

## LYMPHATIC TRACT RECONSTRUCTION USING A PEDICLED DEEP INFERIOR EPIGASTRIC PERFORATOR FLAP

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### ABSTRACT

*We encountered a case in which we used a pedicled deep inferior epigastric perforator (DIEP) flap to repair a lymphatic leak. This case shows that such repairs can lead to the reconstruction of the lymphatic tract and prevent lymphatic leak recurrences. The present report describes a 45-year-old woman with ovarian cancer who underwent hysterectomy, bilateral salpingo-oophorectomy, pelvic lymphadenectomy, para-aortic lymphadenectomy, and omentectomy. She presented with a pelvic lymphocele with lower-extremity swelling. Lymphovenous anastomosis was performed and swelling of the lower extremity abated. However, because of the occurrence of deep vein thrombosis and the recurrence of swelling, we used a 6-cm-long and 14-cm-wide DIEP flap after lymphocele fenestration. The flap was de-epithelialized and fixed into the peritoneum, with the cutis side facing the leakage point. The postoperative course was uneventful, and no recurrence was observed. We obtained good results by providing abundant blood flow to abundant lymph tissue at the fenestration point. It is known that lymphatic vessels can spontaneously connect with each other. We hypothesize that the DIEP flap improved the edema in this case by regenerating the lymphatic network and improving flow into the bridging flap.*

**Keywords:** lymphatic tract reconstruction, lymphovenous anastomosis, deep inferior epigastric perforator flap

We encountered a case in which a refractory pelvic lymphocele (PLC) was treated using a pedicled deep inferior epigastric perforator (DIEP) flap into the pelvis. It is known that DIEP flaps have abundant lymphatic networks (1), and it is believed that providing lymphatic tissue with plentiful blood circulation allows micro-lymphatic networks to develop spontaneously (2), in turn allowing the lymphatic path to be reconstructed. As a result, our patient exhibited readily observable improvements in her condition. Thus, this case demonstrates a novel method of treating this complication.

### CASE

A 45-year-old woman with stage 1a ovarian cancer underwent hysterectomy, bilateral salpingo-oophorectomy, pelvic lymphadenectomy, para-aortic lymphadenectomy (retroperitoneal repair), and omentectomy by abdominal operation. Chylous ascites occurred on the fourth day after surgery and bilateral lower-extremity edema (LE), which was more severe on the left side, and pain occurred during the second week after surgery. Computed tomography

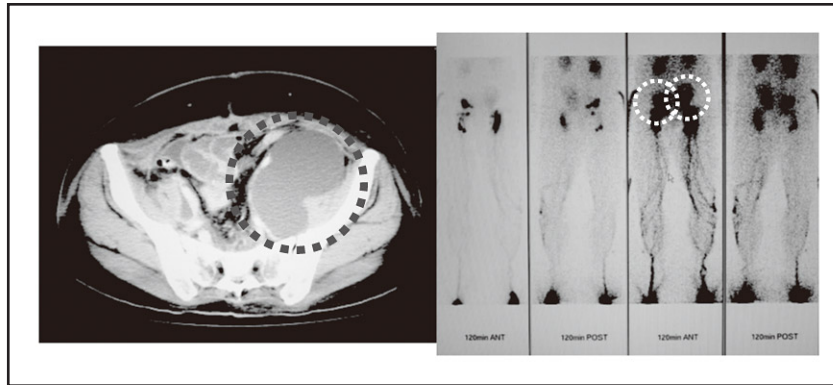


Fig. 1. A large pelvic lymphocele (circle) was observed on computed tomography (left) and lymphoscintigraphy (right).

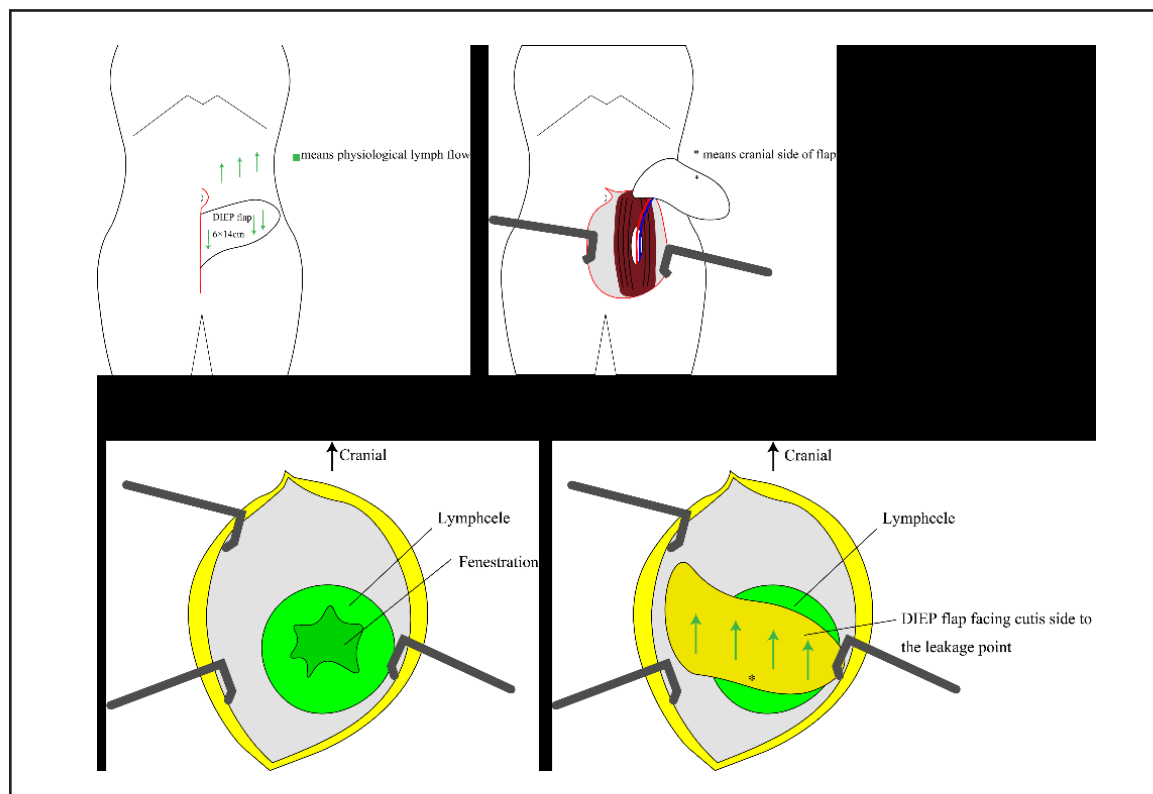
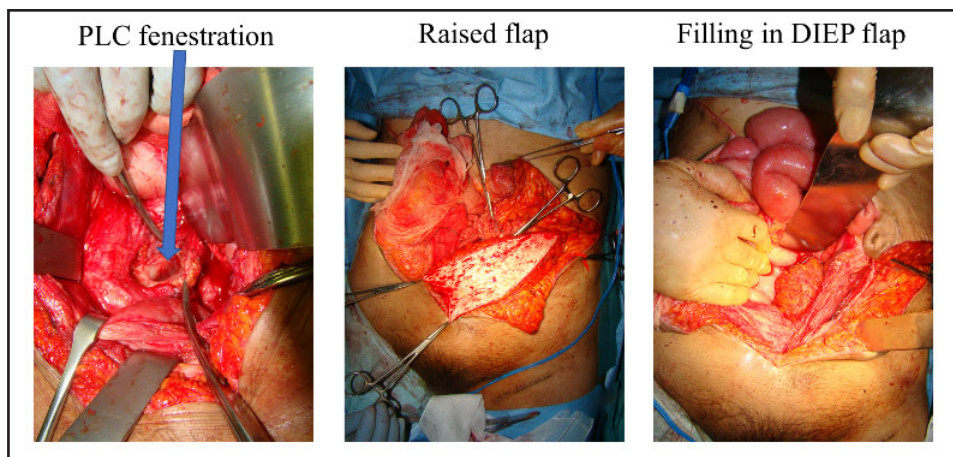


Fig. 2. The flap was raised and the sutured cutis was placed adjacent to the fenestration point. The flap was placed in a cranial to distal orientation. Arrow, physiological lymphatic flow; \*, cranial side of the flap.

and ultrasonography revealed the absence of deep vein thrombosis (DVT), but a large PLC was observed bilaterally (Fig. 1). It appeared that the PLC had resulted from the exclusion of the iliac vein, which leads to high venous

pressure in the lower extremities, resulting in high filtration rates to the lymphatic vessels and subsequent lymphatic drainage obstruction. Accordingly, lymphovenous anastomosis (LVA) was performed in the first month after



*Fig. 3. After fenestration of the pelvic lymphocele (PLC), a pedicled deep inferior epigastric perforator (DIEP) flap was developed and the deepithelialized flap was sutured into the fenestrated area with the cutis side facing the leakage point.*

surgery. Four anastomoses were performed in the posterior portion of the leg and groin area, where lymphatic tracts can be found easily by indocyanine green fluorescence lymphography. The edema improved noticeably for several days after LVA. However, a DVT developed from the exclusion of the external iliac vein and LE worsened on the 11th day after LVA. After insertion of an indwelling inferior vena cava filter catheter, percutaneous drainage was initiated to treat the remaining PLC. The edema improved following drainage but the effusion did not decrease for 2 weeks after catheter insertion. Therefore, we performed fenestration of the PLC and placed a pedicled DIEP flap on the area of the leak as a radical treatment and for lymphatic tract reconstruction. The deep epigastric arteriovenous pedicled flap was designed to be 6-cm long and 14-cm wide to include the perforator artery around the hilum. The rectus abdominis muscle was preserved to retain abdominal wall function. By ligating the superior epigastric artery and vein, flap flexibility increased and it was easier to cover the fenestration window. The pivotal point is the junction of the external iliac artery and DIEP artery. Furthermore, we split the rectus abdominis muscle length-

wise and transferred the de-epithelialized flap into the peritoneum. It was positioned on the cutis side to fenestration point. The flap was placed in a cranial to distal orientation (Fig. 2), with the cutis side facing the leakage point. Thereafter, we sutured the flap to the fenestrated area (Fig. 3). Since the PLC diminished significantly and LE also rapidly improved postoperatively, the patient was discharged and is being followed up in the outpatient clinic. Imaging has not revealed a PLC, and lymphoscintigraphy has shown the uptake of lymph flow into the flap (Fig. 4). The patient has had no PLC recurrence at follow-up 4 years after surgery.

#### DISCUSSION

PLC is a complication that can occur after gynecological surgery for pelvic lymphadenectomy. Typically, only small PLCs are observed. However, patients should be treated if the PLC leads to lower abdominal pain, lower extremity pain, hydronephrosis, or DVT. Percutaneous drainage, sclerotherapy, and fenestration have been reported (3,4) as techniques for treating PLC. LVA has also been reported as an effective surgical approach for PLC (5).

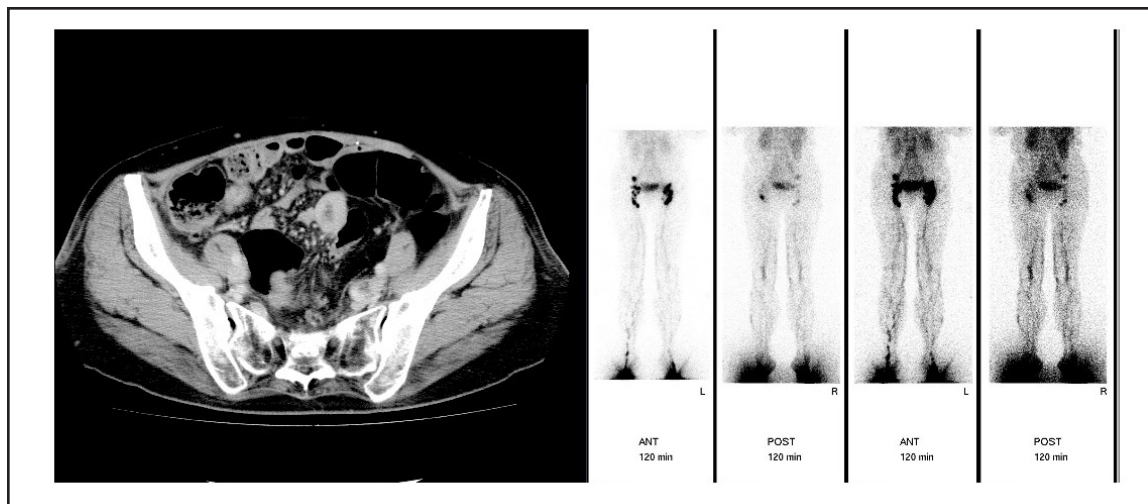


Fig. 4. Postoperative computed tomography revealed the disappearance of the pelvic lymphocele. Lymphoscintigraphy suggested that the lymphatic path flowing to the cranial side had been reconstructed via the flap.

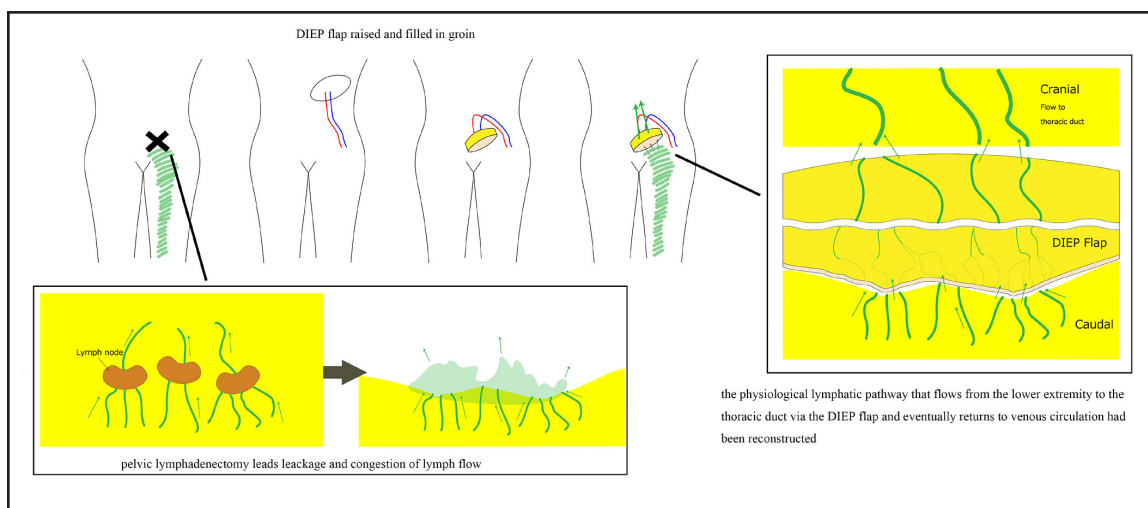


Fig. 5. Schematic of treatment approach utilized in this case (top, left). Insert on lower left highlights how the pelvic lymphadenectomy may have led to leakage and congestion of lymph flow in the lymphocele. Insert on the right shows how the lymph flow was possibly restored via the transplantation of the deep inferior epigastric perforator flap.

In fact, the anastomosis was observed to be effective for the patient in this case, temporarily improving her symptoms immediately after the LVA. However, the drainage route developed by the LVA was obstructed by blockages in the venous path by a thrombosis accompanied by elevated venous pressure. Therefore, her symptoms worsened.

Percutaneous drainage was performed as a subsequent treatment. Nevertheless, the effusion was severe and it could not be cured by drainage alone. For this reason, we discussed another treatment and decided to reconstruct the lymphatic path by patching the tissue with an abundant lymph network at the fenestration point. It is known that

filling the omentum, which has several lymphatic networks, in the axilla or inguinal region alleviates symptoms in patients with lymphedema (6,7). In addition, even though the free-flap operation involved only vascular anastomosis, spontaneous lymph reconnection between the flap and surrounding tissue developed. Moreover, lymphoscintigraphy has shown that when radiotracers are injected into the flap, they transfer to the surrounding tissue and ascend towards the cranium (2). In other words, it is suggested that lymphatic vessels between the flap and surrounding tissue can create a micro-lymph circulation, leading to the reconstruction of a lymphatic path.

Lymph node transfer is another treatment for lymphedema that provides lymph tissue with abundant blood flow. It is thought that transferring the lymph tissue creates micro-lymph circulation, which leads to improvement of lymph flow congestion and lymphedema, although little is known about the exact mechanism (8).

We were unable to use the omentum in this case because the first gynecological surgery included omentectomy. For this reason, we used a DIEP flap. It is known that DIEP flaps have abundant lymphatic vessels (1). Additionally, it has been reported that the rectus abdominis musculocutaneous flap, which uses almost identical tissue (supratunica muscularis), alleviated lymphedema by filling in the groin (9). We hypothesized that using a DIEP flap instead of the omentum would allow for the regeneration of micro-lymph circulation within the area of leakage around the inguinal region to the lymphatic capillaries. Furthermore, a lymphatic path was created from the flap in the groin to the surrounding tissue. Fat tissues of the flap, including rich lymphatic vessels, were exposed to the mesentery and retroperitoneal tissue. It is possible that lymphatic vessels regenerate spontaneously by creating a path through the mesentery or retroperitoneal lymph node to the vein. For this reason, we believe that the physiological lymphatic pathway that flows

from the lower extremity to the thoracic duct via the DIEP flap eventually returns to the venous circulation that was reconstructed (Fig. 5). Lymph reconnection could not be observed visually since the flap was not contrasted clearly on lymphoscintigraphy taken after surgery. However, the lymph flow congestion improved remarkably and no lymphatic congestion around the pelvis was found (Figs. 1,4), providing indirect evidence that the lymphatic path had been reconstructed since direct evidence could not be obtained. To our knowledge, this procedure is unique in its approach to this problem and not only allows the myocutaneous flap to be used to reconstruct the lymphatic flow but in addition also to fill the tissue dead space. This method may be advantageous even if the refractory lymphedema improves early because the network between the flap and surrounding tissue has been reported to develop as early as 2 weeks (2).

Our literature review revealed that there were no reports on the use of a DIEP flap to fill in lymphatic tissue in the groin to reconstruct a lymphatic path. An additional indication of using DIEP flaps postoperatively is to prevent lymphedema, which would be expected for gynecological operations in which resection of organs, including the omentum, is conducted.

#### CONFLICT OF INTEREST AND DISCLOSURE

All authors declare no competing financial interests exist.

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