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CASE STUDY

Chylothorax or leakage of total parenteral nutrition?

A. Wolthuis*, R.B.M. Landewé**, P.H.M.H. Theunissen***, L.W.J.J.M. Westerhuis*

Chylothorax or leakage of total parenteral nutrition? A. Wolthuis, R.B.M. Landewé, P.H.M.H. Theunissen, L.W.J.J.M. Westerhuis. ©ERS Journals Ltd 1998.
ABSTRACT: The diagnosis chylothorax is based on a chemical analysis of the pleural effusion. According to the literature, this analysis can be rather straightforward, comprising measurements of triglycerides, chylomicrons, and cholesterol. In this report we present an autopsy case that alerted us to interpret these results critically. Although the laboratory tests of the pleural effusion in this patient with parenteral nutrition suggested chylothorax, additional tests (potassium (11.3 mmol·L^{-1}) and glucose (128 mmol·L^{-1})) proved otherwise. Comparison of the pleural effusion analysis and the content of the parenteral nutrition led to the final conclusion that the effusion was due to a leakage of parenteral nutrition instead of chylothorax. We therefore suggest adding glucose and potassium measurements to the biochemical work-up of a patient under suspicion of chylothorax.
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Depts of *Clinical Chemistry, **Rheumatology and ***Clinical Pathology, Het Atrium Medisch Centrum, Heerlen, The Netherlands.

Correspondence: A. Wolthuis, Dept of Clinical Chemistry, Atrium, Medical Centre, Heerlen, HenriDunantstraat 5, 6419 PC Heerlen, The Netherlands.
Fax: 31 455766255

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The aetiology of chylothorax includes all factors that interfere with the normal flow of chyle through the thoracic duct, such as obstruction and disruption. This may lead to leakage with an accumulation of chyle (lymph) fluid in the pleural cavity. Because of its structure, the integrity of the thoracic duct can readily be disturbed by relatively weak forces from iatrogenic or noniatrogenic trauma, diseases (malignancies, congestive heart failure, liver cirrhosis), or spontaneously. The diagnosis of chylothorax is based on the lipid profile of pleural fluid: a high triglyceride concentration in the presence of chylomicrons together with a low cholesterol concentration [1–3].

The case of a patient who died because of apparent respiratory failure is presented here. At autopsy, milky-white fluid was found in the pleural cavities. Because the patient had received parenteral nutrition *via* a catheter inserted in the left subclavian vein, we questioned whether the milky-white fluid was chyle or parenteral nutrition. Although the standard laboratory tests suggested chylothorax, additional tests are described which supplied evidence for leakage of parenteral nutrition into the pleural cavity.

Case report

Clinical history

An 83 yr old female had been suffering from rheumafactor-positive destructive rheumatoid arthritis (RA) since 1977. The relevant medical history further included bilateral mastectomy because of breast cancer (1959 right-side; 1981 left-side). At surgery, in 1981, regional lymph nodes were positive for cancer and the patient was treated with adjuvant radiotherapy. Afterwards she had remained disease free. The reason for admission to the hospital was exacerbation of RA and anaemia of chronic disease. Routine radiography of the thorax revealed cardiomegaly without further signs of heart failure and electrocardiography demonstrated microvoltage in all leads. Because of pericardial effusion demonstrated by an ultrasound study, the diagnosis of rheumatoid pericarditis was made and corticosteroids were started. Neither a clinical examination nor radiography suggested the presence of pleural effusion.

After 1 week, the patient complained of insidious but severe abdominal pain and bowel distension. She developed fever and a diagnosis of ileal obstruction was suggested. Enteral nutrition was discontinued and a central venous catheter was inserted in the left subclavian vein. The proper position of the catheter was checked on a radiograph of the thorax. Total parenteral nutrition (TPN) *via* the subclavian vein catheter was started. Two days later the patient experienced progressive dyspnoea and died of apparent respiratory failure. After gaining informed consent an autopsy was performed.

Autopsy

At *post mortem* examination, the patient was seen with signs of cachexia and deformities of many joints, both as a result of long-standing destructive RA. Erroneously, the subclavian vein catheter had been removed prior to autopsy. A milky-like pleural effusion was seen in the left (200 mL) and the right (1,500 mL) pleural cavity, with the extensive formation of pleural adhesions. The lungs were normal at inspection. There was minimal coronary sclerosis, but without signs of cardiac infarction. The pericardium was partly adhered to the underlying tissue and coated with a sterile brownish and fibrinous exudate. In the abdomen, the liver appeared normal at inspection and signs of cirrhosis were absent. The common bile duct and the gall bladder were normal, as was the pancreas. The spleen weighed 120 g (normal) and the pulpa was normal. The abdominal aorta was sparsely affected by

Table 1. – Biochemical analysis of the milky-white effusion accumulated in the patient's pleural cavities and the composition of the total parenteral nutrition (TPN) fluid administered

	Pleural effusion (Total volume 1.7 L)	Composition of TPN fluid (Total volume 2.5 L)	Reference values for serum (Female, aged 83 yrs)
Sodium mmol·L^{-1}	110	60	133–145
Potassium mmol·L^{-1}	11.3	31.2	3.5–5.0
Cholesterol mmol·L^{-1}	0.03	0.00	4.8–6.6
Triglyceride mmol·L^{-1}	20.3	240 (ingredient of lipofundin)	0.80–2.00
Glucose mmol·L^{-1}	128	944	4.0–5.5
Osmolality mOsm·kg^{-1}	425	1602	280–300
Chylomicron % (lipoprotein electrophoresis)	100	49 (measured in lipofundin 20%)	Negligible
Lipofundin mL MCT/LCT 10% (administered separately)	–	500	–

MCT: medium-chain triglyceride; LCT: long-chain triglyceride.

atherosclerosis. Kidneys, adrenals and internal genitalia were normal. Malignancies were not found. No signs of mechanical obstruction of the bowel were observed.

From the view of the *post mortem* examination, it was concluded that the cause of death was probably cardiac, and because the pleural effusion was suspected to be of chylous origin, a chemical analysis was performed.

Chemical analysis

According to the literature, the pleural fluid fulfilled the criteria for chylothorax, with high triglyceride and low cholesterol concentrations and the presence of chylomicrons (table 1) [1–3].

A striking observation, however, was the extremely high concentration of both glucose (128 mmol·L^{-1}) and potassium (11.3 mmol·L^{-1}). Therefore, the composition of the TPN (table 1) was compared with the analysis of the fluid found in the pleural cavities (table 1), taking the osmolar equilibration and *post mortem* redistribution of analytes into consideration. The presence of chylomicrons in the lipoprotein electrophoresis profile could be traced back to the lipofundin component of the parenteral nutrition (fig. 1).

These observations led to the conclusion that the pleural effusion was TPN fluid rather than true chyle.

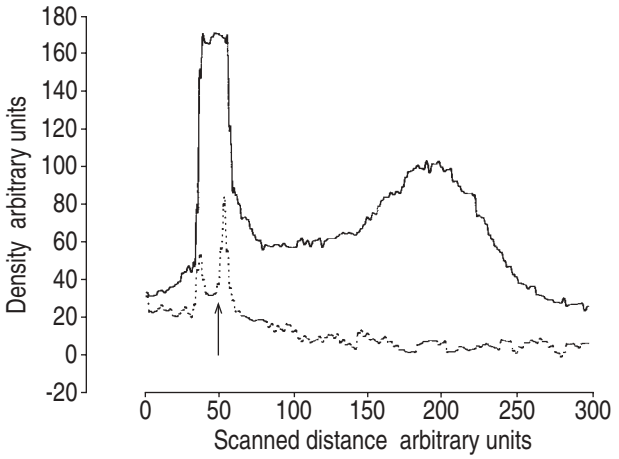

Fig. 1. – Densitometric quantification of a lipoprotein electrophoretic analysis of a 20% lipofundin suspension (fatty acid preparation parenterally administered to the patient; ——) superimposed on the results obtained with the fluid from the lungs (thorax fluid; - - - -). ↑: chylomicrons.

Discussion

Chylothorax is a condition that can be provoked by various stimulants, ranging from trauma, malignancies and liver cirrhosis to heart failure. It can also be a congenital condition [1, 4–8]. The diagnosis is based on the lipid composition of the fluid (high triglycerides and the presence of chylomicrons with low cholesterol). In addition, the lipid profile differentiates chylothorax from pseudochylothorax, which is a fluid with a chyle-like appearance but has no connection with lymphatic vessels or chyle, which contains very high concentrations of cholesterol and no triglycerides or chylomicrons and can develop when fluid is present for a long time in the pleural space and in a fibrotic pleura [1–3]. However, in exceptional cases, as the one described here, these diagnostic guidelines may incorrectly suggest chylothorax. In this case, the patient received parenteral nutrition through a subclavian vein catheter. Although there was no clinical evidence, pleural effusions were found at autopsy. Chemical analysis of the fluid led to the conclusion that the pleural effusion was actually parenteral nutrition. Apparently, the inserted catheter perforated the subclavian vein either directly by mechanical force or indirectly through the effects of the administered fluids on the vascular integrity [9].

Central vein catheterization may lead to iatrogenic complications that require early recognition in order to take adequate measures. In particular, when hyperosmolar hyperalimentation fluids, such as TPN, drain into the pleural cavity, the development of tension hydrothorax can cause serious and acute problems [10]. It is difficult to estimate the incidence of pleural effusions originating from incorrectly inserted catheters since various factors may contribute. Mukau *et al.* [11] studied complications of 1,058 superior vena cava catheter procedures in 853 patients. All patients who developed pleural effusions had left-sided, large-bore 14G catheters (0.4%). They therefore concluded that large-bore or left-sided central venous catheter placement increases the risk of complications [11]. Fletcher and Little [12] compared the catheter in-sertion procedure through puncture of the vein with a 12G needle to the Seldinger method, which uses a guide wire. Both groups contained 99 catheterizations. Although the Seldinger technique reduced the incidence of pneumothorax, pleural extravasation was seen in 2% of the treated patients, presumably as a result of a central vein perforation by the guide wire [12]. Postinsertion radiographic

control may further reduce the risk of an iatrogenic hydrothorax after the placement of central venous catheters [13], but it does not exclude vascular leakage, as is demonstrated in this case. In particular, hyperosmolar fluids such as TPN fluid can cause osmotic injury, leading to vascular leakage despite the intact venous placement of the catheter [9].

Although several cases of pleural effusion induced by incorrectly inserted catheters have been described, we could not find any report of a situation in which the differentiation between chylothorax and parenteral nutrition had to be made *post mortem*. With respect to the data presented in this report, we therefore suggest that the analysis of both glucose and potassium should be added to the biochemical profile of chylothorax, especially in patients receiving parenteral nutrition. The results should then be interpreted in relation to the composition of the administered nutrition.

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