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## Thoracic duct injury due to left subclavicular vein catheterization: A new conservative approach to a chyle fistula using biological glue

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### ABSTRACT

**INTRODUCTION:** A thoracic duct injury complicated with a chylous fistula is a rather rare occurrence associated with left subclavicular catheterization. We present a new method of its conservative management which seems to be the least interventional described so far. It can be used in cases of this iatrogenic injury irrespective of the rate of chyle loss.

**PRESENTATION OF CASE:** Our case report involves a 59-year-old patient with a high-output chyle fistula due to left subclavicular vein catheterization, in which biological cyanoacrylic glue was used through percutaneous infusion to the venous angle, where the thoracic duct was leaking. An extensive review of the relevant literature is presented.

**DISCUSSION:** Most of the high-output fistulas require a long time of conservative treatment, which may result in severe complications due to the prolongation of chyle loss. An operation may be needed in selected cases. Our proposed interventional method can be used in cases of percutaneous injury of a chyle duct, with immediate results.

**CONCLUSION:** An iatrogenic chyle fistula due to left subclavicular catheterization can be obtained with a percutaneous injection of biological glue directly onto the injured vessel.

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### 1. Introduction

The injury of the thoracic duct during the left subclavicular catheterization is a rare (<1%), but a major complication which can be fatal if not treated. The chylous fistula created by such injury, or loss of chyle and lymph into pleural space can lead to dramatic consequences because of the loss of essential proteins, immunoglobulins, fat, vitamins, electrolytes, and water. Larger chylothoraces commonly lead to hypovolaemia due to large volume loss. In the early stages the patient may not demonstrate clinical symptoms or signs of loss of chyle. More complicated cases exhibit clinical features of severe malnutrition. Hyponatraemia, acidosis, and hypocalcaemia are the most commonly recognized phenomena. Mortality is high in patients with recalcitrant or untreated chylothorax. The nutritional deficiency will continue to persist or deteriorate unless definitive therapeutic measures are instituted to stop leakage of chyle through a fistula or into the pleural space.<sup>1</sup>

The above complications indicate the necessity of early treatment of chyle loss. Some already implemented conservative and surgical methods will be described. However, in our case report,

a new conservative management with biological glue, stands as a unique approach with an effective result, by means of using a very simple technique.

### 2. Case report

A 59-year-old man was in-patient in the intensive-care unit of our hospital for supportive treatment of an ischaemic head stroke. On the 9th day after the introduction of a left subclavicular vein cannula, the catheter was removed because of fever. Instantly a milky, opalescent fluid started to drain from the puncture of the catheter at a drainage rate of 50 ml/h (Picture 1). The fluid was identified in the lab as lymph (high fat content in the form of triglycerides). The patient was initially managed with total parenteral nutrition, consisting of high fat and bowel rest. The fluid started to become more thin and clear but the drainage volume remained the same. Lymphangiography could not be done to demonstrate the exact site of lymph leak. In this case we could only speculate that the site of the lymph was near the left venous junction. From the existing puncture and using the possible anatomic position of the venous angle as a guide, a needle was inserted and after a negative blood aspiration, a slow infusion of 2 ml cyanoacrylic biological glue was injected in the whole area. After the withdrawal of the needle the drainage of the lymph was totally arrested. The chest X-rays were completely normal in the following days. The patient left the intensive-care unit in a very good clinical condition.

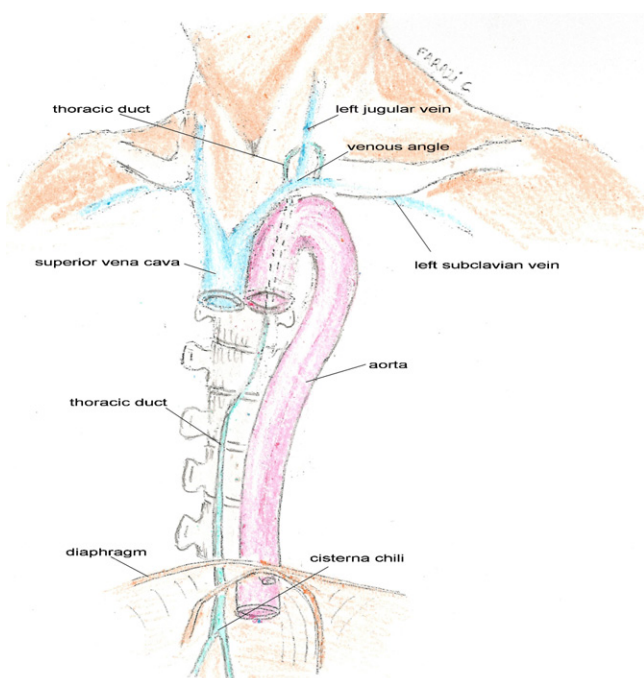
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**Picture 1.** Chyle was draining from the puncture site at a rate of 50 ml/h.



**Fig. 1.** A schematic representation of the lymphatic system.

### 3. Discussion

The major function of the thoracic duct is to transport absorbed fat in the form of triglycerides and cholesterol from intestinal lymphatics into the venous circulation. The thoracic duct has also an important role in the maintenance of fluid balance and return of protein and T lymphocytes to the venous circulation. The most common configuration of the thoracic duct is found in just more than half of individuals. The thoracic duct arises from the cisterna chyli at the level of the first lumbar vertebra. It ascends through the abdomen and chest and reaches behind the left subclavian vein as much as 3–5 cm above the clavicle. The duct then angles forward acutely and ends by opening into the posterolateral aspect of the angulus venosus, or the junction of the left subclavian and internal jugular veins (Fig. 1). However, the thoracic duct in rare variations may also drain either into the left IJV, or into the left subclavian vein, the left brachiocephalic vein, or the left external jugular vein. The termination is usually within 1 cm from the venous angle. Almost

all thoracic ducts terminate at the posterior or lateral aspect of the venous structure at or near the angulus venosus. However, termination of the duct at the anterolateral aspect of the venous angle has been described.<sup>2–4</sup>

The management of chyle fistula or chylothorax is either conservative or operative, if the conservative methods are proved ineffective. The therapeutic decision depends on the amount of the drainage volume. The standard treatment of low-output fistulas is conservative, and consists of bowel rest, total parenteral nutrition (TPN) and the administration of somatostatin. There are reports offering encouraging results by this method,<sup>5</sup> as they show a dramatic reduction of the lymph leakage in 60–100% of cases after 2–6 weeks of treatment. However in these reports, some patients were eventually operated on as a final resort, in order to control the loss of chyle. Octreotide can be used instead of somatostatin, but the results are not equally encouraging.<sup>6</sup>

Especially in post-operative chyle fistulas in neck surgery, there have been reports of cases<sup>7</sup> that were successfully treated with aspiration of the chyle and strapping of the draining area. This type of management is used only when the surgical incision and skin flaps remain healthy. It is obvious that strapping cannot be used in subclavicular injury. However aspirations can be effective in low drainage fistulas.

Instead of using total parenteral nutrition (TPN), Lucente et al.<sup>8</sup> recommended oral feeding based on special diets. The nutritional element involves the use of medium chain triglycerides (MCT) that are easily ingested, rapidly absorbed, and readily metabolized directly into the portal venous system, bypassing the thoracic duct lymphatic system.

Percutaneous infusion with povidone-iodine is also described in the treatment of postoperative cervical chylous lymphocele, based on its inflammatory and sclerosing effects in the subcutaneous area. Percutaneous catheter drainage in combination with povidone-iodine infusion has proved to be highly effective in obliterating lymph leakage after neck surgery.<sup>9</sup>

Surgical intervention is reserved for cases in which treatment has failed to halt the chyle loss, or as an early treatment for those with a high-output fistula.

It has been recommended<sup>10</sup> that a reoperation to ligate the thoracic duct is necessary if drainage exceeds 1000 ml/day for 7 days. Additional indications for an operative management, according to Merrigan et al.<sup>11</sup> include: (1) chyle leak greater than 1000 ml/day for more than 5 days, (2) persistent leak for more than 2 weeks despite conservative management, (3) nutritional or metabolic complications, and (4) loculated chylothorax, fibrin clots, or incarcerated lung.

Surgical approach is either an open thoracotomy or a video-assisted-thoroscopic-surgery (VATS). The operation includes the ligation of the lymphatic vessel together with all fatty and fibrous tissues lying between the right azygous vein and the aorta just above the diaphragm.<sup>12</sup> As an additional measure talc induced pleurodesis may be used.<sup>13</sup> Local injection of tetracycline hydrochloride<sup>14</sup> and mediastinal radiotherapy<sup>15</sup> has also been advocated. The use of fibrin glue has been used as an adjunct in the surgical management of a chyle leak. The glue can be effectively applied on the leaking area during thoracoscopy<sup>16</sup> alone or in combination with thoracic duct ligation.<sup>17</sup> In a case of reoperation for a massive pleural effusion,<sup>18</sup> using thoracoscopy, fibrin glue and an absorbent mesh were used, both of which were applied to parietal and mediastinal pleura. This method was selected because of failure to find the thoracic duct and the leakage point.

Intravenous administration of an  $\alpha$ -adrenergic drug such as etilefrin hydrochloride<sup>19</sup> has been shown to be capable of drying up intra-abdominal lymphatic weeping after resection of the esophagus en bloc with the thoracic duct.

A series of adverse reactions have been reported associated with fibrin glue application, including hypersensitivity or anaphylactic reactions, air or gas embolism if the applied pressure is higher than the recommended by the manufacturer, vascular, skin, subcutaneous tissue, cardiac or respiratory disorders, nausea, and flushing or paresthesia.<sup>20</sup>

Our method, which involves a percutaneous infusion of biological glue directly onto the leaking area, is safe, reproducible and easy to perform. It can be used in any case of chyle fistula, irrespective of its output capacity.

#### 4. Conclusion

The injury of the thoracic duct complicated with a chylous fistula can be managed conservatively, regardless of the volume of the drainage, by using biological glue. Even in high volume fistulas (>1000 ml/day), the method presented in this article is safe and effective, achieving the immediate desired results.

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None.

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None.

#### Ethical approval

Obtained.

#### Contributors

Anestis Ninis designed the therapeutic approach for the chyle fistula and supervised the work for this manuscript. Stephanos Pierrakakis and Christos Farazi-Chongouki designed this work and wrote the manuscript. Christos Farazi-Chongouki illustrated the figure. Pougouras Ioannis, Iordanou Christos, Palivos Lampros contributed in the design and writing of this work together with the thorough bibliographic investigation.

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