Axillary Web Syndrome: a case presenting during neoadjuvant chemotherapy for breast cancer

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Key words

Axillary Web Syndrome, axillary surgery, breast cancer, cording, lymphatic

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Abstract

Background: Axillary Web Syndrome (AWS) was described by Moskovitz et al (2001) as a palpable web of tissue emanating from the axilla, causing pain and restricting arm movement in a subset of patients after axillary lymph node dissection. They associated it with surgical disruption of the superficial lymphatic system. **Aims:** AWS onset in a woman during neoadjuvant chemotherapy, prior to surgery, demonstrates AWS associated with breast cancer treatment is not limited to post-surgery. Possible causative factors in common with axillary lymph node surgery are considered. **Method:** An observational study of AWS diagnosed pre-surgery, describing intra-operative and clinical pathology reports. Medical photography and clinical examination contributed information for the study. **Results:** AWS persisted post-surgery. Resolution with treatment followed a course similar to that experienced with post-surgical AWS. **Conclusion:** Lymphatic disruption is proposed to cause AWS (Moskovitz et al, 2001). Trauma, inflammation or tumour infiltration can disrupt lymphatic function. The authors propose tumour infiltration and neoadjuvant chemotherapy potentially disrupted the lymphatic architecture in this case, evidenced by the pathological report on the axillary tissue specimen.

Moskovitz reported Axillary Web Syndrome (AWS) as a postoperative complication after axillary lymph node dissection (Moskovitz et al, 2001). In a retrospective review of their data, they found AWS reported in 44 cases among 750 breast cancer subjects at 1–8 weeks post surgery. They described only one case of AWS pre-operatively in a woman diagnosed with stage IV breast cancer with extensive fixed nodal disease. They considered this case to be caused by blockage of normal lymphatic flow.

There has been sustained interest in AWS as it impedes post-surgical recovery. Precise definition of the involved anatomical structures and causative factors are still being explored. Consensus of opinion regarding whether to intervene with treatment, as well as optimal treatment technique, has not been established thus far.

AWS without axillary lymph node surgery is occasionally reported and this case study further informs on this.

Clinical case study

A 42-year-old female diagnosed with right multifocal invasive ductal carcinoma presented for disease management. Past medical history included anxiety, depression and hypothyroidism, managed by her GP. Diagnostic investigations confirmed Grade 111 invasive ductal carcinoma, but no evidence of distant metastasis. The surgeon reported a 5 cm palpable mass with lymphadenopathy evident in the supraclavicular and axillary nodes. Neoadjuvant chemotherapy was recommended.

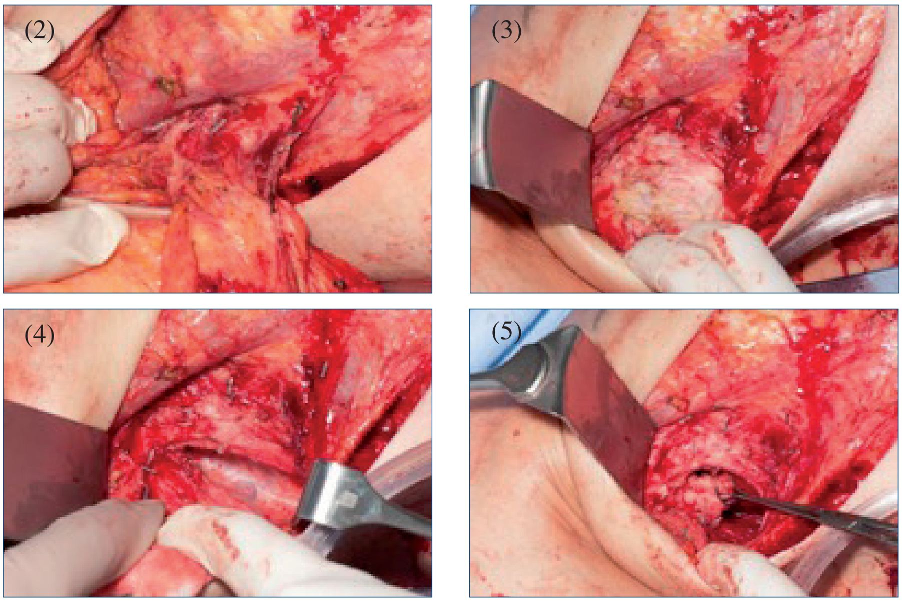
During the course of chemotherapy, the patient experienced right arm pain, movement restriction and mild right arm oedema. Ultrasound imaging excluded deep venous thrombosis. Post-chemotherapy BMI was 26 — a 5 kg weight loss.

Pre-surgical clinical assessment revealed AWS restricting right shoulder abduction, flexion and elbow extension. The axillary neuro-vascular bundle palpated taut at end range of shoulder abduction, with several tight cords visible on the extended arm from the axilla through the cubital fossa, palpable to the base of the thumb, including one under the anterior border of the deltoid muscle (*Figure 1*). The axilla appeared concave in comparison to the contralateral side and the axillary subcutaneous tissue was fixed on palpation with no available mobility between the tissue planes.

During right mastectomy and axillary clearance, the surgeon documented the axilla was tethered, reporting scarring, but no obvious lymph nodes in the axillary fat. The axillary anatomical tissue planes were unclear, with minimal axillary content available *in situ* for dissection. The available axillary tissue was dissected and sent for histopathology (*Figures 2–5*). Post-surgery, the axillary webbing appeared visibly unchanged (*Figures 6–7*) and wound healing was uncomplicated.

Breast cancer histology revealed partial response to chemotherapy, with 10 mm and 3 mm foci of residual invasive ductal carcinoma over a 39 mm area in the mastectomy specimen. No definite lymph nodes were identifiable in the axillary tissue, although a 0.4 mm focus of metastasis was noted. Hormonal testing was ER+/PR+,

Figure 1. Cording to the elbow emanating from the axilla, limiting terminal elbow extension.



Figures 2–5. Figure 2. Axillary contents exposed below pectoralis major, with excised beast tissue still attached at the axilla. Figure 3. Further dissection reveals scarring of the axillary lymphoid tissue. Figure 4. Post excision of the axillary node tissue the posterior muscle tissue of the axilla is visualised. Figure 5. Residual lymphoid tissue is removed from the apex of the axilla.

HER2-. Radiation therapy, hormonal therapy and Xeloda were recommended as adjuvant treatment.

Upper-limb rehabilitation progress was slowed by the restriction the axillary web placed on the right upper-limb range of motion (*Figures 8–10*).

Discussion

Improved survival after breast cancer treatment has led to increased focus on reducing post treatment morbidity. Post-axillary lymph node surgery incidence of AWS was suggested as 48.3% in a 2009 prospective study (Torres Lacomba et al, 2009), and as up to 85.4% of patients in a 2015 systemic literature review (Yeung et al, 2015).

The incidence of AWS is obscured by lack of a precise definition, understanding of the precipitating physiology, and the extent of anatomical structures involved in the clinical presentation. Lymphatic therapists suggest the thin taut ‘cord-like’ vascular structures of AWS be differentiated from thicker tensioned bands of tissue limiting shoulder motion sometimes seen in the axilla (*Figures 1&8*). Post-surgical adhesions formed during the early phase of wound healing may affect lymphatic vessel functioning and mobility (Fourie and Robb, 2009). Aponeurotic tissue expansions extend from the upper-limb fascial layers, and tight scar tissue is capable of tensioning anatomical structures directly or via fascia. The clavi-pectoral fascia has continuity with the medial brachial fascia and the axillary sheath surrounding the axillary neurovascular bundle. This may explain the thicker prominent band of tissue seen in *Figures 1&8*. AWS is proposed to be more consistent with superficial lymphatic vessel anatomy, and to display a finer cord-like appearance. The patient in this case study presents with both the structures described, the finer cords being more pain sensitive to stretch.

Leduc proposed that AWS cords follow the anatomical path of the superficial lymphatic drainage vessels to the axillary nodes and ultrasound imaging of the structures concurs with this (Leduc et al, 2009; 2014). Biopsy of these cords also seems consistent with vascular cause (Moskovitz et al, 2001; Reedijk et al, 2006; Josenhans, 2007). Moskovitz et al (2001) postulated that lymphatic disruption by surgery, lymph flow stasis and coagulation associated with inflammatory mediators might precipitate AWS. Although they found no association with AWS and whether the axillary node specimen was tumour positive, they did propose the occurrence of AWS in his patient who had not had surgery could be due to tumour replacing functioning lymph nodes. This would effectively impede lymph flow. More recent literature on the subject indicates no direct association between axillary lymph node metastasis, neoadjuvant chemotherapy or lymphoedema and AWS (Yeung et al, 2015; Huang et al, 2017). However, in this case, the authors found that AWS onset did present concurrently with mild ipsilateral arm lymphoedema.

Lymphatic vessel trauma during surgical dissection, or cellular destruction due to chemotherapy could release inflammatory and thrombotic mediators, such as thrombokinase, precipitating lymph fluid coagulation and peri-lymphatic inflammation and adhesions (Opie, 1913). Koehler (2016) proposed that lymphatic vessel leakage of high protein lymph fluid into an inflamed perivascular tissue environment could precipitate a physiological process leading to fibrotic adhesions, which ultimately contract, tensioning adjacent lymph vessels. Elasticity of these lymphatic vessels could also be reduced in an inflammatory environment where intravascular lymph is induced to coagulate.

AWS outside of the cancer or surgical scenario has also been reported after vigorous prolonged activity, infection or even with no identifiable cause. These events may also be mediated by lymphatic trauma and inflammation.

Figure 6. Day 1 postoperative.

Figure 7. Skin traction better displays ‘cords’.

Figure 8. AWS restricted arm motion post surgery.

Figure 9. Elbow extension limited by multiple cords post surgery.

Figure 10. Multiple “cords” originating from the axilla restricting arm motion post surgery.

Recent literature on AWS has focused on evidence regarding the palpable or visible tensioned cords being lymphatic in origin. However, early assumptions also associated the condition with Mondor’s disease and venous involvement. In this case study, ultrasound eliminated venous thrombosis. A recent study using Doppler ultrasound showed changes in arterial volume and flow at 3 and 6 months after axillary dissection surgery in a cohort of patients with AWS (Furlan et al, 2017). These changes were not evident at 1 month post surgery, and no pre-surgery measurements were done. In the authors’ clinic, AWS is seen even at 2 weeks post surgery, and Koehler and Hunter (2016) reported it as commonly occurring in the proliferative phase of healing 2–4 weeks post surgery. Perhaps the reported arterial changes were compensatory. Inflammatory changes would influence other local vascular structures, and the lymphatics are responsive to local circulatory changes. Although AWS was evident in this case prior to surgical intervention, the authors cannot exclude the venous or arterial system having some contributing role. Doppler imaging with a blood flow signal indicating venous cause of a post-surgical AWS cord was described by Wei et al (2013).

In discerning specific barriers to functional recovery of the upper limb after breast cancer treatment, it is helpful to understand if the tissue restriction involves neural, vascular or fascial components as their sensitivity to treatment interventions varies.

In this case, the authors propose that it is possible that tumour invasion caused preliminary disruption of the axillary lymph node structure and function. Chemotherapy impacted the cancerous nodal tissue, mediating local lymphatic vessel inflammation, phlebitis, adhesions and lymph flow stasis with symptomatic AWS. The scarring of the lymph nodes that the surgeon observed intraoperatively also gradually tensioned the surrounding fascial structures adding the thicker band of axillary tissue observed. These changes contributed to presentation of lymphoedema and AWS defined by restricted arm movement and pain with tissue stretch in shoulder abduction or flexion range of motion.

Conclusion

AWS has been reported in breast cancer patients as a consequence of axillary node surgery. This case study of pre-surgical AWS shows that AWS is not limited to post surgery. Along with other reports of AWS without axillary surgery, it contributes to understanding the presentation and course of the condition. Considering previously published material, the authors propose that physiological changes associated with AWS in this case study appear consistent with a thrombo-phlebitic process of the superficial lymphatic vessels, with a cascade of physiological events leading to loss of extensibility of the involved tissues, possible perivascular adhesions, intravascular and perivascular lymph stasis.

Clinical reasoning regarding the anatomy and possible pathophysiological changes in the involved tissues supports an increased understanding of AWS and promotes progression in targeting therapeutic interventions. Understanding how to best support functional recovery would improve quality of survival after breast cancer treatment.

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