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Effective treatment of pelvic lymphocele by lymphaticovenular anastomosis

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HIGHLIGHTS

► Pelvic lymphocele is a major complication after pelvic lymphadenectomy.
► We performed lymphaticovenular anastomosis (LVA) on pelvic lymphoceles, and found that LVA was highly effective regardless of the lymphoceles' size.
► LVA could be considered as an initial treatment for lymphoceles.

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ABSTRACT

Objective. Pelvic lymphocele can be a severe complication associated with surgical procedures such as pelvic lymphadenectomy. Lymphaticovenular anastomosis (LVA) is increasing in popularity as a surgical treatment for lymphedema. The aim of this study was to evaluate whether LVA is an effective treatment for lymphocele, which is caused by an obstruction of the lymphatic flow in a manner similar to the development of lymphedema.

Methods. Eleven female patients, who presented with lymphocele, were treated with LVA. Before the operation, 3 of them were treated with a percutaneous catheter. Lymphocele size and the volume of daily drainage were measured before and after LVA.

Results. The lymphocele was completely resolved in 6 patients and partially resolved in the remaining 5 patients. The mean size of the pelvic lymphocele changed from 400 ml (range 50–1050 ml) to 43 ml (range 0–120 ml) ($P<0.01$). In the 3 patients who had percutaneous drainage catheters, the volume of fluid drained decreased from 340 ml/day to 20 ml/day after LVA.

Conclusions. Our technique is minimally invasive and is performed under local anesthesia. LVA is effective regardless of the size of the lymphocele. Therefore, LVA should be considered as a therapy for lymphocele because of its low invasiveness and its effectiveness in re-establishing circulation of lymphatic flow. Further studies should be performed to compare LVA with other minimally invasive techniques, such as percutaneous catheter and sclerotherapy.

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Introduction

A lymphocele is defined as an abnormal collection of lymph fluid, without an epithelial lining, at the site of lymphatic surgery [1,2]. A pelvic lymphocele can occur after surgical procedures such as pelvic lymphadenectomy for gynecologic or prostatic malignancies and renal transplantation [2–7] and has an incidence of 1–49% [1,2,8]. Most lymphoceles are small and asymptomatic, and they disappear spontaneously with time. However, when sufficiently large, they may lead to symptoms such as abdominal pain, infection, increased urinary frequency, hydronephrosis, deep venous thrombosis, and lower extremity lymphedema [1,2,6,8].

Several treatment options are available for the management of pelvic lymphoceles; however, there is no consensus as to which is most effective. Needle aspiration and percutaneous catheter drainage, which are commonly used in the initial management of symptomatic lymphoceles, have reported initial cure rates of up to 80%, but treated lymphoceles are often complicated by infection (in up to 50% of cases) and recur in 80–90% of cases [1,2,9]. The cure rate of sclerotherapy is also reported to be between 77% and 98%, but the success of this treatment is inversely proportional to the size of the lymphocele—larger lymphoceles are more likely to be symptomatic and cause complications; thus, the effectiveness of this therapy is limited [1,9]. Laparoscopic or surgical fenestration is the most invasive of the current therapies

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for pelvic lymphoceles and is often reserved for refractory cases. Complications associated with this approach include perforation of the bladder, transection of the ureter, and injury of pelvic vessels [6,10].

Lymphaticovenular anastomosis (LVA) using supermicrosurgery has been reported as being a simple, minimally invasive, and effective treatment for secondary lymphedema of the upper and lower extremities [11–15]. This technique bypasses proximal lymphatic blockages, providing an alternative route for lymphatic fluid recirculation into the venous system. We reasoned that a similar principle could be used to treat pelvic lymphoceles. By providing an alternative route of lymphatic drainage into the venous system for lymphatic fluid from the lower limb, the flow of lymphatic fluid into the lymphocele would be reduced. Furthermore, we have previously demonstrated that valvular incompetence permits a reversal of the lymphatic flow in cases of lymphedema, and we hypothesized that a similar mechanism in the postsurgical pelvic lymphatic system of patients with lymphoceles would allow drainage of the lymphocele through the newly created LVAs. We have previously reported successful management of a pelvic lymphocele using this approach in a single patient [16]. In this study, we report our experience using this technique to treat pelvic lymphoceles in a series of 11 patients.

Materials and methods

Patients

Eleven female patients with pelvic lymphoceles were referred to our department between May 2010 and October 2011. All the patients had undergone treatment for gynecologic cancer (see Table 1). The presence of a pelvic lymphocele was determined in all cases by a CT scan. In 3 patients, a percutaneous catheter had been inserted prior to referral in an attempt to treat the lymphocele, but drainage had remained unacceptably high.

Preoperative preparation

All patients gave fully informed consent for the procedure, acknowledging that current outcome data on efficacy was unknown. One day before each operation, fluorescence lymphatic imaging, using a near-infrared fluorescence imaging device (Photodynamic Eye, Hamamatsu Photonics, Hamamatsu City, Japan), was performed after the injection of indocyanine green dye (ICG) to identify the lymphatic channels in both lower limbs, as previously described [17–19]. The location of the lymphatic channels was marked, facilitating the accurate placement of short incisions and thereby allowing the procedure to be performed under local anesthesia. In those patients with a percutaneous drainage device in situ, the drain was clamped after lymphatic mapping in order to increase pressure in the lower-limb lymphatics and facilitate LVA.

Operative technique

Under local anesthesia, 2 or 3 incisions (2 cm each) were made on each lower limb—on the dorsum of the foot, the distal medial thigh, and the groin—overlying previously mapped lymphatic channels [20]. Dissection of superficial lymphatic channels and venules was performed under magnification using the operative microscope. Lymphaticovenular anastomosis was performed using either 11/0 or 12/0 nylon sutures in an end-to-end (Fig. 1A and B) or side-to-end configuration. The patency of anastomoses was confirmed by either washout of the venous lumen by lymphatic flow or venous backflow into the lymphatic channels. Wounds were closed with intradermal 4/0 PDS and interrupted 5/0 nylon sutures.

Postoperative management

Twice daily for 7 days after surgery, 60 μg of prostaglandin E1 (Prostandin; Ono Pharma. Co., Osaka, Japan) was injected intravenously. Prostaglandin is used for dilation of the vessels and seems to result in decreased occlusion of the anastomosis site. Compression therapy was started on postoperative day 14. All but one patient had follow-up CT scans.

Assessment

Assessment of the lymphocele was performed by either CT or ultrasonography. The volume of the lymphocele was calculated as an ellipsoid. Statistical analysis of the data was performed using a Wilcoxon test. A P value less than 0.05 was deemed significant.

Results

The demographic details of the patients and the details of their gynecologic treatment are shown in Table 1. We performed a mean of 8.2 lymphaticovenular anastomoses, with a mean venule diameter of 0.70 mm and a mean lymphatic diameter of 0.55 mm. In 6 of the 11 patients, the pelvic lymphocele was completely resolved after LVA, and in the remaining 5 patients, the lymphocele was partially resolved. The average pelvic lymphocele size was 400 ml (range 50–1050 ml) on preoperative CT scan and 43 ml (range 0–120 ml) on postoperative CT ($P<0.01$). In the 3 patients who underwent preoperative placement of percutaneous drainage catheters, the mean volume of fluid drained each day was reduced from 340 ml to 20 ml after LVA (Fig. 2).

Prior to our operations, 10 patients had symptoms: 1 had hydronephrosis requiring a urinary stent, 1 had frequent pre-ileus, 2 had increased urinary frequency, 2 had infection of lymphoceles, 3 had abdominal pain, and 7 had lower-extremity lymphedema. All symptoms except for lymphedema were alleviated after the LVA operation, and the lymphedema was improved from the pre-LVA state. No patients in

Table 1
Patient data.

Age	Site of primary cancer	Stage	Primary operation	Pre-LVA lymphocele volume [ml]	Post-LVA lymphocele volume [ml]	Catheter inserted
52	Cervical cancer	Ib	RH, BSO, PLA	60	0	−
63	Cervical cancer	IVb	RH, SILA, PALA	160	0	+
42	Endometrial cancer	Ic	RH, BSO, PLA	50	0	−
53	Endometrial cancer	Ib	RH, BSO, PLA	1050	0	+
53	Endometrial cancer	Ic	TAH, BSO, PLA	700	0	−
66	Endometrial cancer	Ic	RH, BSO, PLA, PALA	200	110	−
42	Ovarian cancer	Ic	TAH, BSO, PLA, PALA,	460	50	−
53	Ovarian cancer	Ia	TAH, BSO, PLA, PALA, pOM	170	90	−
56	Ovarian cancer	IIIc	Secondary EILA	500	100	+
61	Ovarian cancer	Ic	TAH, BSO, PLA, PALA, pOM	700	0	−
69	Ovarian cancer	Ic	TAH, BSO, PLA, PALA, pOM	350	120	−

RH: radical hysterectomy, BSO: bilateral salpingo-oophorectomy, PLA: pelvic lymphadenectomy, SILA: superficial inguinal lymphadenectomy, TAH: abdominal total hysterectomy, pOM: partial omentectomy, EILA: external iliac lymphadenectomy, PALA: para-aortic lymphadenectomy.

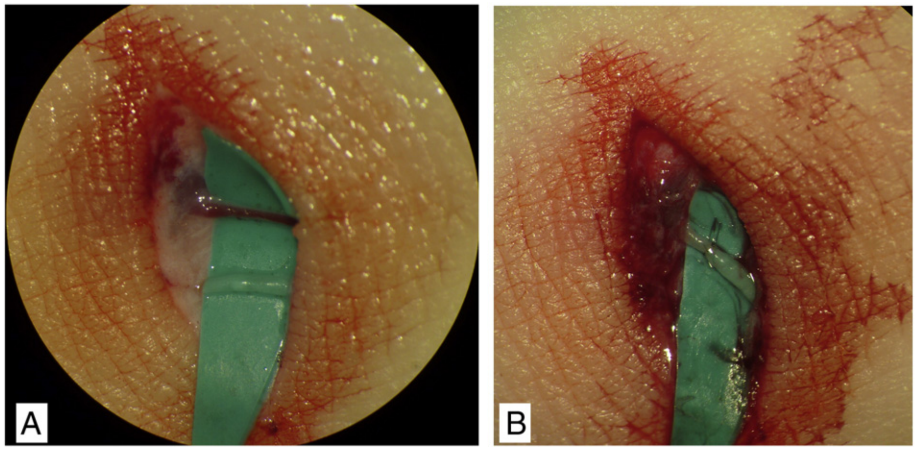

Fig. 1. Lymphaticovenular anastomosis. (A) Pre-anastomosis image. The upper vessel is a vein; the lower image is a lymphatic channel. (B) Post-anastomosis image. The anastomosis was performed with 5 sutures of 11–0 nylon. The left side of the anastomosis looks clear because the lymphatic fluid is under higher pressure than venous blood; therefore, flow from the lymphatic channel on the right washes out blood from inside the vein.

our series suffered any complications of LVA. Specifically, there were no infections and no wound-healing problems.

Representative case

The lymphocele was detected on CT 11 days before LVA (Fig. 3A). The patient had abdominal pain, urinary frequency, and lower-extremity lymphedema. A percutaneous catheter was inserted 3 days before the operation and the daily volume of drained fluid was recorded until the tube was removed (Fig. 3D). The operation site of LVA was noted (Fig. 3B). A CT image taken 3 days after the operation showed that the lymphocele had disappeared (Fig. 3C). The catheter was removed after confirming that the symptoms had disappeared.

Discussion

Since Teruel et al. [21] first reported successful sclerotherapy with povidone iodine for lymphoceles, several types of sclerotherapy with a variety of agents have been reported [1,6,9]. The cure rate for sclerotherapy is reported to be between 77% and 98% [1], and the recurrence rate is 31% [22]. However, the success of this treatment is inversely proportional to the size of the lymphocele [1]—larger lymphoceles are more likely to be symptomatic and cause complications; thus, when the lymphoceles most require treatment, this therapy is likely to be relatively less effective.

Laparoscopic or open surgical fenestration can be used to open a pathway from the lymphocele into the peritoneal cavity, allowing the peritoneum to absorb lymphatic fluid [23]. These techniques enable lymphatic fluid to re-circulate into the venous system. However, they are more invasive than other therapies and have been associated with complications including bladder perforation, ureter transection, and injury of pelvic vessels [6,10]. Recurrence can occur with closure of the fenestrated window in 6–15% of cases [6,24].

The ideal therapy for lymphoceles would be more effective and less invasive than traditional treatment methods (including sclerotherapy and surgical fenestration), with fewer complications and a lower chance of recurrence. Moreover, restoration of lymphatic circulation, broken by lymphadenectomy, is desired.

LVA is emerging as the treatment of choice for lymphedema of the extremities. Before the LVA operation was available, only conservative therapies, such as massage and compression garments, could be used for lymphedema. These techniques do not enable re-establishment of lymphatic fluid circulation into the venous system, but simply release it into the trunk lesion. Therefore, patients are never able to discontinue the therapy if they wish to reduce the edematous lesion. LVA was

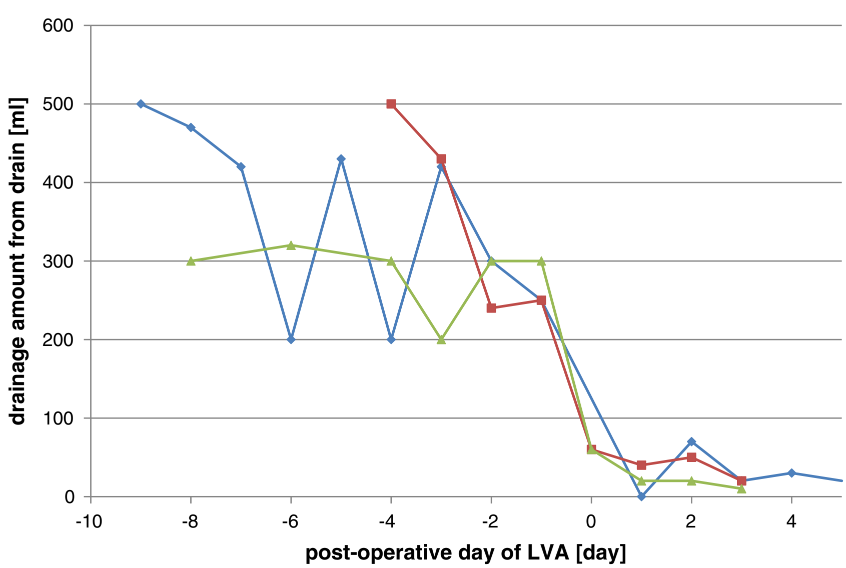

Fig. 2. Daily drainage from 3 patients who had preoperative placement of percutaneous drains. Note the dramatic decrease in drainage following LVA.

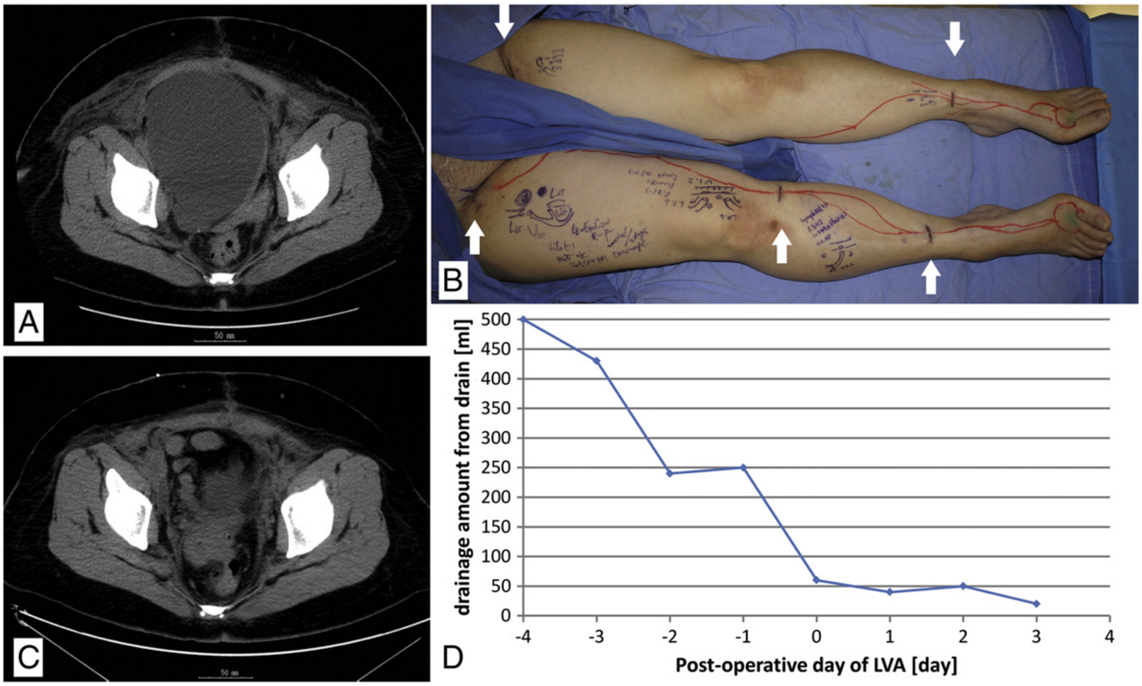

Fig. 3. Resolution of pelvic lymphocele after LVA. (A) CT scan of a large pelvic lymphocele after gynecologic surgery. (B) Immediate postoperative view. Seven anastomoses were performed through five 3-cm incisions under local anesthesia. (C) A CT scan of the same patient 3 days after LVA demonstrates complete resolution of the lymphocele. (D) The drainage chart of the same patient demonstrates large daily drainage volumes before LVA. Following LVA, the volume of fluid drained was dramatically reduced, and the drain was removed on postoperative day 4.

introduced as a new concept for lymphedema therapy [13–15]. The aim is to bypass proximal lymphatic blockages that cause congestion of lymphatic flow and thereby provide an alternative route for lymphatic fluid recirculation. Although the lymphatic channels normally have autokinetic movement because of smooth muscles, when the muscle damage due to lymphedema is irreversible, compression therapy is needed as an adjuvant therapy to direct lymphatic fluid into venulae. However, when the damage is dormant, the muscles react by pushing lymphatic fluid into the venous system. In this case, the patients do not need to receive any further adjuvant therapy.

In lymphoceles, the lymphatic flow from the lower limbs is similarly interrupted at the surgical region, where it flows into the cavity. This is illustrated in Fig. 4, where ICG injected into the dorsum of the feet is seen to escape into the percutaneous drainage catheter of a lymphocele. We reasoned that LVA would enable the lymphatic flow from the limbs to bypass the lymphocele, reducing its volume and preventing lymphatic flow into the lymphocele, thereby allowing spontaneous resolution. Our results supported this hypothesis, with total recovery in 6 of the 11 cases and improvement in the remaining 5 cases.

We believe that LVA has multiple advantages over the other methods currently used to treat lymphoceles. First, LVA is minimally invasive because it can be performed under local anesthesia and requires only 2 or 3 small skin incisions. Second, LVA is effective for

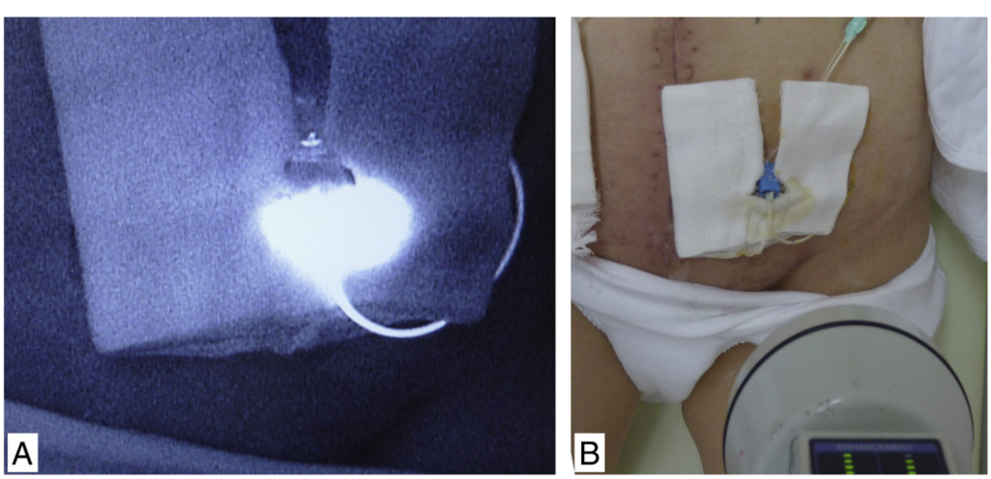

Fig. 4. Demonstration of lymphatic flow from the leg into a pelvic lymphocele. (A) Fluorescence lymphatic image of a percutaneous catheter, 5 min after injecting ICG into the first dorsal web space of the foot, indicates the lymphatic flow from the leg rapidly entering the lymphocele. It also indicates that the fluorescing root is the dominant lymphatic channel pouring into the lymphocele. (B) Conventional photograph of the same area. The Photodynamic Eye camera used to obtain the picture in (A) is seen at the bottom of the picture.

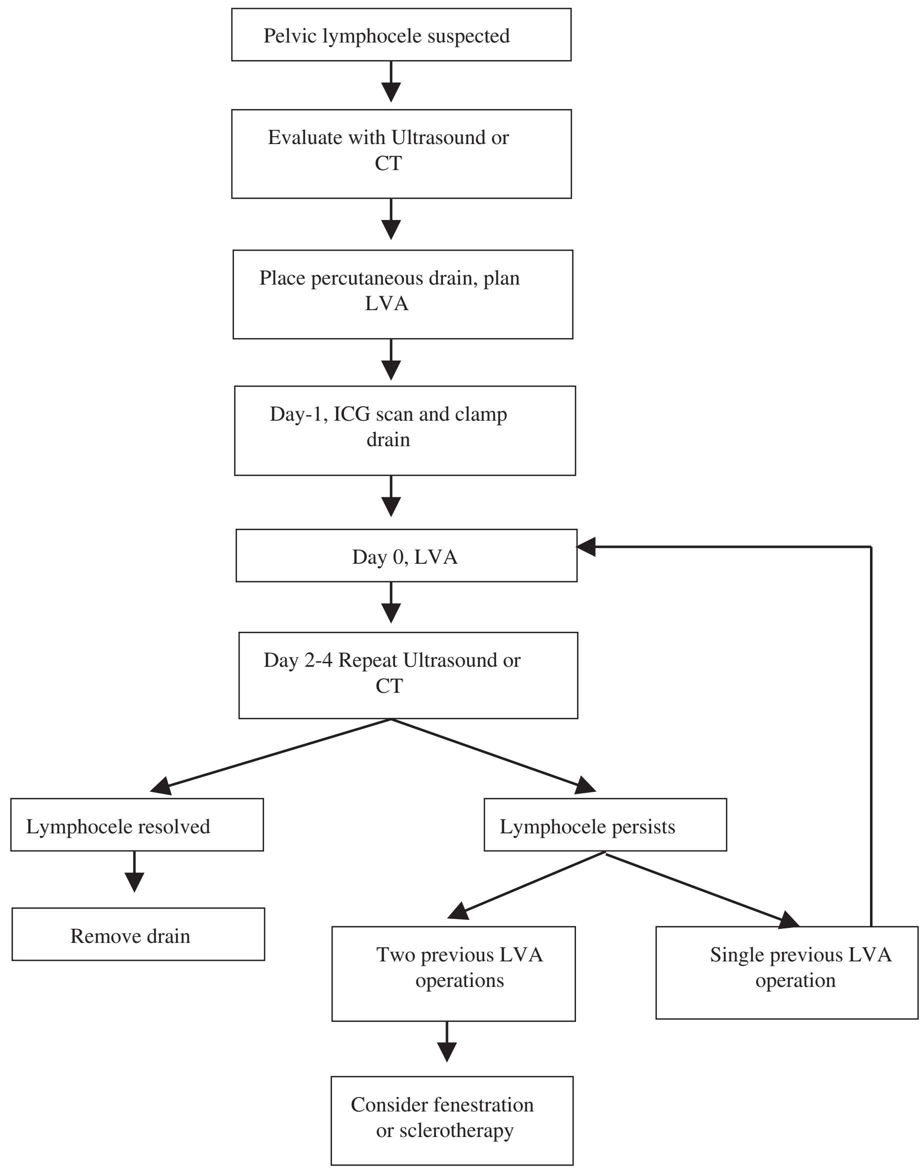

Fig. 5. Algorithm for the management of pelvic lymphocele.

all sizes of lymphocele. Third, LVA can prevent or improve lymphedema, which is a common complication of pelvic lymphadenectomy. This is in contrast to other techniques that resolve the fluid collection by blocking or sclerosing lymphatic channels, which may in itself provoke the development of lymphedema.

Our experience of reverse lymphatic flow with the valvular incompetence of lymphatic channels in lymphedema indicates that lymphatic flow into the lymphocele from places other than the leg may occur in a retrograde pattern into the leg's lymphatic channels and then into the venous system. Competent lymphatic valves may account for the partial failure of our technique, and we recommend that a percutaneous catheter be used to drain the remaining fluid if it is symptomatic.

Unfortunately, LVA is not perfectly effective for all patients. We suggest that the reason for this is that the lymphatic channels used for LVA are sometimes not the dominant lymphatic channels for the lymphoceles. In such cases, the lymphocele could diminish but not vanish. A second LVA might be able to locate the dominant lymphatic channel. Other therapies could also be used: LVA is an indirect approach to the lymphocele whereas other therapies approach lymphoceles directly. We present our algorithm for management of pelvic lymphoceles in Fig. 5.

In conclusion, our technique is minimally invasive and is performed under local anesthesia. It is therefore suitable for patients who have recently undergone major pelvic surgery. LVA should be considered as an initial therapy for lymphoceles because of its low invasiveness, high effectiveness, and ability to re-establish circulation of lymphatic flow. Further studies should be performed to compare LVA with other minimally invasive techniques, such as percutaneous catheter and sclerotherapy.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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