Editorial Commentary

Postoperative complications of mediastinal cyst resection and their management

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The incidence of complications after resection of mediastinal cysts is not well described in the literature. The incidence of complications after resection of mediastinal cysts reported in few case reports and small case series vary between 2–7% (1-4). Most complications that occur after resection of mediastinal cysts are similar to those that occur after any thoracic procedure (2,3) (*Table 1*,*2*). Sound knowledge of the possible postoperative complications allow the surgical team to anticipate postoperative complications and thus reduce this morbidity.

Postoperative respiratory complications

Postoperative pulmonary complications are reported after resection of mediastinal cysts (4). Following any thoracic surgery, respiratory function is impaired to varying degrees depending on the approach used. With open surgery having much higher incidence of respiratory complications than minimally invasive approaches (4). Respiratory complications after mediastinal cyst resection range from atelectasis, pleural effusion, to pneumonia (3,4,9). Atelectasis is a common postoperative pulmonary complication. If not managed aggressively, atelectasis can develop into pneumonia.

The impact of these respiratory complications is not only clinical but also economical given that they result in longer hospital stay (7,10,11). Risk factors for developing postoperative pulmonary complications following thoracic surgery include age, pulmonary function tests, cardiovascular co morbidity, current smoking and chronic obstructive pulmonary disease (10-12).

Respiratory complications after mediastinal cyst resection can be diminished by optimizing the patients preoperatively, choosing minimally invasive approaches, and focusing on the basics of postoperative care, such as pulmonary physiotherapy, fluid management, and pain control (3,4).

Postoperative bleeding

Another complication, which may happen early after resection of mediastinal cyst is postoperative bleeding (3). Bleeding immediately postoperative can be due to technical complication or coagulopathy. Generally postoperative bleeding is caused by technical complications. Postoperative bleeding usually presents with high chest tube output or hemodynamic instability. As soon as bleeding is suspected, coagulation blood tests should be performed, and coagulopathy rectified accordingly. Given that most postoperative bleeding is caused by technical complications, the surgeon should have a very low threshold to take the patient back to the operating room for re-exploration. To prevent postoperative bleeding whenever a vascularized cyst is anticipated, embolization of afferent vessels has been performed in order to reduce surgical bleeding (12).

Infections

Infectious complications after mediastinal cyst resection are not reported frequently in the literature, since the chest wall has multiple blood supplies (12). The reported incidence

Table 1 Complications of mediastinal cyst resections and their management

Complications	Characteristics	Prevention/management
Postoperative respiratory complications	Atelectasis, pleural effusion, and pneumonia	Optimize patient preoperatively
	Respiratory function is impaired to varying degrees depending on the approach used	Choose minimally invasive approach when possible
		Focus on postoperative care (fluid management, pain management, pulmonary hygiene and chest physiotherapy)
Postoperative bleeding	Postoperative bleeding can be due to surgical bleeding or coagulopathy	Preoperative embolization of afferent vessels → to reduce surgical bleeding complications when a vascularized cyst is anticipated
	Most common due to technical complications	Correct coagulopathy
	Presents with high chest tube output or hemodynamic instability	Low threshold to take back a patient for re-exploration and control of bleeding
Infection	Rare complication since the chest wall has an excellent blood supply and these procedures are considered clean procedures	Preoperative antibiotics prophylaxis
	Incidence in the literature varies from 5% to 24.4%	Postoperative infections should be treated with antibiotics
Cardiac complications	Very common complication after any thoracic surgery	Medical management
	The most common arrhythmia that happens after thoracic surgery is supraventricular tachycardia	
Reperfusion lung injury	Happens after resection of cysts that are compressing the pulmonary artery	Prevent this complication by gradually aspirating cyst before extraction
Chylothorax	Reported as the most common postoperative complication after resection of mediastinal cysts	First line of management of chylothorax → conservative treatment (medium chain triglycerides diet)
	Chylothorax is caused by incomplete ligation of lymphatic channels or direct injury to the thoracic duct during resection of mediastinal cysts	If the chyle leak does not resolve after the use of medium chain triglycerides → total parenteral nutrition should be considered to reduce the chyle flow
		If chylothorax does not respond to the conservative management → reoperation is required
Chylopericardium	Rare complication that happens after mediastinal cyst resection	Management and prevention strategies for chylopericardium are the same as the ones discussed for chylothorax
	Reported to occur when chyle leaks into the pericardial cavity instead of the thoracic cavity because of a previous pleurodesis	
Injuries to structures surrounding mediastinal cyst	Injuries can occur to surrounding structures (esophagus, phrenic nerve, recurrent laryngeal nerve, azygos vein, aorta, and bronchus)	Detailed anatomic knowledge and meticulous dissection helps to prevent these complications
	Injuries to surrounding structures are more common when there are adhesions or in redo surgeries.	
	Injuries to the phrenic nerve → occur when resecting an anterior mediastinal cyst	
	Injury to the vagus nerve	
	Injury to the recurrent laryngeal nerve → occur when resecting an anterior mediastinal cyst	

Table 1 (*continued*)

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Complications	Characteristics	Prevention/management
Recurrence	Potential long-term complication	Recurrence is avoided by complete removal of the cyst
	Most recurrence is due to incomplete surgical resection	If a recurrence occurs → it is advised to resect the cyst before the appearance of symptoms
	Recurrence is also more likely to happen when attempting resection of infected cysts, mediastinal lymphangiomas, and multi-loculated cysts and bronchogenic cysts	

The arrows indicate next step.

Table 2 Complications reported after resection of different types of mediastinal cysts

Mediastinal compartments	Cyst types	Locations	Specific reported complications
Anterior mediastinum	Thymic cyst	Anterior mediastinum	Phrenic nerve paralysis and chylothorax (5,6)
Middle mediastinum	Bronchogenic cysts	One third in middle mediastinum (4,7)	Recurrence if cyst not completely excised (3,4,7)
		Two thirds extend to the limits of the posterior portion of the mediastinum (4,7)	
	Esophageal cysts	Most commonly found embedded in the wall of the lower half of the esophagus (8)	Tracheal and esophageal injuries, pseudodiverticulum development, and vagus nerve injury or paralysis (8)
	Pericardial cysts	50–70% located in cardiophrenic angle (9)	Phrenic nerve injury (9,10)
		30–50% in the visceral compartment (9)	
Posterior mediastinum	Neurenteric cyst	Posterior mediastinum	Chylothorax (9,10)

of infectious complications varies from 5% to 24.4% (3,4). These procedures are considered clean procedures, except for resection of some foregut cysts that may have secondary infection (3,4). Antibiotic prophylaxis should be administered preoperatively, and postoperative infections should be treated with antibiotics and drainage if required (4).

Cardiac complications

Arrhythmias are reported after any thoracic surgery (3,4,7,10,13). Risk factors for arrhythmias include: cardiovascular co-morbidities, postural change, anesthetic agents, extensive dissection, intraoperative bleeding, previous thoracic irradiation and age (2,3,14).

Reperfusion lung injury

Reperfusion lung injury can happen after resection of cysts that are compressing the pulmonary artery (7,14). To avoid such a complication, gradual aspiration of the cystic fluid before extraction of the cyst is advised (14).

Chylothorax

Chylothorax is reported as a common postoperative complication after resection of mediastinal cysts (9,10,13). The incidence of chylothorax after mediastinal cyst resection varies in the literature (9,10,13,14). Etiologies of chylothorax include resection of mediastinal cyst with incomplete ligation of lymphatic channels or direct injury to the thoracic duct at the time of the resection (9). Chylothorax causes loss of proteins, vitamins, and fat which leads to metabolic and nutritional deficiencies. A prompt diagnosis is essential to prevent chylothorax complications. The first line of management of chylothorax is conservative treatment (13,14). Conservative treatment involves replacing the lost proteins and fat. In addition to, draining large chylothoraces to ensure that the lung expands completely (9,10). The administration of medium chain triglycerides is recommended for these patients,

because they are absorbed directly into the portal system. If the chyle leak persists after the administration of medium chain triglycerides then total parenteral nutrition should be started to reduce the chyle flow.

If chylothorax does not respond to the conservative management, then, reoperation is required (9,10,13,14). If the thoracic duct is identified during the operation then ligatures or clips can be used to ligate the thoracic duct (9,10). If the thoracic duct is not identified, then mass ligature of the tissues between the aorta and azygos vein at the level of the diaphragmatic hiatus resolves the chylothorax (9,13). In symptomatic high risk patients, embolization of the thoracic duct or endoscopic aspiration with the injection of a sclerosing agent should be considered (9).

To prevent chylothorax after resecting a mediastinal cyst, Mortman et al. advised to ligate both the afferent and efferent limbs of the thoracic duct feeding the cyst (9). Yet, despite ligating the afferent and efferent limbs of the thoracic duct, Mortman et al. reported a chylothorax (9).

Chylopericardium

Chylopericardium can happen after mediastinal cyst resection (9,10). Chylopericardium occurs when chylous fluid accumulates in the pericardial cavity. Chylopericardium is reported to occur when chyle leaks into the pericardial cavity instead of the thoracic cavity because of a previous pleurodesis (10). The management and prevention strategies for chylopericardium are the same as the ones discussed for chylothorax (9,10,13). It is recommended that the pedicles should be ligated in mediastinal cyst resections (10). Additionally, careful intraoperative assessment may help localize any point of chyle leakage (10). Conservative management, including low-fat diet, is the first preference in the initial management of postoperative chylopericardium (9,10,13,14). If no response to conservative treatment after >2 weeks then surgical repair should be considered (10).

Injuries to surrounding structures

While resecting mediastinal cysts, nearby structures are at risk of injury. Injuries can happen to the esophagus, phrenic nerve, recurrent laryngeal nerve, azygos vein, aorta, and bronchus (2,3,7,9-11,14).

Injuries to the phrenic nerve

Injury to the phrenic nerve can occur when resecting an anterior mediastinal cyst. It is more common for injuries to occur in redo surgeries and when there are adhesions (11,13-15). Injuries to the phrenic nerve may result in temporary or permanent diaphragmatic paralysis. This can cause the patient to have shortness of breath on exertion, atelectasis, and decreased exercise tolerance. If the patient is on a ventilator postoperatively, then it might be difficult to wean the patient off the ventilator. Usually, it is initially suspected on a chest X-ray (CXR) that shows elevation of the affected hemi diaphragm. Diagnosis can be confirmed with ultrasound or fluoroscopy. If the patient is symptomatic, or cannot be weaned from the ventilator, then, diaphragmatic plication is the best method for management (11,15).

Injury to the vagus nerve

Injury to a vagus nerve can also occur during resection of mediastinal cysts (10,13,14). Usually, one vagus nerve is injured during resection of mediastinal cysts, and the other intact vagus nerve provides parasympathetic input to the gastrointestinal tract.

Injury to the recurrent laryngeal nerve

Injury to the recurrent laryngeal nerve can occur when resecting an anterior mediastinal cyst (7,13,14). Injuries to the recurrent laryngeal nerve usually presents with a weak, hoarse, and whispery voice postoperatively. Patients would usually complain off their voice getting weaker as the day progresses. Such injuries may cause aspiration due to inability to cough effectively. Laryngoscopy is used to confirm the diagnosis. Treatment depends on whether the injury is temporary or permanent.

Other complications that can happen after mediastinal cyst resection include pulmonary embolism, deep venous thrombosis, renal failure, and strokes (2-4,9,10,13). These complications should be recognized early and aggressively managed.

Recurrence

Recurrence of the mediastinal cyst is a possible long-term complication (3,4,7). It can happen in some cases even as far as 20 years after resection (3,4,7,13). Many case reports attribute their recurrence to incomplete surgical resection (3,4,7). Incomplete resection can happen if the entire mucosal lining of the mediastinal cyst is not completely

resected. Cases in which this is more likely to happen are those in which a part of the cyst is adherent to critical mediastinal structures. It is also more likely to happen when attempting resection of infected cysts, mediastinal lymphangiomas, and multi-loculated cysts (11,15,16). Incomplete cyst resection can also occur in patients with bronchogenic cysts because of severe adhesions between the cyst and the tracheal wall and pulmonary artery (1). In addition, incomplete resection is more likely to happen when video-assisted thoracic surgery (VATS) approach is used because of limited visibility and mobility during the operation, while standard open thoracotomy and the robotic approach do not have this issue.

Recurrence of mediastinal cysts can sometimes precipitate potentially serious vascular and pulmonary complications (3). These should be avoided by complete removal of the cyst. Removal of cyst margins is still, however, controversial (2). If a recurrence occurs, it is advised to resect the cyst before the appearance of symptoms (13).

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