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Unilateral Diaphragmatic Paralysis, A Rare Complication of Laparoscopic Resection of an Ovary Cyst: A Case Report

Shadi Moloughi[1], Seyedeh Azam Pourhoseini[1], Mona Jafari[1], Amin Dalili[2*]

1. *Department of Obstetrics and Gynecology, Minimally Invasive Gynecologic Surgery, Imam Reza Hospital, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran*
2. *Surgical Oncology Research Center, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran*

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Corresponding Information:
Amin Dalili,
Surgical Oncology Research Center, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

Email: Daliliam@mums.ac.ir

ABSTRACT

Unilateral diaphragmatic paralysis can happen after different thoracic surgeries; however, the development of this disorder after laparoscopy surgery is a very uncommon problem. We reported a case of unilateral diaphragmatic paralysis in a young female, who underwent laparoscopic resection of an ovary cyst. She presented respiratory distress during anesthesia recovery and thus was intubated. Chest X-ray showed an elevated right hemidiaphragm with no evidence of pneumothorax or other pulmonary problems. She experienced full recovery from the paralysis with no specific intervention, four days after surgery and was discharged in good condition. In conclusion, a rare complication of the laparoscopy surgery is unilateral paralysis of the diaphragm muscle. It seems that this condition may resolve spontaneously or may need further supportive treatments. Our case was a young woman who experienced this improvement after a short period; however, some may need surgical plication and phrenic nerve pacing. Still, there may be some cases that accommodate the condition and need no treatment.

Keywords: Diaphragm Paralysis, Laparoscopic Surgery, Ovarian Cyst, Postoperative Complication, Case Report

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1. Introduction

Since the first proposal of laparoscopic surgery in 1901 by Georg Kelling, many tendencies have been developed toward the development and use of this non-invasive method of surgery (1). The surgery is used in many abdominal and pelvic interventions like polyp, stone, fibroid, and cyst removal, tumor removal, tubal ligation, urethral and vaginal reconstruction surgery, ectopic pregnancy removal, and endometriosis surgery (2-4).

Many benefits have been addressed for this type of surgery. This type of operation needs no large incisions, lowers hospital stay time, reduces postoperative pain, needs less analgesic sedation, and prevents massive blood losses (5). However, the complications of laparoscopic intervention have not been fully addressed. Some of these complications include perforation of internal organs like the gastrointestinal tract and bladder, extraction or port-site hernia, surgical site infection, and nerve injuries (6). Rare complications have also been addressed such as biliary granulomas, spontaneous pneumothorax, or diaphragmatic paralysis (7). Most of diaphragmatic paralysis cases are usually seen after thoracic surgeries. Although extremely rare, diaphragm paralysis can occur during laparoscopic surgery due to nerve stretching from pneumoperitoneum, causing transient neuropraxia (8). Here, we report a female case who underwent unilateral diaphragmatic paralysis after laparoscopic resection of the endometrioma cyst.

2. Case Presentation

A forty-year-old female, gravida 2 and live 2, was referred to the gynecology clinic with abdominal pain, severe dysmenorrhea, and dyspareunia. She reported a previous hospitalization period due to severe pelvic pains, with no significant medical intervention, six months before this admission. Social and familial

history had no notable findings, and medical history comprised only analgesics. Furthermore, she had no previous surgical history. In the physical examination, vital signs were within normal ranges. She had a pulse rate of 96 beats per minute, a respiratory rate of 18 per minute, a blood pressure of 110/75 mmHg, and an O_2 saturation of 95%. Routine physical exams were normal, except for abdominal tenderness in the right lower quadrant. The vaginal examination also had no considerable findings.

The patient underwent abdominal and pelvic sonography for a diagnostic clue. Ultrasound revealed three adjacent cystic lesions in the right ovary, suspicious of endometrioma. Thus, the patient was planned to have a diagnostic and curative laparoscopy in lithotomy position with an insufflation pressure of 15 mmHg. During the exploration, an endometrioma cyst was evident in the right ovary. Moreover, the ovaries showed a kissing sign. The surgery was performed in two hours. A right salpingo-oophorectomy was conducted, and the patient was planned for anesthesia recovery. The surgery proceeded without any unusual events. During the recovery, the patient had low Spo_2 after extubation, as low as 85 percent. The other vital signs were as follows: a heart rate of 90, a respiratory rate of 22, temperature of 36.8°C, and a blood pressure of 125/85 mmHg. The O_2 saturation did not change to normal values even after one hour of mask ventilation. Lung auscultation revealed decreased sounds in the right lung. Therefore, she was admitted to the intensive care unit (ICU). Mechanical ventilation and initial assessment including monitoring vital signs, arterial blood gases, and conducting imaging studies such as chest X-rays (CXR) and ultrasound were done. An elevated hemidiaphragm view was found in the CXR (Figure 1). A suspicion of pneumothorax was raised; however, the patient had normal oxygen saturation during surgery. With this regard, a watchful observation was done for the patient. Additionally, the patient received pain management and respiratory physiotherapy. The respiratory distress faded on the second day of admission to the ICU and thus was extubated. However, she received oxygen through a nasal cannula. On the third day, the patient's vital signs were stable, and she was transferred to the normal ward. A control CXR was done for the patient, which showed improved diaphragm condition (Figure 2). Finally, she was discharged in good condition with no complications on the fourth day.

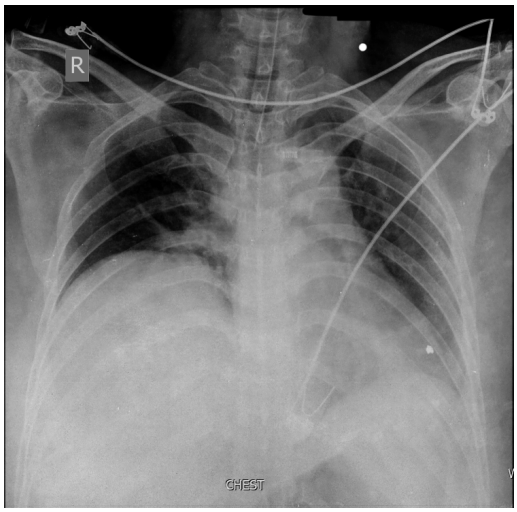


Figure 1. elevated hemidiaphragm view was seen in the CXR

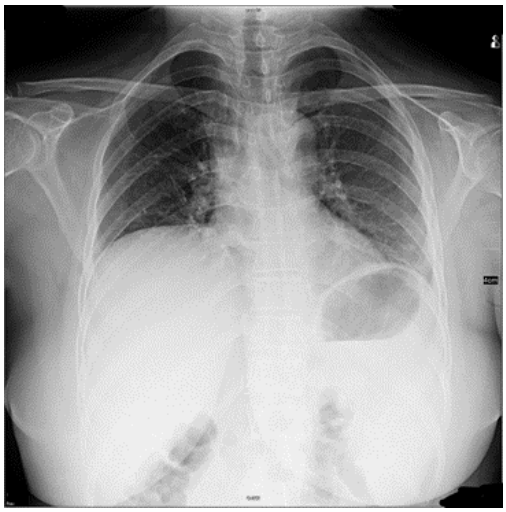


Figure 2. A control CXR was done for the patient which showed improved diaphragm condition.

3. Discussion

Given the patient's clinical presentation, several differential diagnoses should be considered, including atelectasis, pneumothorax, pulmonary embolism, diaphragm paralysis, and postoperative pneumonia. However, based on the specific signs and symptoms, particularly the elevated diaphragm observed on the CXR, diaphragm paralysis was determined to be the most likely diagnosis in this patient.

Diaphragm is a key muscle that helps with normal inspiration. In this regard, paresis or paralysis of the diaphragm can result in respiratory failure. The condition can be bilateral or unilateral; however, most of the cases are unilateral, and rarely bilateral paralysis happens. Unilateral paralysis barely causes respiratory dysfunction and usually manifests itself in rigorous activities or cases with parenchymal or functional diseases of the lung **(9, 10)**. Diaphragm paralysis can occur due to a variety of causes, including traumatic, compression, inflammatory, neuropathic, iatrogenic, and idiopathic. The iatrogenic cases may be due to the nerve block, and the local spread of the anesthesia drug may cause the phrenic nerve block. Moreover, it may happen due to the trauma during surgery. Most of the diaphragmatic paralysis cases that happen due to trauma occur in open-heart surgery, especially during

the cooling process. Other thoracic surgeries may cause this problem, too **(11)**. However, in an extremely rare manner, the condition may happen during laparoscopy surgery. In patients undergoing laparoscopic abdominal surgery, the stretching that occurs during pneumoperitoneum appears to be the cause of transient nerve neuropraxia **(8)**. Hence, several strategies can be implemented to mitigate the risk of postoperative diaphragm paralysis: 1) Minimize dissection and manipulation near the diaphragm and phrenic nerve, 2) Monitor insufflation pressures meticulously, avoiding abdominal overdistension, 3) Strive to complete the surgery promptly to limit nerve exposure to potential risks, 4) Ensure precise performance of regional blocks to prevent inadvertent spread of anesthesia to the phrenic nerve, 5) Vigilantly monitor respiratory function in the immediate postoperative phase to promptly identify any signs of diaphragm dysfunction.

To our best knowledge, there was only one case in the literature in which diaphragmatic paralysis happened after laparoscopic surgery. Castillo et al **(7)** reported an 82-year-old man with cholecystitis gangrenous, who underwent a 90 minutes laparoscopy and 12 hours after the surgery, presented respiratory distress along with low blood oxygen saturation of 85 percent. The patient was admitted to the critical care unit and supportive treatments including intubation were conducted. The arterial blood gas analysis showed acute hypercapnic respiratory failure, and the chest radiograph showed volume loss in the right hemithorax, with no pneumothorax or clear consolidations. They reported during the disease, the patient's condition became better, and thus they extubated him; however, another reintubation was needed as his respiratory condition got worse. Several workups were conducted that ruled out myelopathies and demyelinating disorders. Finally, electromyography showed the right phrenic paralysis. The patient was intubated for one month and thus thoracostomy was done. The authors reported that six months after thoracostomy, the patient experienced normal respiratory function **(7)**.

Our case was self-limiting in nature and only a CXR yielded to diagnosis and there was no time for complementary assessments. It seems that the amount of damage posed to the phrenic nerve is important in the case of the natural history of the disease. Paresis of the nerve may be self-healing, and the patient can achieve normal function; however, complete paralysis may result in long-term respiratory failure. Moreover, our case study was younger and the regeneration of the tissue is better in younger cases **(12)**. In a normal, healthy living body, unilateral diaphragmatic paralysis may be asymptomatic. However, stress-posing procedures like surgery can make the patient symptomatic **(13)**. CXR is the first modality used for the diagnosis that has high sensitivity but low specificity. The confirmatory test is a fluoroscopic assessment, named the Sniff test. Unilateral diaphragmatic paralysis cases show no movement or paradoxical movement in paralyzed sections that are positive in 90 percent. Other tests including electromyography, pulmonary function test, trans diaphragmatic pressure measurements, thoracic ultrasound, CT scan, and MRI may also be used **(12)**.

The treatment of the condition is controversial. It is reported that the main part is watch and wait. Many cases may be accommodated with the condition and in some cases, the function of the phrenic nerve may return **(14)**. It is important to provide ventilatory support. If the patient receives no improvement, even after a period of six months, other treatment options should be considered. These include surgical plication and phrenic nerve pacing **(14, 15)**.

4. Conclusion

A rare complication of laparoscopy surgery is unilateral paralysis of the diaphragm muscle. It seems that this condition may resolve spontaneously or may need further supportive treatments. Furthermore, to mitigate the risk of postoperative diaphragm paralysis, various strategies can be employed. These include minimizing nerve manipulation, close monitoring insufflation pressures, promptly completing surgery, administering precise regional blocks, and closely monitoring respiratory function postoperatively.

5. Declarations

Acknowledgments

None.

Ethical Considerations

Our study is conducted based on Helsinki Declaration.

Authors' Contributions

All author have been involved in drafting the manuscript. All authors read and approved the final manuscript.

Conflict of Interest

The authors declare no conflict of interest.

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Patient consent statement

Informed consent was obtained from the patient.

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