



Case report

Chylothorax after spinal fusion surgery: A case report and literature review

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ABSTRACT

Chylothorax is reported as a postoperative complication, mainly in the field of thoracic surgery, but there are only 14 reports in the field of spinal surgery.

A 64-year-old woman underwent spinal fusion surgery by the anterior and posterior approach for her scoliosis. She developed leg edema and right pleural effusion 2 months after the surgery. Laboratory findings showed decreased total protein and albumin levels in serum. The color of the thoracentesis sample was pinkish white, and the Triglyceride level in the pleural effusion was high. So, her leg edema was found to be associated with malnutrition and the pleural effusion was caused by chylothorax. The point of leakage from the lymph duct was confirmed in the right thoracic cavity of the slice that corresponded to that with the screw at Th11 by lymphatic scintigraphy. Her symptoms did not improve by diet restriction and lipidol lymphography, but her pleural effusion and albumin levels improved by the administration of octreotide. In the clinical course, serum albumin levels appeared to show an inverse correlation with the amount of pleural effusion, so it was thought that her serum albumin level decreased owing to leakage of protein, including albumin, into the thoracic cavity via the injured thoracic duct.

We concluded that the chylothorax was owing to complications of the surgery. Although reports of chylothorax occurring as a complication of spinal fusion surgery are rare, when prolonged hypoalbuminemia or unilateral pleural effusion is observed, chylothorax should be considered as a differential diagnosis.

1. Introduction

Chylothorax is defined as a state in which the chyle leaking out from the thoracic duct is stored in the thoracic cavity, and it is classified as congenital, traumatic, or atraumatic, but it is often difficult to identify the cause. Furthermore, chylothorax is classified into exudative chylothorax and transudative chylothorax, depending on its nature [1]. Most patients have exudative chylothorax, which is mainly caused by damage to the thoracic duct as a result of surgery or trauma, but about 10% of the patients have transudative chylothorax, which is caused by liver cirrhosis, nephrotic syndrome, or congestive heart failure owing to an increase in the thoracic pressure resulting from an increase in venous pressure [2–4]. As a treatment, chest drainage and dietary fat restriction are first performed, and if the chylothorax does not improve, octreotide treatment is performed. Furthermore, if the site of the lesion is obvious, catheter embolization and surgical ligation are considered. Chylothorax is reported as a postoperative complication, mainly in the field of thoracic surgery, and reports in the field of spinal surgery are very rare. As we encountered a patient who developed chylothorax

after spinal fusion surgery, we here report this case together with a literature review.

2. Case report

A 64-year-old woman underwent oblique lateral interbody fusion for L1/2 to L4/5 for the treatment of scoliosis in September 20XX. Two weeks after the first operation, she underwent pedicle screw placement for Th8 to S2 and posterior lumbar interbody fusion for L3 to L5 (Fig. 1). From 2 months after the surgery, she noticed bilateral leg edema, which worsened gradually. She was hence treated with diuretics at another hospital, but the leg edema did not improve. Subsequently, a chest X-ray showed that she had right pleural effusion, and she was referred to our department. On physical examination at the time of admission, decreased right lung respiratory sounds and bilateral pitting leg edema were observed. Laboratory findings showed decreased total protein (TP) (4.7 g/dL) and albumin (Alb) (2.1 g/dL) levels, but no other abnormalities were observed (Table 1). Chest X-ray and computed tomography (CT) showed only right pleural effusion, and lung

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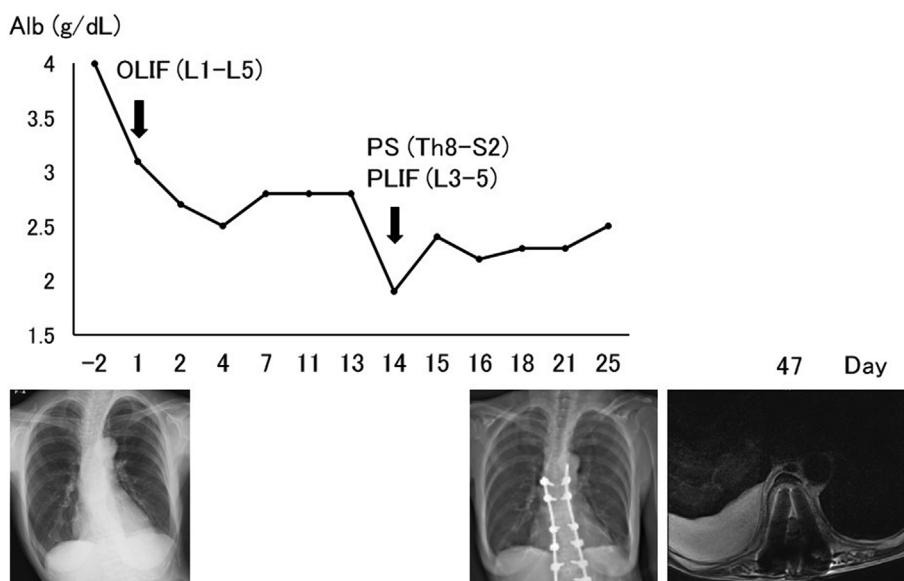


Fig. 1. Perioperative course of the patient. Spinal surgery was performed in 2 stages; on day 1 and day 14 of hospitalization, and postoperative albumin levels showed a transient decrease on both operation days. X-ray on day 24 (to assess bone condition) showed blunting of the costophrenic angle, which was not seen before surgery. Right pleural effusion was showed on magnetic resonance imaging on day 46 of hospitalization. OLIF: oblique lateral interbody fusion PS: pedicle screw PLIF: posterior lumbar interbody fusion.

Table 1
Laboratory data on admission.

Hematology		Biochemistry			Pleural effusion		
WBC	6200 / μ L	TP	4.7 g/dL	pH	7.8		
Neu	76.7 %	Alb	2.1 g/dL	SG	1.011		
Ly	12.8 %	AST	20 U/L	TP	1.2 g/dL		
Eo	5.2 %	ALT	8 U/L	Alb	0.9 g/dL		
RBC	468 $\times 10^4/\mu$ L	TG	62 mg/dL	LD	81 U/L		
Hb	13.5 g/dL	T-Cho	198 mg/dL	T-Cho	< 57.0 mg/dL		
Plt	35.9 $\times 10^4/\mu$ L	LD	213 U/L	TG	852 mg/dL		
RBC	468 $\times 10^4/\mu$ L	BUN	12.2 mg/dL	Glu	103.0 mg/dL		
		Cre	0.45 mg/dL	ADA	5.4 U/L		
		Na	141 mmol/L				
		K	3.8 mmol/L				
		Cl	109 mmol/L				
		CRP	0.08 mg/dL				

parenchyma abnormalities and lymph node enlargement were not observed (Fig. 2). The color of the thoracentesis sample was pinkish white (Fig. 3), and the Triglyceride (TG) level in the pleural effusion was high (852 mg/dL). As the patient's serum TG level (62 mg/dL) and Total cholesterol level (< 57.0 mg/dL) in the pleural effusion both showed lower levels than the TG level in the pleural effusion, the pleural effusion was concluded to be a result of chylothorax. The point of leakage from the lymph duct could not be identified by lymphography, but fluid



Fig. 3. Right thoracentesis solution. The pleural effusion sample was pinkish white.

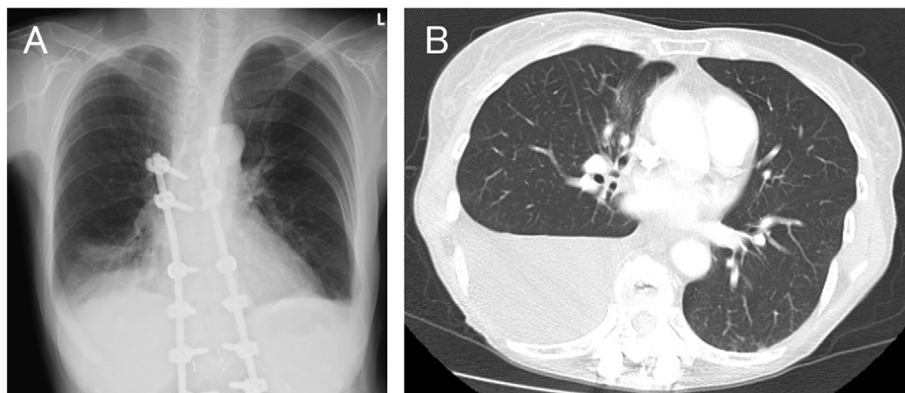


Fig. 2. Chest X-ray at the time of hospitalization. The right costophrenic angle was dull (A). There was no lung parenchyma abnormalities or lymph node enlargement, but right pleural effusion was showed on chest CT (B).

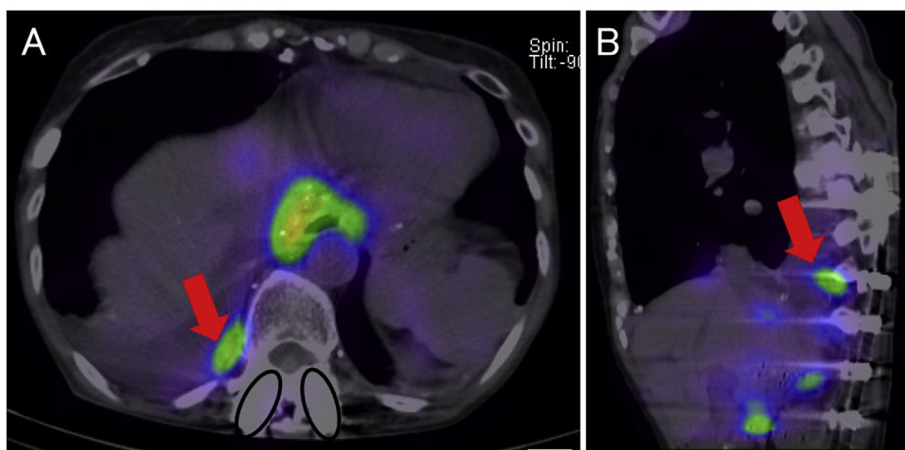


Fig. 4. Lymphatic scintigraphy. A hot spot was identified in the right thoracic cavity near the screw in the Th11 slice (red arrows). Black circles indicate the position of the screw.

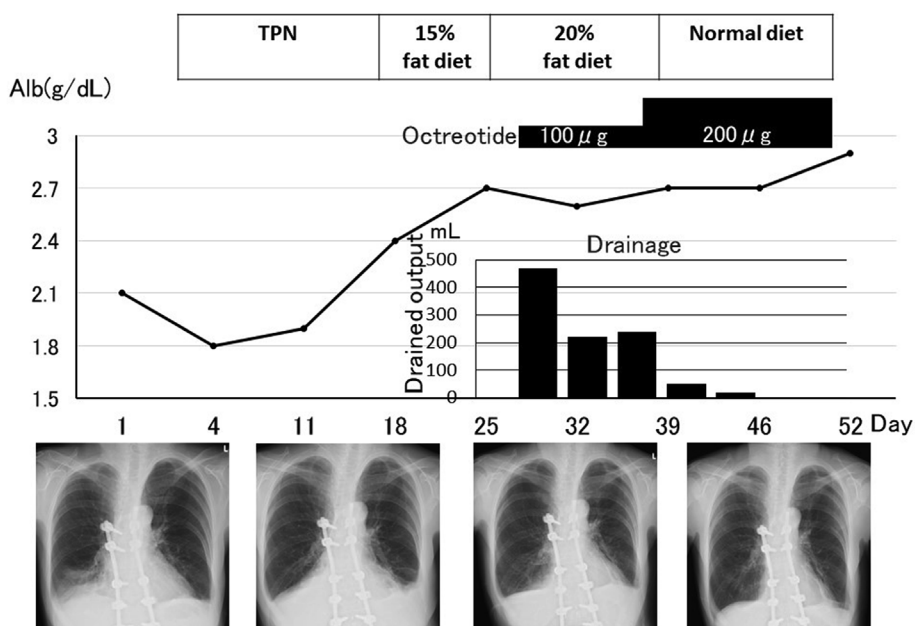


Fig. 5. Patient's clinical course after admission. Albumin levels and the amount of pleural effusion appear to be inversely correlated. Albumin levels and the amount of pleural effusion were improved after starting the fat-restricted diet and octreotide treatment. TPN: total parenteral nutrition.

accumulation was confirmed in the right thoracic cavity of the slice that corresponded to that with the screw at Th11 by lymphatic scintigraphy (Fig. 4); therefore, we considered this to be the point of leakage of the lymph fluid. After hospitalization, she underwent fasting, and total parenteral nutrition management was performed. As a result, chest X-ray showed a decrease in her right pleural effusion, and she was started on a fat-restricted diet (15% of the standard fat intake) and her albumin level and leg edema showed a slight improvement. However, when her diet was changed to a 20% fat-restricted diet, pleural effusion gradually increased again, and hence a chest drain tube was inserted in the thoracic cavity and octreotide treatment (100 µg/day) was started. Subsequently, because the volume of chest drainage did not change, the dose of octreotide was increased to 200 µg/day. The patient's pleural effusion decreased gradually, her albumin level and leg edema improved, and hence her fat restriction was discontinued and the patient was discharged (Fig. 5).

3. Discussion

Chylothorax is defined as a state in which the chyle leaking out from the thoracic duct accumulates in the thoracic cavity. The thoracic duct starts from the cisterna chyli, passes through the aortic hiatus of the diaphragm, and goes up on the right side of the thoracic vertebra. After that, the thoracic duct changes course to the left side near the third and fourth thoracic vertebrae, goes up the dorsal side of the esophagus, opens to the left venous angle where it ends [5]. Damage to the lymph duct in the thoracic cavity leading to the thoracic duct results in chylothorax, so it was considered that the lymph duct in the thoracic cavity was damaged for some reason in this patient.

Chylothorax is mainly known as a postoperative complication of thoracic surgery, and its incidence is 0.7%–2.4% in lung cancer patients undergoing lung lobectomy with lymph node dissection or total lung removal [6,7], and 3.8%–8.8% in esophageal cancer patients [8,9]. When we searched reports of post-spinal surgery complications using the words of chylothorax and fusion in PubMed, we found only 14 reported cases (Table 2) [10–18]. The methods of approach to the spine

Table 2
Reports of chylothorax after spinal fusion surgery.

Case	Age	Sex	Approach	Fusion	Pleural effusion	Treatment	Reference
1	35	M	Ant	Th 9/10-Th 11/12	L	drainage	[10]
2	47	F	Ant	Th 3-Th 12	R	drainage	[11]
3	43	F	Ant	Th 3-L 1	R	drainage	[11]
4	25	M	Ant	Th 7-L 3	R	drainage	[11]
5	17	F	Ant	Th 6-L 1	R	drainage	[11]
6	11	M	Post	Th 3-L 2	R	drainage	[11]
7	40	F	Post	Th 3-L 2	R	drainage	[11]
8	16	F	Post	Th 3-L1	R	drainage, TPN	[12]
9	33	M	Ant	Th 7-Th8, Th 6-Th10	L	drainage, operation	[13]
10	72	F	Ant	Th 6-Th 10	L	drainage	[14]
11	75	M	Ant	Th 12-L 3	L	drainage, TPN, operation	[15]
12	9	M	Ant	Th 12-L3	R	drainage	[16]
13	53	M	Ant	C6–C7	R	drainage, TPN	[17]
14	18	F	Post	Th 3-Th 12	L	drainage, TPN, operation	[18]
Present case	64	F	Post	Th 8-S2, L3-L5	R	drainage, octreotide, TPN	

were 10 cases from the anterior side and 4 cases from the posterior side, and pleural effusion was confirmed in 9 cases in the right side and 5 cases in the left side. Chylothorax appeared to occur more often in the right side with an anterior approach, but also occurred by the posterior approach. Thirteen out of the 14 cases were caused by thoracic spinal fusion, but 1 case developed as a result of lower cervical spinal fusion. In other words, it is important to note that lymphatic vessel damage in the thoracic cavity can occur regardless of the method of approach used in the spinal surgery, and is caused not only by fusion of the thoracic vertebrae but also by lower cervical spinal fusion. Anatomically, it was very interesting that chylothorax on the right side occurred after lower cervical spine surgery, although the thoracic duct was located on the left side at the lower cervical spine level. This suggests that physical invasion, such as vibration and impact accompanying surgery indirectly damaged the lymph duct branching from the thoracic duct to the right thoracic cavity, rather than directly damaging the thoracic duct.

As the nature of the chylothorax in this patient was transudative rather than exudative, it was considered not to be a result of dysfunction of the thoracic duct owing to surgical invasion, but possibly caused by an increase in the internal pressure of the thoracic cavity via some mechanism triggered by surgery. On the other hand, it has been reported that prolonged loss of chyle resulted in secondary hypoalbuminemia in a patient with chylothorax [19]. Even in this patient, when oral intake was resumed, pleural effusion caused by chyle leakage increased, accompanied by a decrease in the serum albumin level (Fig. 5). Chyle is composed of lipids, such as cholesterol and triglycerides, and proteins, such as immunoglobulins [5]. Therefore, we believe that serum albumin levels decrease when proteins including albumin leak into the thoracic cavity owing to thoracic duct injury, and exudative chylothorax can change into transudative chylothorax as a result of secondary dilution of the chylothorax owing to low colloid osmotic pressure.

As for the treatment of chylothorax, spontaneous healing is first anticipated by decreasing the flow rate of the thoracic duct by not ingesting fats. However, if this is not successful, octreotide treatment and surgical thoracic ligation are also considered. In recent years, the efficacy of thoracic embolization using lipiodol has been reported owing to the improvement of catheter technology [20]. Even in this present patient, total parenteral nutrition alone did not improve the symptoms, and lymphography with lipiodol was performed. Although lymphography with lipiodol has been reported to be useful not only for identifying injured areas but also for the treatment of chylothorax by causing inflammation in the injured region, resulting in closure of the fistula [21], the chylothorax of this patient did not improve, so octreotide treatment was performed. Octreotide is a somatostatin-mimetic octapeptide, and since Rimensberger et al. [22] reported the usefulness of somatostatin for the treatment of chylothorax in 1998, there have

been a number of reports on the use of octreotide for the treatment of refractory chylothorax [8,23]. As the underlying mechanism of the therapeutic effects, the fistula may be closed by decreasing the flow rate of the chyle by the following 2 mechanisms. 1) Somatostatin is secreted from the pancreas, stomach, and duodenum, and it exerts inhibitory actions on stomach acid and bile secretion, and thus reduces chyle flow by suppressing the absorption of fat, which is the raw material for chyle [24,25]. 2) Somatostatin acts on somatostatin receptors present in lymphoid tissues [26] and it reduces chyle flow by shrinking lymph vessels [27]. Even in this case, octreotide treatment resulted in the improvement of chylothorax noninvasively, suggesting its usefulness.

4. Conclusion

We encountered a patient with chylothorax after spinal fusion surgery. When prolonged hypoalbuminemia and unilateral pleural effusion after spinal fusion surgery are observed, chylothorax should be considered as a differential diagnosis.

Conflicts of interest

None declared.

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