



Early Physical Therapy Management of a Patient with Diaphragmatic Eventration Following Diaphragmatic Plication: A Case Report

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Abstract

Diaphragmatic plication is the recommended surgical procedure for the treatment of diaphragmatic eventration in those who have failed conservative care. The present case report describes a 63-year-old male patient who presented with breathlessness on exertional activities. Chest X-ray and Computed Tomography (CT) of the thorax revealed diaphragmatic eventration on the right side. After failed conservative management, the patient underwent diaphragmatic plication surgery and was followed up with postoperative physical therapy management. Physical therapy intervention was started from 3 days postsurgery and was continued for 1 week. The treatment goals focused on reducing breathlessness, reducing pain on the incision site, preventing postoperative complications, and improving functional capacity. The present study highlights the benefits of early physical therapy interventions including incentive spirometer, dyspnea relieving techniques, Transcutaneous Electrical Nerve Stimulation (TENS), and light- to moderate-intensity aerobic exercises in the patient after plication surgery.

Keywords

- ▶ diaphragmatic eventration
- ▶ diaphragmatic plication
- ▶ physical therapy
- ▶ rehabilitation

Introduction

Diaphragmatic eventration can be defined as an abnormal elevation of a portion or the entire hemidiaphragm due to lack of muscle or nerve dysfunction while maintaining its continuity.^{1,2} The eventration can be congenital or acquired. A portion of the diaphragm is weakened, resulting in cephalic displacement in the affected side that leads to diminished lung expansion that results in symptoms like dyspnea on exertion, orthopnea, tachypnea, shallow breathing, and respiratory distress.^{1,2} Diaphragmatic plication is the surgical procedure that is recommended for the treatment of diaphragmatic eventration for those who have failed conservative management.³ The surgery involves repositioning and/or reshaping the elevated portion of the hemidiaphragm or the entire hemidiaphragm that allows for greater expan-

sion of lungs resulting in improvement in pulmonary functions, symptoms, and quality of life.^{3,4} However, the surgery can also be associated with postoperative complications that affect a patient's functional capacity, increased hospital length of stay, and overall health care costs.^{4,5} Thus, this study aims at determining the potential benefits of early physical therapy interventions in a patient following diaphragmatic plication.

Case Presentation

A 63-year-old male patient was referred to the department of physiotherapy by cardiothoracic and vascular surgery unit on postoperative day 3 (POD 3). The patient had a chief complaint of difficulty in breathing while walking for a long distance and climbing stairs. Also, he had pain in the surgical

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incision site, which was continuous, sharp, burning, and aggravated on coughing and during bed mobility. The patient's history revealed that he first reported breathlessness 4 months ago on activities such as walking uphill and ascending and descending stairs, which was relieved by rest. After a week, he visited a nearby hospital where chest X-ray was taken, which showed elevation of the right diaphragm muscle. He was first treated conservatively with medications, which continued for 4 months. During this whole 4 months, his symptoms did not improve, so he visited another hospital for further investigations and management. On investigations, chest X-ray and computed tomography (CT) of the thorax showed diaphragmatic eventration on the right side. The patient underwent diaphragmatic plication surgery via the posterolateral thoracotomy approach for the same. Postoperatively, he was kept in the cardiac care unit (CCU) for observation. His vitals were stable and oxygen saturation was maintained at 99% at 5 L of oxygen on face mask. He returned to the ward the following day and was subsequently weaned off from the face mask the very next day. The physical therapy assessment and management were started from POD 3. On POD 3, he had breathlessness of grade 3 out of 10 on the modified Borg dyspnea scale. It aggravated while walking for a long distance and climbing stairs. He had a history of COVID-19 infection 1.5 years back, which was managed with medication. He has a history of systemic hypertension and dyslipidemia for the last 11 years, which is being controlled successfully with medications.

Clinical Findings

On observation, the patient was well oriented and followed all the verbal instructions consistently. There were no signs of respiratory distress and no usage of accessory muscles was noted. The chest findings revealed an abdominothoracic breathing pattern. Thoracotomy incision was present on the posterolateral side of the right thorax. On examination, the thoracic expansion was symmetrical on both sides on the axillary level. However, thoracic expansion was reduced on the

Table 1 Chest expansion using inch tape measurement (Pretreatment and Posttreatment)

Level	Pretreatment difference (cm)	Posttreatment difference (cm)
Axillary	2.5	3
Nipple	2	3.5
Xiphoid	1.5	3.5

right side on the nipple and xiphoid levels. Chest expansion using inch tape measurement showed decreased chest expansion on the axillary, nipple, and xiphoid levels pretreatment (►Table 1). On lung auscultation, normal vesicular breath sound was heard. There was reduced air entry on the right middle and lower lung field, and no added sound was noted. The first heart sound (S1) and the second heart sound (S2) were heard on cardiac auscultation. General musculoskeletal examination revealed full range of motion and grade 5/5 muscle strength using the Medical Research Council (MRC) scale on bilateral upper and lower extremities. On investigations, coronary angiogram showed normal epicardial coronaries and mild left anterior descending (LAD) artery bridging. CT of the thorax revealed elevated right hemidiaphragm with subsegmental atelectasis noted in the right middle and lower basal segment. ►Fig. 1 shows chest X-ray before and after the plication surgery. Pulmonary function testing revealed moderate restrictive disorder with an forced expiratory volume (FEV1)/forced vital capacity (FVC) ratio of 75.57%.

Physical Therapy Interventions

The main goal of physical therapy was to reduce breathlessness during activities, reduce pain on the incision site during coughing and movement, prevent postoperative complications, and to improve functional capacity and cardiorespiratory fitness. The patient started physical therapy treatment on POD 3 and continued until hospital discharge (1 week). The

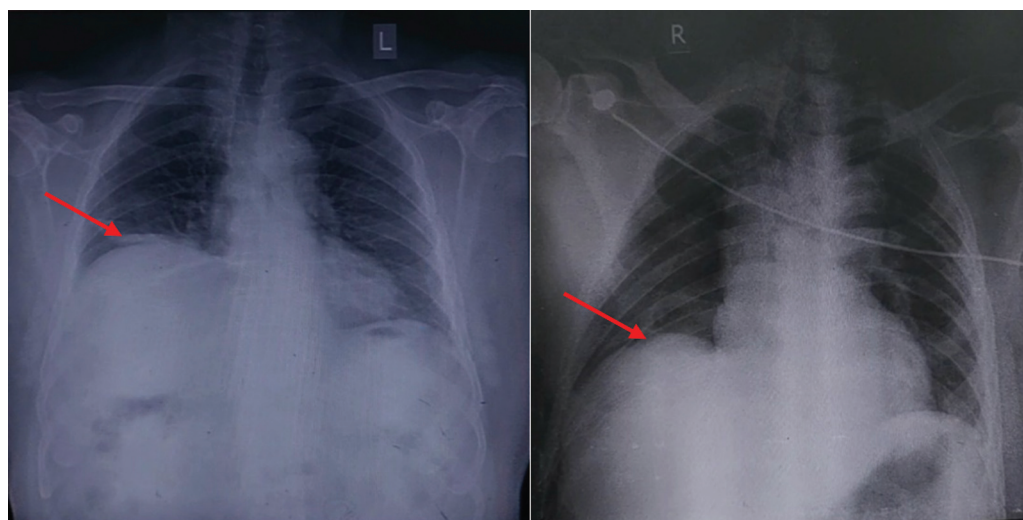


Fig. 1 Arrow marks indicate the position of diaphragm before and after surgery.

Table 2 Outcome measures

Parameters	Pretreatment	Posttreatment	Decrease (%)	Increase (%)
Modified Borg dyspnea scale	Grade 4	Grade 1	90	
NPRS	On rest: 4/10 On activity: 8/10	On rest: 2/10 On activity: 4/10	50 50	
6-minute walk test	Distance covered: 510 m	Distance covered: 570 m		40
Barthel index	75/100	90/100		30
HADS	Anxiety: 10 Depression: 7	Anxiety: 7 Depression: 7	30	

Abbreviation: HADS, Hospital Anxiety and Depression Scale; NPRS, Numeric Pain Rating Scale.

treatment was a 45- to 60-minute session per day. For reducing breathlessness, the patient was taught pursed lip breathing, dyspnea relieving positions, and pacing technique. The splinted huffing technique was taught to the patient to reduce pain on the incision site while coughing. Transcutaneous electrical nerve stimulation (TENS) with a frequency of 100 Hz, intensity adjusted according to the patient, was given for a duration of 30 minutes for the management of postoperative thoracotomy pain.⁶ The patient was also given incentive spirometer (10 repetitions, 3 sets every 2 hours) and deep breathing exercises. The patient was made to perform active range-of-motion exercises in the lower limbs in the supine position. Bed mobility exercises were taught to the patient progressing from the supine position to the lateral decubitus position to the sitting position. Light- to moderate-intensity aerobic exercises were also prescribed, which included marching on spot, sit-to-stand, ambulation, and stair climbing.⁷ On the first day of treatment, the patient was ambulated around the room with the support of one person without any assistive devices. On the day of discharge, the patient was able to ambulate independently a distance approximately 100 m without exertion. The patient was also able to ascend and descend two flights of stair independently. There was an improvement in the chest expansion as shown in ►Table 1. The outcome measures taken pre and post physical therapy management are shown in ►Table 2. The patient was discharged after 1 week. Home exercise program such as spirometer, relaxation exercises, postural correction exercises, and aerobic exercises along with the general awareness of physical activity were given.

Discussion

Diaphragmatic plication is the preferred surgical intervention for diaphragmatic eventration, especially for those who have failed conservative management. Patients with diaphragmatic eventration usually present with dyspnea on exertion, orthopnea, tachypnea, and shallow breathing, and some may present with significant respiratory distress. The main goal of diaphragmatic plication surgery is to flatten the dome of the diaphragm, providing the lungs with greater volume for expansion by reducing compression on lung parenchyma. This surgery has been shown to improve pulmonary functions, symptoms, and quality of life in patients with diaphragmatic eventration.^{3,4} However, plication sur-

gery can also be associated with postoperative complications such as pleural effusion, empyema, pneumonia, deep vein thrombosis, atelectasis, and thoracotomy pain.⁵ Therefore, early physical therapy management after the plication surgery can help prevent these postoperative complications.

However, there are limited number of studies that have investigated the effect of early physical therapy management following the plication surgery on the postoperative outcomes. Hence, this is the first study that have investigated the role of physical therapy following diaphragmatic plication surgery. The present case report suggests that early physical therapy interventions including early mobilization, incentive spirometer, dyspnea-relieving techniques, relaxation exercises, and light- to moderate-intensity aerobic exercises show improvement in patient's symptoms as measured with outcome measures like Numeric Pain Rating Scale (NPRS), modified Borg dyspnea scale, 6-minute walk test (6MWT), Barthel's index, and Hospital Anxiety and Depression Scale (HADS).

Conclusion

Early physical therapy interventions have the potential benefits in reducing breathlessness, reducing pain on the incision site, preventing postoperative complications and improving functional capacity in the patients after diaphragmatic plication surgery.

Funding

None.

Conflict of Interest

None declared.

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