CHYLOUS LEAK FOLLOWING LEFT ANTERIOR SPINE DECOMPRESSION: CASE REPORT

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ABSTRACT

Chylous leakage is an unusual complication following anterior spinal surgery. This leakage can occur as a result of traumatic injury to the thoracic duct, the cisterna chyli, or the retroperitoneal lymphatic vessels. We report a case of a 56 year old female with thoracic spine disc prolapses with cord compression. She had chylous leakage following anterior transthoracic decompression and was managed conservatively. The leakage stopped 6 days postoperatively and subsequent recovery was uneventful.

INTRODUCTION

The anterior (transthoracic) approach to the thoracic spine offers unrivaled exposure of the anterior portions of the vertebral bodies, from T2 to T12. Nevertheless, this approach seldom is used; mainly because of its dangers (1). The approach is effective in the following situations:

(i) Treatment of infections, such as tuberculosis of the thoracic vertebral bodies
(ii) Fusion of the vertebral bodies
(iii) Resection of the vertebral bodies for tumor and reconstruction with bone grafting
(iv) Correction of scoliosis (Dwyer instrumentation technique and rods) and kyphosis
(v) Osteotomy of the spine
(vi) Anterior spinal cord decompression
(vii) Biopsy

A few cases of iatrogenic chylous leakage have been reported following the anterior transthoracic approach to the spine. The leakage often results from direct injury to the lymphatic trunk or cysterna chili. If unrecognized, this can lead to chylothorax. The mortality following unrecognized chylothorax can be as high as 50%.

CASE REPORT

We report a case of a 56 year old lady who presented with progressive back pain and paraparesis of three months onset. She had been admitted three times in the past due to lumbar spondylosis without much improvement at different centres. She was a known hypertensive on amlodipine, neurobin and plasil.

Lumbar spine X-ray done showed severe degenerative disease with oosteophytes and sclerotic vertebra at L4/L5. MRI revealed disc prolapsed at T10 and T11 with cord compression. Similar pathology was noted in the lumbar region. Degenerative changes were in line with X-ray imaging done earlier.

She underwent a left costotransversectomy through the 10th rib and decompression at T10/T11. Intraoperatively, a milky white fluid mixed with blood was noticed. Haemostasis was achieved and meticulous closure of the defect done and an underwater seal drainage done.

Postoperative recovery 1st day was uneventful but a milky white fluid was observed in the underwater seal drain. Total amount of fluid drained on the first day was 500mls. The patient was managed conservatively and progressive reduction in chyle drainage was observed with only 100mls drained on day six. A further 24hour observation showed no more drainage and the chest

tube was removed. The patient was discharged home in good health with much reduction in symptoms (pain and spasms).

DISCUSSION

Chylous leakage is a debilitating condition and has been a challenge for the clinician over centuries. This condition following anterior spinal surgery is rather uncommon but associated with severe morbidity if not diagnosed and treated early (2).

Anatomy of the thoracic duct: The thoracic duct was first described in 1951 by Pecquet (3). It's about 37 to 45cm long and has a triangular dilatation called cisterna chyli formed by the two lumbar lymphatic trunks uniting with the intestinal lymphatic trunk and ends at a junction with the left subclavian vein into which it drains. However only 50% of patients have discrete cisterna chili (4). The vessel transmits intestinal chyle to the bloodstream and drains the lymphatics of the body except the right side of the head and neck, right upper limb, right lung, right side of heart and the convex surface of the liver.

The cisterna chyli forms the thoracic duct and ascends the thorax through the aortic hiatus passing posterior to the median arcuate ligament of the diaphragm between the azygous vein on the right and the aorta on the left. This happens to be the favoured anatomic site for elective ligation of the duct as it is constant here than in the thorax where it exhibits relative variability (5).

The duct crosses over to the left of the vertebral column at the fifth or sixth thoracic vertebra and runs upwards posterior to the aortic arch and anterior to the subclavian artery and exits through the superior thoracic aperture. In the neck, the duct forms an arch anterior to the scalenius anterior muscle at the level of the seventh cervical vertebra by turning laterally and downwards to terminate at the junction of the subclavian vein and the internal jugular vein.

Histologically, the duct has three coats. The external and middle coats formed by elastic and muscle fibres surrounded by areolar tissue and inner coat formed by endothelial and subendothelial plexus of arterioles in a bed of longitudinal elastic fibres. There are numerous valves in the lumen of the duct along its course about eight to ten, 2-3cm apart but more in the neck (6). Retrograde flow of blood and lymph into the thoracic duct at its termination is prevented by the presence of bicuspid valves formed by semilunar fold of endothelium.

Physiology of chyle: The thoracic duct transports about 4 litres of chyle in a healthy adult per day. This varies from 10 to 100ml per kilogram body weight per day depending on diet, drug intake, intestinal function and degree of mobility (5). Flow rate depends on flow from the lacteal system. Propulsion of the duct is effected by contraction of the muscular wall at intervals of 13-14s. Flow may also be increased by compression of cisterna chyli during periods of raised intra-abdominal

Table 1
Features of lymph fluid

Relative density	1.012-1.015
pH	7.4-7.8
Colour	Milky (colourless in starvation)
Sterile	Yes
Bacteriostatic	Yes
Fat (g/l)	5-30*
Protein (g/l)	20-30
Albumin	12-42
Globulin	11-31
Albumin: globulin ratio	3:1
Fibrinogen (mg/l)	160-240
Glucose (mmol/l)	2.7-11.1
Urea (mmol/l)	1.4-3.0
Cell count (per dl)	
Lymphocytest	40 000-680 000
Erythrocytes†	5000-60000
Enzyme concentration (units/ml)	
Pancreatic lipase	0.5-2.4
Amylase	50-83
Aspartate aminotraferase	22-40
Alanine aminotransferase	5-21
Alkaline Phosphatase	2-4.8
Acid Phosphate	0.3-0.8
Electrolyte concentration (mMol/l)	
Sodium	104-108
Potassium	3.8-5.0
Chloride	85-130
Calcium	3.4-6.0
Phosphate	0.8-4.2

Source - *BJS.* 1997; **84**:15-20

*Trigleceride level is greater than in plasma, cholesterol concentration is less than in plasma; cholesterol: triglecide ratio is less than 1; lymph fluid also contains cholesterol esters, free fatty acids, sphingomyelins, phospholipids and neutral fats as chylomicrons as well as fat-soluble vitamins.

† Form 95 per cent of cellular content, 90 per cent as T cells.

pressure like coughing and inspiration. This combined extra luminal pressure gradient enhances transmission and the unidirectional valves prevent backflow. About 95% of transmitted lymph is from gastrointestinal tract and the liver and the rest from skeletal tissue. It contains a mixture of lymphatic and gastrointestinal derived substances like lymphocytes, immunoglobulins, enzymes and products of digestion. The concentration of electrolytes, antibodies and enzymes approximate to that of plasma (5,7).*Why do we worry about chylous leakage?* The effect of leakage depends mainly on the amount, rate and duration of leakage of chyle. There is therefore an asymptomatic period which can pass unnoticed depending on the magnitude of the leak, size of the pleural cavity and the nature of patient management. It is known that the asymptomatic period is prolonged in a fasting patient and usually if straw coloured delaying diagnosis (8).

The effects of this can be said to be local, metabolic and immunologic. Locally the leakage of chyle can lead to a compression effect on the ipsilateral lung and if very copious can lead to a mediasternal shift compromising lung function. Also the continuous loss of chyle can lead to hypovolumia which can be compounded by hypoproteinaemia resulting in fluid resuscitation problems. Other conditions like, acidosis, hyponatraemia and hypocalcaemia are the most recognized metabolic effects (9). Patients would require nutritional support as a result of this condition as well as the increase in metabolic rates from stress of surgery, trauma or most likely sepsis or infection.

Cell mediated immunity as well as humoral response is impaired by prolong chyle loss. This lead the early clinicians involved in organ transplant to resort to drainage of the thoracic duct to induce immunosuppression (10,11). The prolong leak depletes the T-cell population thereby impairing cell mediated immune response. Also hypoalbuminaemia and lymphopenia from chyle loss with impaired antibody response leads to an increase in the risk of bacterial and viral infections (12, 13).

Causes of chylous leakage: The causes are very varied and can be broadly grouped into traumatic and non-traumatic causes of chylothorax (Table 2). Traumatic causes include stab wounds, gunshot injuries, motor vehicle accidents and iatrogenic causes during surgery. Non-traumatic causes also involve primary or secondary malignancy such as lymphoma or metastatic disease which invades or compresses the thoracic duct (14, 15).

Usually in anterior exposure of the thoracolumbar spine, the cisterna chyli in the upper lumbar spine is not conspicuous and is often associated with injury resulting in chyle leakage through the sutured diaphragm into the thoracic cavity producing a chylothorax as it occurred in this case report (16). Chylothorax which can lead to acute or chronic alterations in the pulmonary function occurs in 0.2-1% of cases following cardiothoracic surgery with 69 to 85% of cases occurring in children (17). It is worth noting that chylothorax or leakage is a rare complication in central venous cannulation and where it is associated with subclavian vein thrombosis is usually bilateral and often fatal (18).

Table 2
Causes of chylothorax

Congenital
Atresia of the thoracic duct
Trauma at birth
Trauma
latrogenic
Surgery
Cervical
Thoracic
Abdominal
Therapeutic and diagnostic procedures
Central venous cannulation
Translumbar arteriography
Oesophageal sclerotherapy
Non-iatrogenic
Blunt
Penetrating
Intrinsic
Neoplasm
Venous thrombosis
Pulmonary lymphangiomatosis
Extrinsic
Neoplasm
Lymphoma
Metastatic disease
Lymphadenitis
Infection
Spotaneous

Source - *BJS*. 1997; **84**:15-20

Diagnosis: The diagnosis of chylothorax or leakage is mainly clinical with critical observation of drainage tubes and vital signs of patient either intra-operatively or post-

operative. In this particular case report, the diagnosis was initially made intra-operatively by the observation of chyle in a rather bloody field. More often than not the diagnosis is made once the condition is established or sometimes goes unnoticed if it is subclinical.

The recognition of chyle rather than pus is detected by the presence of an odourless milky white fluid of even consistency which does not clot and does not contain organisms but rather has a high proportion of lymphocytes (19). Clinically the patients may present with dyspnoea, tachypnoea, fever and signs of pleural effusion. Also an observed increase in chest drainage tube collection after a risky operation should be suspicious and recurring pleural fluid collection. Note that diagnosis is difficult in a fasting patient or a post-operative patient as fluid is often straw coloured or blood stained as indicated earlier.

Diagnosis is usually confirmed by the administration of a cream or foodstuff of high fat content by mouth or via nasogastric tube. This induces a change in the colour or the fluid content effused due to the transport of the absorbed fat in the lacteal system and is the most useful test in the clinical setting (17,20).

Management: There is a controversy as to the management of chylous leakage. Some authors advocate conservative management while others advocate for early surgical management (21,22). However most authors agree that both methods of management must be considered in the light of the causes and the nature of the patients condition (29).

Mortality rate was 50% prior to surgical ligation of the thoracic duct and 50% of chylous leakages close spontaneously. However mortality after timely surgical intervention was 10 -16% significantly lower than non-surgical intervention (14, 23).

The principles of conservative management involves progressive, decreasing chyle production, draining the pleural or retroperitoneal space, appropriate fluid and nutritional replacement enterally or parenterally and supportive respiratory care (7). Chyle production can be reduced by as much as 80% through enteral dietary manipulation with medium chain triglycerides (24). Long term effects can lead to deficiency in linoleic acid (13). It is known that approximately 50% of congenital and traumatic cases resolve on such management but it is difficult to tell when this will happen (5).

As in this case primary repair was done peri-operatively but conservative management was instituted as the patient continued to drain chyle. However the progressive reduction in the amount drained daily gave the indication of a possible successful repair so we persisted till the drain was removed and patient discharged home. In literature, Nakai and Zielke (4) encountered six cases of chylothorax when surveying the outcome of 2000 spinal operations and all patients where managed conservatively with complete recovery.

Somatostatin (octreotide) is also used in the conservative management of iaotrogenic chylothorax in children. It is known to reduce gastrointestinal secretions thereby helping to reduce the volume of chyle produced but it used to be used with caution because of potential side effects (25).

For conservative management some authors suggest that if there is no progressive reduction in chylous drainage between 7-10 days then it is better to explore the chest and ligate the thoracic duct than to persist which invites metabolic complications from loss of fat, protein and electrolytes (26).

Operative treatment is recommended when conservative management fails. It involves an open thoracotomy or a thoracoscopic approach to ligate the duct in the upper abdomen or lower thorax where the anatomy is relatively constant between T8 and T12 just above the aortic hiatus by right thoracotomy (27). In situations where the thoracic duct cannot be located, mass ligation of tissues between the aorta and the azygous vein is done (28) as in this case. Also pleurodesis by partial pleurectomy has also been advocated in situations where the duct cannot be identified (13). The use of talc and tetracycline to achieve pleurodesis is also documented in literature. Ligation of the duct can also be done in the poirier's triangle (between internal carotid artery, arch of aorta and vertebral column) if the leakage is in the upper thorax or the neck. The identification of the leak is by the application of a milky cream which appears whitish or the use of methylene blue which demarcates the site for ligation.

Radiotherapy and /or chemotherapy can also be used to relieve obstruction to flow in the thoracic duct from malignancy but success rate is limited (18). As much as conservative management is advocated in relatively mild and uncomplicated cases of chylous leakage, surgery is advocated in the following situations; chyle leakage greater than 1 litre per day for more than 5 days, persistent leakage for more than 2 weeks despite conservative management, presence of nutritional or metabolic complications and loculated chylothorax, fibrin clots or incarcerated lung (29).

CONCLUSION

The mortality and morbidity associated with any form of chylothorax or leakage is quite high and should be treated with a high degree of suspicion with early intervention to subvert untoward effects. It will be useful if clear-cut protocols are put in place by institutions to outline the channel of management of such rare but dreaded complications in surgery to avoid unnecessary delays.

REFERENCES

1. Cook, W.A. Trans-thoracic vertebral surgery. *Ann. Thorac. Surg.* 1971: **12**:54.
2. Wemyss-Holden, S.A., Launois, B. and Madden, G.J. Management of thoracic duct injuries after oesophagectomy. *Br. J. Surg.* 2001: **88**:1422-1445.
3. Rocca-Rosetti, S., Marrocu, F., Cossu, F. *et al.* La lymphographie dans l'etude de la morphophysiologie, de la physiopathologie et de la pathologie du 6systeme de la canal thoraciqueo. *J. Belge. Radiol.* 1965; **48**: 306-322.
4. Nakai S. and Zielke, K. Chylothorax - a rare complication after anterior and posterior spinal correction. Report on six cases. *Spine.* 1986; **11**(8):830-833.
5. Paes, M.L. and Powell, H. Chylothorax: an update. *Br. J. Hosp. Med.* 1994; **51**: 482-490.
6. El-Zawahry, M.D., Sayed, N.M., El-Awady, H.M., Abdel-Latif, A. and El Cindy, M. A study of the gross microscopic and functional anatomy of the thoracic duct and the lymphatico-venous junction. *Int. Surg.* 1983; **68**: 135-138.
7. Robinson, C.L. The management of chylothorax. *Ann. Thorac. Surg.* 1985; **39**:90-95.
8. Bolger, C., Walsh, T.N., Tanner, W.A. and Hennessy, T.P. Chylothorax after oesophagectomy. *Br. J. Surg.* 1991; **78**:587-588.
9. Servelle, M.., Nogues, C.I., Soulie., J., Andrieux, J.B. and Terhedebrugge, R. Spontaneous, postoperative and traumatic chylothorax. *J. Cardiovasc. Surg.* 1980; **21**:475-486.
10. Machleder, H.I. and Paulus, H. Clinical and immunological alterations observed in patients undergoing long-term thoracic duct drainage. *Surgery.* 1978; **84**:157-165.
11. Bell, J.D., Marshall, G.D., Shaw, B.A. *et al*. Alterations in human thoracic duct lymphocytes during thoracic duct drainage. *Transplant. Proc.* 1983; **15**:677-680.
12. Dumont, A.E., Mayer, D.J. and Mulholland, J.H. The suppression of immunologic activity by diversion of thoracic duct lymph. *Ann. Surg.* 1964; **160**: 373-383.
13. Puntis, J.W., Roberts, J.D. and Handy, D. How should chylothorax be managed? *Arch. Dis. Child.* 1987; **38**:593-596.
14. Worthington, M.G., de Groot, M.,Gunning, A.J. and von Oppell, U.O. Isolated thoracic duct injury after penetrating chest trauma. *Ann. Thorac. Surg.* 1995; **60**:272-274.
15. Rames, R.D., Schoenecker, P.L. and Bridwell, K.H. Chylothorax after posterior spinal instrumentation and fusion. *Clin. Orthop. Relat. Res.* 1990;**261**:229-232.
16. Gartside, R. and Herbert, J.C. Chylothorax following fracture of the thoracolumbar spine. *Injury*. 1988; **19**:363-364.
17. Marts, B.C., Naunheim, K.S., Fiore, A.C. and Pennington, D.G. Conservative versus surgical management of chylothorax. *Am. J. Surg.* 1992; **164**:532-534.
18. Milsom, J.W., Kron, I.L., Rheuban, K.S. and Rodgers, B.M. Chylothorax: an assessment of current surgical management. *J. Thorac. Cardiovasc. Surg.* 1985; **89**: 221-227.
19. Bessonel, N., Ferguson, T. B. and Burford, T. H. Chylothorax. *Ann. Thorac. Surg.* 1971; **12**:527-550.
20. Teba, L., Dedhia, H.V., Bowen, R. and Alexander, J.C. Chylothorax review. *Crit. Care Med.* 1985; **13**:49-52.
21. Johnstone, D.W. and Feins, R.H. Chylothorax. *Chest Surg. Clin. North Am.* 1994; **4**:617-628.
22. Selle, J.G., Snyder, W.H. and Schreiber, J.T. Chylothorax: indications for surgery. *Ann. Surg.* 1973; **177**:245-249.
23. Propst-Proctor, S.L., Rinsky, L.A. and Bleck, E.E. The cisterna chili in orthopaedic surgery. *Spine.* 1983; **8**(7):787-792.
24. Senior J. R. The place of medium chain triglycerides. *Am. J. Med. Scie.* 1969; **257**:75-80.
25. Ulibari, J.I., Sanz, Y., Fuentes, C., Mancha, A., Aramendia, M. and Sanchez, S. Reduction of lymphorrhagia from ruptured thoracic duct by somatostatin. *Lancet*. 1990; **336**: 258(letter).
26. Hertzog, P., Tow, L., Perssone, C. *et al*. Post-operative chylothorax in thoracic surgery:with reference to 12 cases. *Ann. Chir. Thorac. Cardiovasc.* 1975; **14**:159-171.
27. Kent, R.B. III and Pinson, T.W. Thoracoscopic ligation of the thoracic duct. *Surg. Endosc.* 1993; **7**:52-53.
28. Patterson, G.A., Todd, T.R.J., Delarue, N.C., Ilves, R., Pearson, F.G. and Cooper, J.D. Supradiaphragmatic ligation of the thoracic duct in intractable chylous fistula. *Ann. Thorac. Surg.* 1981; **32**:44-49.
29. Merrigan, B.A., Winter, D.C. and O'Sullivan, G.C. Chylothorax: Review. *Brit. J. Surg.* 1997; **84**:15-20.