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Brachial Plexopathy After Modified Radical Mastectomy: A Case Report

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Abstract

Introduction: Brachial plexus injury (BPI) is not a common complication of surgery and anesthesia, which may happen with varied mechanisms like over-abduction, no appropriate positioning, and upper limb stretching. The overall prognosis of BPIs is commonly satisfactory, but the poor function of the upper limb may not be fully recovered in all cases and may end in the permanent sequel in serious injuries.

Case Presentation: This study reported a woman with breast cancer. She developed a right brachial plexopathy following a modified radical mastectomy. Upon conservative treatment, full recovery was achieved and normal function of the right upper limb was observed 3 months following the operation.

Conclusions: The arm's extremely abnormal positioning during intraoperative manipulation and axillary retraction or hyper abduction can lead to BPI. Nerve injury can occur even in diabetic patients, whose blood glucose is well controlled and have no other risk factors. If the nerve structure is intact, spontaneous recovery can be expected with conservative management.

Keywords: Anesthesia, General, Mastectomy, Brachial Plexus Neuropathy, Lymph Node Dissection

1. Introduction

Brachial plexus injury (BPI) with different mechanisms may happen as a result of breast cancer treatment such as metastatic invasion, chemo-therapy initiated neurotoxicity, radiotherapy, surgical fibrosis, ischemia, surgical trauma, and inappropriate positioning of the patient in the operating room (1). Iatrogenic BPI is not a common complication during anesthesia and surgery; however, it may cause permanent disability and can result in litigation. The brachial plexopathies incidence is ~ 0.2% of all cases receiving general anesthesia, and 7% to 10% of brachial plexopathies are iatrogenic (2). BPI can be observed in cardiac surgery, general and orthopedic surgery, and modified radical mastectomy (3). The injury can happen due to some varied mechanisms like improper positioning, over-abducting, and upper limb stretching. However, paralysis of the brachial plexus may occur while an elective surgical procedure is in the process although reasonable care has been taken to assure the patient is positioned appropriately (4).

2. Case Presentation

A woman aged 57 years old diagnosed with a right breast invasive ductal carcinoma was scheduled for surgery. The tumor was located in the upper outer quadrant (25 mm × 28 mm in diameter). She received a right-side modified radical mastectomy. The patient had a history of diabetes mellitus for 3 years while her blood glucose was well controlled.

With a regular preoperative examination, the patient was found to have no evidence of musculoskeletal problems. The patient's vital signs were reported to be stable with oxygen saturation (SpO2) = 96% in room air and the electrocardiogram was recorded to be normal during the examination. On the operating table, induction of general anesthesia was done with fentanyl (250 μg), propofol (120 mg), and atracurium (40 mg) in the supine position. During the operation, sevoflurane (2% to 3%) and Remifentanil infusion (total dosage 1500 μg) were used to maintain anesthesia. While the patient was in a supine position, the modified radical mastectomy was performed when she abducted and maintained both arms

at nearly 90 degrees. Her forearms were being extended and strapped to arm boards. The patient's right arm was abducted 90 degrees during the procedure to make the operating field expose. The lymphadenectomy was carried out and the surgery took 2:30 hours. The whole procedure was conducted smoothly in axillary dissection with no surgical injuries to the brachial plexus. With the expected blood loss of 150 mL as well as urine output of 550 mL, the patient received 2500 mL of crystalloid fluid.

She reported weakness of the right upper extremity as well as finger slight numbness in the following day. Further, she complained about not being able to move the hand completely and limited wrist flexion and extension. Also, she reported having no sensation on the index finger and thumb with reduced sensation in her right forearm. The lower extremities were recorded to have normal motor and sensory functions. Table 1 shows a neurological examination of the right upper limb after the operation and rehabilitation. A right brachial plexopathy was diagnosed in the patient regarding the clinical symptoms, examination, and electro-diagnostic studies. For 3 days, dexamethasone (8 mg daily IV) neurobion: (vitamin B1: 100 mg + vitamin B6: 100 mg + vitamin B12: 1000 μg) IV infusion in1000 cc isotonic saline daily was administrated in for the patient (5). After the patient was discharged, active and passive physical therapies were conducted. An electromyography (EMG) was performed on the 28th day after the injury, which showed normal spontaneous potential in the arm, forearm, as well as hand muscles. For all 5 nerves of the brachial plexus, the nerve conduction velocity (NCV) was reported to be normal and 3 months after the surgery, the patient regained normal function in her right hand.

3. Discussion

BPI is reported to be rare during mastectomy and axillary dissection. Over-traction during axillary exploration, surgical injuries of the brachial plexus, or upper-extremity manipulations to improve surgical exposure are the main causes (6).

Brunette et al. reported a postoperative bilateral brachial plexopathy in a 39-year-old man following laparoscopic bariatric surgery. They indicated that head-up intraoperative body position during surgery might be the main risk factor for postoperative brachial plexopathy (7).

Via a pathophysiologic study of BPI from Burnett et al., it was concluded that 3 principal mechanisms resulting in nerve injury are laceration, compression, and stretching. The mechanism in this case which led to BPI was most probably stretching of the nerves as well as diabetes mellitus that interfered with nutrient supply to the nerve. The position of the arm (abduction to over 90 degrees and extension) has a certain effect on the brachial plexus tension (8).

The right arm was in the abduction position with some degree of extension. During the operation, it maintained a 90-degree abduction, which took 2:30 hours. In this circumstance, the plexus was under maximum tension.

Injuries interfering with the nutrient supply result in nerve damage and can be due to mechanical (nerve entrapment), ischemic (compression), or metabolic (diabetes) mechanisms. They may be subtle and undetectable. Nonetheless, the combination of prolonged operation time and continuous stretching of the upper limb can result in considerable nerve damage and serious symptoms clinically (9). An early nerve pressure palsy the commonest position-related injury can occur in an unconscious patient under general anesthesia. The reported case received general anesthesia and the surgery lasted for 2:30 hours. Her arms remained in the abduction position during surgery. The risk-mentioned factors can cause injury to the arms in the hyper-abducted position due to the brachial plexus compression on both sides (10).

It is recommended to conduct an overall assessment of the patient before the surgery, to identify any predisposing factors to allow immediate precautionary actions if needed.

Brachial plexus nerve injury may occur in certain conditions despite conventionally accepted positioning and padding (3, 11). Clinical examination, EMG, axon reflex testing, and electro-diagnostic studies are the bases for the diagnosis of brachial plexus nerve injuries. During the perioperative period, changes in nerve function can be detected by electro-diagnostic studies; however, there is a need for prospective large trials to demonstrate the significance of electro-diagnostic investigations in the early prevention and diagnosis of brachial plexus neuropathy (12). The disability of wrist flexion was obvious in the first few days of this study; however, 2 days later, EMG showed no abnormal findings. During flexion of the right wrist, the symptoms persisted for a period of 2 months; nevertheless, fully disappeared following conservative treatment. The brachial plexus neuropathies overall prognosis is commonly satisfactory, but a long recovery period (up to a year) with residual symptoms sometimes pursue. It seems that, even with optimal anesthetic and surgical methods, brachial plexus neuropathies are unavoidable (3). The frequency of brachial plexus neuropathies may be reduced by the following factors:

- In supine patients, arm abduction is needed to be confined to < 90 degrees with the hand and forearm to be

Table 1. Summary of Neurological Results of the Right Upper Limb

Anatomical Location and Function	Muscle Strength (Grade)	
	First Postoperation Day	After Rehabilitation
Motor function		
Shoulder abduction (n axillaris)	4	5
Elbow flexion (n musculocutaneous)	3	5
Elbow extension (n radialis)	4	5
Wrist flexion (n medianus)	2	5
Wrist extension (n radialis)	3	5
Finger flexion (n ulnaris)	4	5
Finger extension (n radialis)	3	5
Sensory function		
Pain and light touch	Reduced	Normal
Reflexes		
Deep tendon reflexes	Reduced	Normal
Tone	Reduced	Normal

kept in full supination;

- Arm abduction linked to head rotation to the contralateral side should be prevented;

- The risk of neuropathy may be reduced by padded arm boards;

- Every patient should have a postoperative neurologic assessment to allow early detection and treatment of nerve lesions (1, 6, 9).

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Footnotes

Authors' Contribution: HAF, study concept and design; SKh, original methodologist/researcher; FB, NA, research designer; ASM, critical revision of the manuscript for scientific and factual content; AT, research consulter.

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