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Current Problems in Cancer

journal homepage: www.elsevier.com/locate/cpcancer



Axillary web syndrome: Incidence, pathogenesis, and management

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A B S T R A C T

Axillary web syndrome (AWS) refers to the development of fibrotic bands or “cords” in the axilla of patients who have undergone axillary lymph node dissection for breast cancer. We review the incidence, pathogenesis, risk factors, and management of AWS. AWS is a common complication in patients who undergo axillary lymph node dissection. Even though AWS is self-limited in most cases, it causes significant morbidity. The optimal management of AWS is unclear but physiotherapy appears to be beneficial. The widespread use of less invasive procedures to evaluate the presence of metastasis in the axillary lymph nodes (ie, sentinel lymph node biopsy) is expected to reduce the incidence of AWS. The close collaboration of surgeons, oncologists, and physiotherapists is necessary for the prevention and management of this frequent condition.

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A R T I C L E I N F O

Keywords: Axillary web syndrome; Axillary lymph node dissection; Breast cancer; Physiotherapy

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Introduction

Axillary web syndrome (AWS) refers to the development of fibrotic bands or “cords” in the axilla of patients who have undergone axillary lymph node dissection (ALND) for breast cancer.^{1,2} AWS can also occur in less common indications for ALND (eg, melanoma staging) as well as in patients with extensive malignant axillary lymphadenopathy.^{2,3} The characteristic fibrotic bands are tender, nonerythematous, are only palpable or can also be visible, and become more prominent, taut and painful during shoulder abduction.^{2,4} In approximately 20% of patients, these “cords” extend along the anterior and medial aspect of the arm, across the antecubital fossa and may reach the radial aspect of the wrist at the base of the thumb.^{1,2,4,5} In some cases, the fibrotic bands take the form of subcutaneous nodules that mimic breast cancer metastases.³ Common symptoms include pain in the axilla that can radiate down the arm, and limited shoulder movement, particularly abduction.^{2,6}

Incidence and risk factors

Moskowitz et al were the first to describe and name AWS in a retrospective study of 750 patients who underwent ALND (Table).² AWS was recorded in 44 of 750 patients (6%) and developed in most cases during the second postoperative week.² The presence of axillary metastases did not appear to be associated with the development of AWS.² No case of AWS was recorded in patients who had undergone only mastectomy without ALND.² AWS resolved in all patients within 3 months.² In addition, the authors reported AWS in 4 patients who underwent lumpectomy and sentinel lymph node dissection.² AWS symptoms and signs in the latter 4 patients were similar with the 44 patients who underwent ALND but appeared to be less severe.²

In a more recent prospective study, AWS was observed at 2 weeks postoperatively in 26 of 36 who underwent ALND (72%) and in 10 of 49 patients who underwent sentinel node biopsy (20%; $P < 0.00005$).⁴ Therefore, more invasive and extensive axillary surgery appears to predispose to AWS.⁴ In addition, lean patients (mean body mass index of 23) were more likely to develop AWS than obese patients (mean body mass index of 26).⁴ The authors suggested that the excess subcutaneous fat in obese patients might prevent the development of adhesions between the skin and the underlying tissues.⁴ Another explanation might be that the fibrotic bands are less visible and less easily palpable in obese patients.⁴ On the other hand, preoperative limitation in shoulder movements, metastatic involvement of axillary nodes and sentinel node biopsy outside level I-II of the axilla were not associated with the incidence of AWS.⁴ Three months postoperatively, only 1 patient in each group had residual signs of AWS that is 1 of 26 (4%) in the ALND group and 1 of 10 (10%) in the sentinel node biopsy group.⁴

Table

Major studies that evaluated the incidence and risk factors for axillary web syndrome (AWS) among patients undergoing axillary lymph node dissection.

Reference	Number of patients	Incidence of AWS	Risk factors for AWS
2	750	6%	None identified
4	36	72%	Body mass index <23 kg/m ²
7	139	57%	None identified
8	116	48%	Body mass index <25 kg/m ² Younger age Radiotherapy Chemotherapy
9	193	28%	More extensive surgery
10	97	29%	Younger age More extensive surgery
11	173	91%	Hypertension

In a randomized controlled trial, AWS was observed in 79 of 139 patients (57%) 6 weeks after ALND.⁷ Type of surgery (modified radical mastectomy vs breast conserving surgery) or administration of radiotherapy had no effect on the occurrence of AWS.⁷ AWS was still present in 43 of 139 (31%) and 21 of 139 (15%) of patients at 12 and 26 weeks postoperatively, respectively.⁷ However, no patient had residual signs of AWS 1 year postoperatively.⁷

In a more recent prospective study in 116 patients who underwent ALND, AWS was observed in 56 of 116 patients (48%).⁸ AWS developed in a median of 16 days after the operation (range 12-22 days).⁸ In accordance with the study of Leidenius et al.,⁴ lean patients were more likely to develop AWS.⁸ In addition, patients who developed AWS were younger than those who did not (mean age 48.9 and 58.1 years, respectively; $P < 0.0001$).⁸ Moreover, patients who were given radiotherapy or chemotherapy were also more likely to develop AWS.⁸ Interestingly, 4 patients exhibited a recurrence of AWS when submitted to radiotherapy or chemotherapy.⁸ On the other hand, the extent of breast surgery (quadrantectomy, modified mastectomy, and lumpectomy) and the number of dissected lymph nodes had no effect on the occurrence of AWS.⁸ Three months postoperatively, residual signs of AWS were present in 2 of 56 patients (4%).⁸

In another large prospective study ($n = 193$), the incidence of AWS during the early postoperative period (ie, within 45 days after surgery) was 28%.⁹ Patients undergoing ALND were at higher risk for developing the syndrome than those undergoing sentinel lymph node biopsy.⁹ Interestingly, injury of the intercostobrachial nerve more than tripled the incidence of AWS.⁹

In a small retrospective study ($n = 97$), 29% of patients developed AWS.¹⁰ Again, young age and more extensive surgery (ie, greater number of resected lymph nodes) were associated with higher incidence of the syndrome.¹⁰

In a very recent prospective study ($n = 173$), almost all women (91%) developed AWS.¹¹ Interestingly, hypertension was identified as a risk factor for AWS whereas diabetes mellitus appeared to be associated with lower incidence.¹¹

Overall, AWS appears to occur in more than half of patients who undergo ALND and develops during the second postoperative week.^{4,7,8} The low rates reported by Moskovitz et al are probably due to the retrospective design of their study.² Less extensive axillary surgery (ie, sentinel lymph node biopsy) reduces the risk for AWS whereas the administration of radiotherapy or chemotherapy increases the risk.^{4,8}

Pathogenesis

The “cords” in AWS represent sclerosed veins and lymphatics with surrounding fibrosis.^{1,2} Venous clipping and lymph node resection interrupts the flow in veins and lymphatics.^{1,2} Subsequently, thrombosis, inflammation and fibrosis transform veins and lymphatic vessels into fibrotic bands.^{1,2} In the study of Moskovitz et al, biopsy of the axillary web disclosed dilated lymphatics with occasional fibrin clots and venous thrombosis at various stages of recanalization.² In a recent case series of 15 women with AWS, the pattern of “cords” was similar to the distribution of brachial lymphatic vessels, further supporting the lymphatic origin of these fibrotic bands.⁵ Adhesions of the “cords” to surrounding tissues contribute to the reduction in shoulder mobility.⁶

Natural course and management

AWS is a nonprogressive and self-limited disorder that resolves spontaneously regardless of treatment.^{1,2,4} At 3 months postoperatively, <5% of patients have residual signs of AWS.^{2,4,8} In the study with the longer follow-up, no patient had AWS 1 year after ALND.⁷ The spontaneous resolution might be due to the recanalization of the occluded vessels or to progressive collagen resorption.³

Even though AWS is self-limited, management is frequently required for pain relief and mobility improvement.¹ Some experts argue the physiotherapy can shorten the duration of AWS and alleviate symptoms.¹ In mild cases, active assisted forward flexion, horizontal abduction and passive end-ranging of internal and external rotation are recommended.^{1,12} Soft tissue treatment techniques aiming at mobilization and stretching of restricted tissues were also reported

to be beneficial.^{6,12} Others support the use of manual lymph drainage in the axilla and the fibrotic cords in combination with compression bandaging and active and action-assisted shoulder exercises.^{8,13} In more severe cases, gravity-assisted pendulum exercises for shoulder range of motion appear to be useful.¹ Joint mobilization, stretching and strengthening exercises have also been proposed.¹³ Patient education and at-home exercise might also be useful.¹³ However, the retrospective study of Moskovitz et al suggested no benefit of physical therapy and range-of-motion exercises.² In addition, in the randomized controlled trial of Lauridsen et al, AWS rates did not differ between patients treated with physiotherapy early (starting during the sixth to eighth postoperative week) or later (after the 26th postoperative week).⁷ Regarding other treatments, nonsteroidal anti-inflammatory agents do not appear to be helpful.² Surgical disruption of cords is contraindicated because it results in no substantial benefit and can promote lymphedema.¹

Conclusions

AWS is a common complication in patients who undergo ALND. Even though it is self-limited in most cases, it causes significant morbidity. The optimal management is unclear but physiotherapy appears to be beneficial. The widespread use of less invasive procedures to evaluate the presence of metastasis in the axillary lymph nodes (ie, sentinel lymph node biopsy) is expected to reduce the incidence of AWS. The close collaboration of surgeons, oncologists, and physiotherapists is necessary for the prevention and management of this frequent condition.

Conflict of interest

We have no conflict of interest to declare.

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