year old	32	66	53.0	1.42	0.88–2.29	0.097
60 years or older	20	67	47.0			
Obesity						
Yes	15	45	33.5%	0.85	0.51–1.43	0.331
No	35	84	66.5%			

RR Relative risk, *CI* confidence interval

had undergone AL surgery showed 36% of AWS incidence, whereas those that had undergone SLNB showed incidence of 11.7%, which means 68% (RR = 0.32; IR 95%, 16−0.67) of AWS risk reduction. Those women who underwent mastectomy increased the risk twice more than the other women who did not in this research (RR = 1.98; I 95% CI 1.01−3.91). Regarding tumor characteristics, women with positive lymph node had 62% more risk in developing AWS than women without lymph node metastasis (RR = 1.62; 95% CI 1.02−2.57) (Table 3).

About healing complications, seroma was found in 37.9% of the women, tissue necrosis in 20%, hematoma in 7.2%, and scar infection in 12.3%. Among these, only hematoma was statically associated with AWS, doubling the AWS risk (RR = 2.09; 95% CI 1.19–3.68) (Table 4).

The incidence of winged scapula resulting from long thoracic nerve was 41.6% and was not observed to be associated with AWS. Upper-limb numbness from intercostobrachial nerve injury showed an incidence of 61.5%, which increased the risk of developing AWS by three times (RR = 2.93; 95% CI 1.52–5.63) (Table 4).

Early occurrence of edema (vol 200 ml) was not frequent (3.2%) and was not associated with AWS. The report about edema sensation (subjective edema) occurred at 38.2%, which represents almost twice the increased risk of developing AWS (RR = 1.88; 95% CI 1.19–2.97) (Table 4).

By controlling the possible confounding variables between AWS and the factors that showed statistical significance in the bivariate analysis, the variables with the best explication of AWS occurrence were found: One is the type of axillary surgery in which women who underwent SLNB showed 68% less risk of developing AWS than women who underwent AL (RR = 0.32; IR 95% 1.40–7.29; *P* value = 0.006), and the other is numbness at the intercostobrachial nerve, which represented 3.19 times more risk of developing AWS (RR = 0.32; IR 95% 1.40–7.29; *P* value = 0.006).

Discussion

The final sample was composed of 185 patients during follow-up surgery, after 45 days, which corresponds to loss to follow-up of 4.1%. Most of the study subjects underwent aggressive systemic and regional treatment as a result of advanced staging, and were obese women with low level of education.

Among the evaluated women, the incidence of AWS was 28.1%, and according to the type of axillary approach, those women who underwent SLNB had an incidence rate of 11.7%, whereas those who underwent AL showed an incidence of 36%; this result is almost similar to a previous

Table 3 Bivariate analysis of the axillary web syndrome, treatment characteristics, and tumor characteristics ($n = 185$)

Oncology treatment	Axillary web syndrome			RR	CI 95%	*P* value
	Yes (*n*)	No (*n*)	Total (%)			
QT neoadjuvant						
Yes	15	35	27.0	1.09	0.66–1.81	0.430
No	37	98	73.0			
RXT neoadjuvant						
Yes	2	6	4.3	0.88	0.26–3.01	0.600
No	50	127	95.7			
Axillary lymphadenectomy						
SLN	7	51	33.0	0.32	0.16–0.67	0.000
AL	44	74	67.0			
Lymph nodes removed						
>15 lymph nodes	30	58	47.6	1.50	0.94–2.40	0.059
≤15 lymph nodes	22	75	52.4			
Breast surgery						
Mastectomy	44	92	73.5	1.98	1.01–3.91	0.023
Conservative	8	41	26.5			
QT ongoing						
Yes	12	30	23.2	1.02	0.59–1.76	0.546
No	39	100	76.8			
RXT ongoing						
Yes	12	23	19.0	1.28	0.75–2.17	0.248
No	40	109	81.0			
Lymph node status						
Positive	29	52	43.8	1.62	1.02–2.57	0.030
Negative	23	81	56.2			
Staging cancer						
Advanced (>IIB)	28	55	44.9	1.43	0.90–2.27	0.085
Early stage (II A)	24	78	55.1			

RR Relative risk, *CI* confidence interval, *AL* axillary lymphadenectomy, *lSLNB* sentinel lymph node biopsy, *QT* chemotherapy, *RXT* radiotherapy

study conducted in the same institution in which 38.2% of the subjects developed AWS [8]. These incidence rates found in our institution were lower than those reported in the literature. Lacomba et al. [9] pointed an incidence of AWS in 48.3% of patients that underwent LA, and Leidenius et al. [5] observed an incidence of AWS in 72% of women that underwent LA and in 20% of women that underwent SLNB. The lowest incidence in our study population can be explained partly by the fact that these women are evaluated by the physical therapy before any after the oncology treatment [11].

Many authors have referred the clinical characteristic of the AWS such as upper-limb pain and reduction in the range of motion. The results of our study point to a report of spontaneous pain that was present in 13.5% of women, but only 5.4% at these women showed AWS. Lacomba et al. [9] verified 56 patients with AWS, and 6 has showed myofascial pain syndrome; this could be explained by the antalgic posture adopted by patients with AWS, which causes muscle shortening and activation of trigger points.

The reduction of the active range of motion was observed in 23.2%, 11.4% of which were women with AWS. Menezes et al. [12] observed that 85.7% of patients with limited range of motion have AWS, and Moskovitz et al. [13] verified that 74% of the patients who showed AWS had joint restriction. These divergent results in the literature could be because of the different methodological designs because most articles about AWS are case reports [6, 7, 10, 14–17] or retrospectives studies [12, 13, 18] where the identification of AWS may have induced the symptoms. In this study, all women were subjected at palpation and examination of the affected arm independent of the symptoms reported.

About the risk factors for developing AWS, younger women showed 42% more risk for AWS but without statistical significance ($P = 0.09$). The age was not evaluated as a risk factor for AWS in other studies.

Obesity has been identified as a protective factor for AWS. The results of this study, although without statistical significance, indicated that obese women have 15% less

Table 4 Bivariate analysis of the surgery complications and the risk of development axillary web syndrome ($n = 185$)

Oncology treatment	Axillary web syndrome			RR	CI 95%	*P* value
	Yes (*n*)	No (*n*)	Total (%)			
Seroma						
Yes	16	50	37.9	0.82	0.49–1.37	0.488
No	32	76	62.1			
Tissue necrosis						
Yes	05	31	20.0	0.44	0.19–1.04	0.050
No	45	99	80.0			
Hematoma						
Yes	07	06	7.2	2.09	1.19–3.68	0.049
No	43	124	92.8			
Scar infection						
Yes	04	18	12.3	0.61	0.24–1.52	0.319
No	47	110	87.7			
Winged scapula						
Yes	26	51	41.6	1.40	0.88–2.22	0.185
No	26	82	58.4			
Numbness ICBN						
Yes	42	68	61.5	2.93	1.52–5.63	<0.001
No	09	60	38.5			
Early edema (>200 ml)						
Yes	01	05	3.2	0.58	0.10–3.55	0.459
No	51	128	96.8			
Subjective edema						
Yes	28	42	38.2	1.88	1.19–2.97	0.007
No	24	89	61.7			

RR Relative risk, *CI* confidence interval, *ICBN* intercostobrachial nerve

risk of developing AWS, and a similar result was found in a previous study conducted in the same institution [8]. Leidenius et al. [5] and Lacomba et al. [9] ascertained that obese patients showed less risk for AWS, and the same was observed in the study carried out by Menezes et al. [12], in which 33.3% of the patients who manifested AWS were obese or overweight. The lower frequency of AWS in obesity could be explained by the fact that fibrous cords lymph were less visible or palpable at the thick subcutaneous layer, which could hinder the diagnosis and evaluation of AWS, when these were not achieved at routine. Therefore, obesity could not be indicative of protection for AWS but could, in fact, hamper the diagnosis or minimize the symptoms.

Mastectomy was accomplished in 73.5% of women evaluated in this study of which 44 (32.4%) developed AWS, and among those who underwent conservative surgery, 8 (16.3%) developed AWS. The incidence of AWS in mastectomized women was similar to the that of Moskovitz [13] and less than that publicized by Lacomba et al. [9], who observed that 58% of patients who underwent radical mastectomy have AWS. On the other hand, Menezes et al. [12] verified that 50% of the patients who developed AWS had undergone mastectomy. Regarding the procedure at the axilla, women who underwent LA showed an AWS incidence rate of 36%, whereas those who underwent SLNB showed an incidence rate of 11.7%, representing a decrease in the risk of 68% even after controlling for confounding variables. Similar results have been reported in the literature, which confirms that AWS is more related to axillary procedure than breast surgery and minimal invasive surgery with reduced morbidity [5, 12, 13].

With reference to the tumor characteristics, 67% of the patients had an axillary dissection, whereas only 44% had positive nodes, probably because we included patients with neoadjuvant therapy and those with contraindications for sentinel lymph node biopsy. Among those with AWS, 38% had axillary positive lymph nodes, which increases the risk of developing the syndrome by 62%. The presence of positive lymph nodes was associated with radical surgery; in the logistic regression, this variable lost its statistical significance and, therefore, becomes a confounding variable. The results of this actual study are in accord with those of other studies, which did not find direct association between axillary positive lymph nodes and AWS [5, 12, 13].

Considering the complications of the breast cancer treatment surgery, after controlling for pertinent variables, only the upper-limb numbness for intercostobrachial nerve injury was statistically associated with AWS, which increase the risk by 3.19 times. These results diverge from those publicized by others authors, probably because of the cordon lymphatic formation rear local hyperalgesia, which can be confusing during palpation evaluation that is used to detect nerve damage. Another possible explanation is that the likely probable cause factor for damage of lymphatic collectors, which generate the AWS, is the same for the intercostal nerve injury, i.e., intra-operative injury [5, 13].

The principal contribution of this study is the fact that this study included the analysis of the characteristics that were previously reported in the scientific literature as possible risk factors and that this study was also able to control the interplay of confounding variables, thus enabling a direct approach to measure the risk for AWS. However, the main limitation is the small sample size, which may not have been sufficient to identify associations between the independent variables and AWS.

Conclusion

The incidence of AWS after 45 days of surgical treatment for breast cancer was 28.1%. After controlling for possible confounding factors, the variables that best explained the occurrence of AWS were the type of axillary surgery, where women who underwent SLNB showed 68% less risk for AWS compared with those who underwent AL (RR = 0.323; 95% CI 0.13–0.79, P value = 0.014), and numbness in the path of the intercostobrachial nerve, which represented 3.19 times the risk of AWS than those who reported no numbness (RR = 3.194; 95% CI 1.40–7.29, P value = 0.006).

Acknowledgments The authors declare that this manuscripts comply with the current laws of Brasil and the study was approved by the research ethics committee of the National Cancer Institute/INCA. This article did not receive any grant support.

Conflict of interest No potential and real conflicts of interest.

References

1. Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D (2011) Global cancer statistics. CA Cancer J Clin 61(2):69–90
2. Morrow M (2010) Trends in the surgical treatment of breast cancer. Breast J 16(Suppl 1):S17–S19
3. Kootstra JJ, Hoekstra-Weebers JE, Rietman JS, de Vries J, Baas PC, Geertzen JH, Hoekstra HJ (2010) A longitudinal comparison of arm morbidity in stage I-II breast cancer patients treated with sentinel lymph node biopsy, sentinel lymph node biopsy followed by completion lymph node dissection, or axillary lymph node dissection. Ann Surg Oncol 17(9):2384–2394
4. Leduc O, Sichere M, Moreau A, Rigolet J, Tinlot A, Darc S, Wilputte F, Strapart J, Parijs T, Clement A, Snoeck T, Pastouret F, Leduc A (2009) Axillary web syndrome: nature and localization. Lymphology 42(4):176–181
5. Leidenius M, Leppanen E, Krogerus L, von Smitten K (2003) Motion restriction and axillary web syndrome after sentinel node biopsy and axillary clearance in breast cancer. Am J Surg 185(2):127–130
6. Rezende LFF, Franco RL, Gurgel MSC (2005) Axillary web syndrome: practical implications. Breast J 11(6):531
7. Pappo I, Wasserman I, Stahl-Kent V, Sandbank J, Halevy A (2004) Mondor's disease of the axilla: a rare complication of sentinel node biopsy. Breast J 10(3):253–255
8. Bergmann A, Mattos IE, Koifman RJ, Ribeiro MJ, Nogueira EA, Ribeiro EP, Marchon RM, Maia AV, Roberto DR, Pereira TB, Santos IV, Viana FV, Magno J, Gonçalo AC (2007) Axillary web syndrome after lymph node dissection: preliminary results of 1004 breast cancer patients. Lymphology 40(Suppl):198–203
9. Torres Lacomba MT, Mayoral Del Moral O, Coperias Zazo JL, Yuste Sanchez MJ, Ferrandez JC, Zapico Goni A (2009) Axillary web syndrome after axillary dissection in breast cancer: a prospective study. Breast Cancer Res Treat 117(3):625–630
10. Fourie WJ, Robb KA (2009) Physiotherapy management of axillary web syndrome following breast cancer treatment: discussing the use of soft tissue techniques. Physiotherapy 95(4):314–320
11. Bergmann A, Ribeiro MJP, Pedrosa E, Nogueira EA, Oliveira ACG (2006) Fisioterapia em mastologia oncológica: rotinas do Hospital do Câncer III/INCA. Rev Bras Cancerol 52(11):97–109
12. Menezes AG, Sampaio EA, Carvalho CC (2008) Perfil das pacientes pós-cirurgia de câncer de mama com síndrome do cordão axilar. Rev Bras Mastol 18(2):48–53
13. Moskovitz AH, Anderson BO, Yeung RS, Byrd DR, Lawton TJ, Moe RE (2001) Axillary web syndrome after axillary dissection. Am J Surg 181(5):434–439
14. Franco RL, Rezende LF, Gurgel MSC (2005) Axillary web syndrome. Rev Bras Mastol 15(4):182–185
15. Tilley A, Thomas-Maclean R, Kwan W (2009) Lymphatic cording or axillary web syndrome after breast cancer surgery. Can J Surg 52(4):E105–E106
16. Reedijk M, Boerner S, Ghazarian D, McCready D (2006) A case of axillary web syndrome with subcutaneous nodules following axillary surgery. Breast 15(3):411–413
17. Villamiel EC, Alcover AR, Rodriguez IM (2008) Axillary web syndrome. Prog Obstet Ginecol 51(12):745–748
18. Aydogan F, Belli AK, Baghaki S, Karabulut K, Tahan G, Uras C (2008) Axillary web syndrome after sentinel node biopsy. Breast Care (Basel) 3(4):277–278