Reconstruction of recurrent diaphragmatic eventration with an elongated polytetrafluoroethylene sheet

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Abstract

We report the case of a 31-year old woman with recurrence of left diaphragmatic eventration 3 years after a previous surgery for this condition. At the initial occurrence, she had experienced dyspnoea on exercise and subsequently underwent laparoscopic plication of the diaphragm with an endo-stapler at a local hospital. Immediately after the operation, the diaphragm was torn and the intestine entered the thorax. Therefore, plication involving sewing was performed. Then, 3 years later, the patient again experienced dyspnoea and was diagnosed as having recurrence of left diaphragmatic eventration. Observation under thoracoscopy revealed that the centre of the left diaphragm was thin but not torn. We reconstructed the left diaphragm with an elongated polytetrafluoroethylene sheet on the naïve diaphragm. The patient was discharged from our hospital 5 days after surgery. Her respiratory function improved and she has not experienced recurrence.

Keywords: Diaphragmatic eventration • Recurrence • Thoracoscopic surgery • Elongated polytetrafluoroethylene sheet • Pulmonary function

INTRODUCTION

Diaphragmatic eventration is not frequently observed, because it is generally oligosymptomatic [1]. However, it is now generally accepted that surgical treatment is indicated in cases with distinct complaints involving abdominal and/or thoracic organs that can be related to this pathological condition [2]. Several methods of surgical repair of diaphragmatic eventration have been reported, but appropriate selection from among these methods for recurrences is difficult. We report a case of surgical repair for the recurrence of diaphragmatic eventration.

CASE REPORT

A 31-year old woman without any significant medical history had experienced dyspnoea on exercise that had led to the diagnosis of a left-side diaphragmatic eventration 3 years previously. She underwent laparoscopic plication of the diaphragm at a local hospital. In the surgery, the whole layer of the thin and flaccid part of the diaphragm was resected using four times the stapling to be tense to palpation through four abdominal ports. Immediately after the operation, the left diaphragm tore and the intestines moved into the thorax. Direct suture of the torn diaphragm with

2-0 Vicryl (polyglactin suture, Ethicon Inc., USA) was then performed through a right subcostal abdominal incision. Three years after that surgery, dyspnoea returned, and she was diagnosed with recurrence of left diaphragmatic eventration at our hospital. Chest X-ray and computed tomography showed a mediastinal shift to the right side in the expiratory phase (Fig. 1A–C). Results of respiratory function tests indicated impairment: forced vital capacity (FVC) 2.78 l (91.5%) and forced expiratory volume in 1 s (FEV₁) 2.31 l (85.4%). Before surgery, we decided on the materials that we would use for reconstruction if the diaphragm tore under thoracoscopy and the intestine invaded the thorax. Depending on the situation, we planned to use either a latissimus dorsi muscle flap or an elongated polytetrafluoroethylene (ePTFE) sheet (Gore-Tex®, W.L. Gore & Associates, Inc., USA). The patient was placed in the right lateral position and kept slightly head-up to decrease the abdominal pressure on the diaphragm. A 12-mm port was placed in the 5th intercostal space on the anterior axillary line and the 8th intercostal space opened. Observation under videothoracoscopy revealed that the centre of the left diaphragm was thin but not broken (Fig. 2A). We then made a 10-cm lateral thoracotomy through the 8th intercostal space and attached the ePTFE sheet to cover the naïve diaphragm and sutured the edges of ePTFE sheet to the posterior part of the 10th rib, mediastinum, cardiophrenic angle and anterior chest wall using 2-0 Nylon

Figure 1: Chest X-ray (A and B) and chest computed tomography (C) before surgery. In the inspiratory phase, left diaphragmatic relaxation was severe (A and C) and left lung volume did not decrease. In the expiratory phase, the left diaphragm did not move, but instead the entire diaphragm shifted to the right side (B) restricting movement of the right lung.

(polyamide suture, Nichi-In Bio Sciences Pvt. Ltd., India and Japan) with proper tension, so that the tip of the diaphragm was positioned approximately 5 cm caudally and the mediastinum did not shift to the right side in the expiratory phase (Fig. 2B). The postoperative course was uneventful, and the chest drain was removed on postoperative day 2. The patient's respiratory symptoms improved, and she was discharged from our hospital on postoperative day 5. Chest X-ray showed no mediastinal shift in the expiratory phase 1 month later. Respiratory function improved in 2 months [FEV₁ 3.19 l (105.6%), FEV₁ 3.09 l (104.7%)]. She has not experienced recurrence of diaphragmatic eventration 6 months after surgery.

DISCUSSION

Diaphragmatic eventration does not require treatment if asymptomatic. However, therapy is indicated if accompanied by symptoms such as dyspnoea, recurrent pneumonia, chronic bronchitis, chest pain, poor exercise tolerance, cardiac arrhythmias or functional disorders of the stomach [2]. Diaphragmatic weakness causes a decrease in ventilation and oxygenation because of the paradoxical motion of the affected diaphragm during inspiration and expiration [2, 3]. Several methods of surgical repair of diaphragmatic eventration, such as direct suturing of the diaphragm by sewing or use of an endo-stapler and reconstruction with artificial sheets or the patient's own muscle, were reported [2, 4, 5]. In our case, the failure of the previous operation with a stapling device and recurrence of diaphragmatic eventration after the second operation may have been due to too much strain to the thin diaphragm. The recurrence of diaphragmatic eventration was accompanied by dyspnoea; therefore, we decided on surgical repair. Her naïve diaphragm was markedly thin and not suitable for direct suturing. If the intestine had entered the thorax, we would not have used an ePTFE sheet, but a latissimus dorsi muscle to avoid adhesion between the intestine and the ePTFE sheet and to avoid bacterial infection of the artificial sheet in the thorax once the intestine entered. Fortunately, in our case, the diaphragm was not torn and we could use the ePTFE sheet. Chest X-ray before surgery showed that the mediastinum shifted to the right side in the expiratory phase, and ventilation of the right lung was restricted. Reconstruction with the ePTFE sheet was successfully performed, with the left reconstructed diaphragm being properly repaired, and mediastinal shift was avoided. This brought about improvement in respiratory function.

In summary, we experienced a case of re-relaxation of the diaphragm, which had been plicated 3 years before. We successfully reconstructed the diaphragm by placing the ePTFE sheet over the naïve diaphragm with tension. There has been no recurrence 6 months after surgery.

Conflict of interest: none declared.

Figure 2: Intraoperative findings (A and B) and chest X-ray after surgery (C and D). Elevation and thin area (arrows) of the diaphragm is shown, but no torn area appears in the diaphragm before repair (A). Attachment of the ePTFE sheet and cardiophrenic area by 2-0 Nylon (B). Chest X-ray 1 month after surgery during the inspiratory phase (C) and expiratory phase (D). There is marked improvement in left lung expansion and normalization of the position of the left diaphragm and mediastinum. H: heart; D: diaphragm; i.c.: intercostal; L: lung.

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