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Thoracic Duct Drainage during Lymphangiography

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Summary

In 26 patients lymphangiography was combined with the thoracic duct drainage and with the removal of the contrast medium passing via the thoracic duct. In patients with intact lymph nodes 33.0 per cent and in patients with tumorous involvement of lymph nodes 18.5 per cent of the contrast medium were removed and thus prevented to enter the blood circulation. Thoracic duct drainage prevented the increase in serum GOT which was found in patients submitted to lymphangiography without the thoracic duct drainage. Thoracic duct drainage was supposed to be effective in reducing the risk of oil embolism in lymphangiography.

Lymphangiography has become a useful tool for the diagnosis of obstructive edema, tumorous involvement of lymph nodes, lymphomas and other diseases of the lymphatic system. However, this procedure may lead to side effects which are mostly caused by the passage of the oily contrast medium to the systemic blood circulation. The contrast

material which is not intercepted by the lymph nodes passes from the thoracic duct into the left subclavian vein. In the presence of lymphatic obstruction lymphaticovenous anastomoses represent another mechanism for the passage of the oil to the venous system. Thus, pulmonary embolization of the contrast medium occurs in lymphangiography (1, 4, 6). Histologic studies indicate pulmonary oil embolism in nearly all cases (15). A transient decrease in pulmonary diffusing capacity, pulmonary capillary-blood volume and pulmonary compliance was observed following lymphangiography, even without complaints of dyspnoea (7). *Wallace* (17) did not find any significant impairment of forced vital capacity and maximum voluntary ventilation in patients as the result of the lymphangiography. On the other hand, the measurement of the carbon monoxide diffusion capacity revealed a significant drop in 19 out of 20 patients. Pulmonary oil embolism may be fatal especially in patients who have impaired pulmonary function. Besides, oil embolism following lymphangiography was demonstrated in other organs, e.g., in the liver (8, 10).

We have tried to remove part of the oily contrast medium by the thoracic duct drainage during lymphangiography. The purpose of this study was to measure the quantity of the contrast material passing via the thoracic duct and to find if this procedure might prevent some side effects of lymphangiography.

Methods

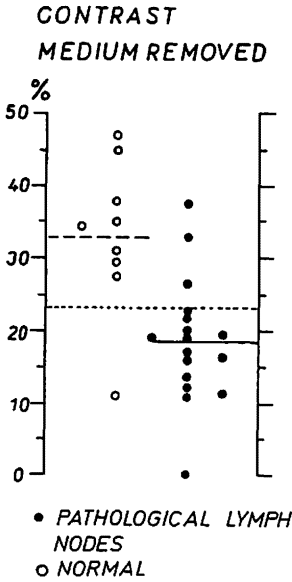
In 26 patients with Hodgkin's disease (9 cases), malignant tumors (13 cases) and inflammatory diseases of the veins and lymphatics (4 cases) lymphangiography was performed by *Kinmonth's* method (9). In 9 of these the lymph nodes were found to be intact, in 17 patients the intra-abdominal and/or pelvic nodes were damaged by neoplastic involvements. The quantity of Lipiodol Ultrafluid infused was 16 to 20 ml. Prior to the infusion of the contrast medium the terminal part of the thoracic duct was cannulated and the lymph was collected into graded tubes for the period of 2 to 8 hours from the beginning of the infusion. During the lymph collection saline was infused into the right subclavian vein to maintain the normal level of the central venous pressures which was monitored. The contrast medium flowing with the lymph formed a sediment when samples of the lymph withdrawn were allowed to stand in graded tubes. The volume of the contrast medium was macroscopically measured.

In 12 of these patients and in 10 control patients with lymphangiography but without the thoracic duct drainage the blood serum was analyzed for the activity of glutamic-oxalacetic and glutamic-pyruvic transaminases (14) before and within 24 and 48 hours after intralymphatic administration of the contrast medium. The differences between the means were statistically tested by the t-test.

Results

The mean and border values of the thoracic duct lymph flow, duration of lymph drainage, quantity of the contrast medium removed and percentage of the contrast medium removed are given in table 1. The quantity of the contrast medium removed was related to the lymph flow and to the involvement of the lymph nodes. The percentage

of the contrast medium removed was considerably higher in patients with intact lymph nodes (mean 33.0 per cent) than in those with damaged lymph nodes (mean 18.5 per cent) (Fig. 1).



After lymphangiography without the thoracic duct drainage serum GOT increased by 83 per cent. This increase was statistically significant. On the other hand, after lymphangiography with simultaneous drainage of the thoracic duct lymph serum GOT decreased by 10 per cent. The respective increases in serum GPT were 36 and 20 per cent. The mean values of both transaminases are given in table 2.

Fig. 1 Percentage of the contrast medium removed by the thoracic duct drainage in patients with intact (open circles) and those with damaged lymph nodes (closed circles) following lymphangiography. Horizontal lines show the means.

Table 1 Mean and range of lymph flow, duration of lymph collection and quantity of contrast medium removed in 26 patients with lymphangiography.

	Mean	Range
Lymph flow (ml/min)	0.92	0.21 - 5.10
Duration of lymph collection (hours)	4.5	2 - 8
Quantity of contrast medium removed (ml)	3.9	0 - 8
Per cent of volume administered	23.4	0 - 47.1

Table 2 Means and S.D. of serum GOT and GPT (units) in patients submitted to lymphangiography without and those with the thoracic duct drainage.

Hours	Without lymph drainage (n = 10)		With lymph drainage (n = 12)	
	GOT	GPT	GOT	GPT
0	9.8 ± 3.3	14.3 ± 3.8	11.3 ± 3.7	13.4 ± 3.6
24	17.9 ± 6.2	19.4 ± 5.9	10.5 ± 3.4	15.4 ± 4.6
	p < 0.05			
48	12.0 ± 5.1	14.9 ± 4.2	15.3 ± 4.4	14.5 ± 4.1

Discussion

Koehler et al. (8) investigated the fate of ^{131}I -tagged Ethiodol following lymphangiography in dogs. It was found that the oil did not remain confined to the lymphatic system. All body organs contained small but easily measurable quantities of radioactivity. An average of only 25 per cent of the injected medium was retained in the lymphatics at the end of three days. An average of 50 per cent was recovered from the lungs. The remainder of injected activity was found to be fairly uniformly distributed throughout the body. The lungs act as blood filter trapping the majority of undegraded Ethiodol. There is some histologic evidence, however, that small amounts of oil pass this filter on certain occasions.

Oil embolism following lymphangiography can be controlled by using the least possible amount of oily contrast material, and by stopping the injection as soon as obstructive disease or lymphatico-venous anastomosis is found (12). However, this often makes a valuable filling of the lymphatic system impossible. It has been proved that a fistula of the thoracic duct prevented pulmonary embolization of Lipiodol UF administered intralymphatically in dogs (11). *Tjernberg* (16) performed the cannulation of the thoracic duct in patients submitted to lymphangiography. No pulmonary embolism was detected roentgenologically.

In this study we have found that a considerable amount of contrast medium may be removed from the circulation by the thoracic duct drainage. With longer duration of the lymph collection this amount may be even enhanced. Therefore, this procedure is an effective way of avoiding oil embolism after lymphangiography. Of course, a small amount of the contrast medium may pass to the venous system via possible lymphatico-venous anastomoses. These are, however, unlikely to occur in patients without lymphatic obstruction.

Hepatic oil embolism after lymphangiography is not common. *Chavez and Picard* (2) reported 36 cases of radiographically detectable hepatic oil embolization in an accumulated series of 18,371 lymphograms. This represents an incidence of only 0.19 per cent. According to *Koehler et al.* (8) 2.8 per cent of the injected contrast material was found in the liver three days following lymphangiography in intact dogs. In patients where oil reaches the liver in large amounts abnormal lymph dynamics exist. For such flow to occur, both the abdominal lymphatics and the inferior vena cava have to be obstructed. Nevertheless, minor amounts of oily contrast medium may reach the hepatic portalvenous system by way of lymphatico-venous anastomoses (13). *Fuchs et al.* (5) measured the hepatic function prior to and following lymphography in 8 patients. Routine clinical tests (serum bilirubin, SGOT, SGPT, alkaline phosphatase) remained generally at control levels. Similar results were obtained for the sulphobromophthalein transfer rate and storage capacity of the liver. Phagocytic activity of the reticuloendothelial macrophages lining the sinusoids of the liver was significantly impaired in all four patients tested. The authors admitted that in patients with liver disease lymphography with oily contrast material might lead to an additional impairment of liver function, particularly phagocytic activity.

In our study it was shown that in patients submitted to lymphography without the thoracic duct drainage serum GOT significantly and GPT insignificantly increased within 24 hours. Thoracic duct drainage prevented the increase in both transaminases.

This phenomenon might be explained by a transitory hypoxemia due to a secondary alteration of systemic and/or intrahepatic blood circulation, when the oily material was allowed to enter the blood circulation. *Fabel* (3) described a highly significant fall in arterial oxygen tension four hours following intralymphatic injection of Lipiodol UF in 20 patients. The direct effect of hepatic oil embolism is less probable.

Thoracic duct drainage is suggested to prevent the most serious complications of lymphangiography. Besides, it enables to administer greater amounts of oily contrast medium without any risk and thus to improve the visualization of the lymphatic system. Of course, this combined procedure does not revise the common contraindications of lymphangiography. In patients with abnormal pulmonary functions, radioisotope investigation of the lymphatic system, if necessary, is advisable.

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