INTRODUCTION

Donor-site seromas are known to be the most common complication following latissimus dorsi (LD) flap transfer for breast reconstruction.1–6 The reasons for seroma formation remain unclear. Enlargement of a dead space has been considered to be a major factor favoring seroma formation since many seromas develop following excision of a large volume of tissue. Such mechanisms as disruption of lymph vessels and increased vascular permeability due to inflammatory cytokines in a dead space created by harvesting the LD flap have been suspected to be involved in seroma formation.1–5,7 It is also known that women above 50 years of age or with a body mass index of 23 or greater have increased risk for seroma formation.8

Various methods for preventing seromas have been evaluated including quilting the LD flap donor site,9 and local application of triamcinolone,10 OK-432,11 or fibrin glue.1,12 There seems to be high variability in seroma formation. A quilting technique that decreases the dead space has been shown to have a positive effect, but had very high seroma formation overall.13 Unfortunately, none of those techniques were effective to fully solve the problem.

Polyglycolic acid (PGA) is a biodegradable polymer that is hydrolyzed within 4–6 weeks after implantation. PGA elicits a local inflammatory reaction, with local increase in neutrophils and the inflammatory cytokine, interleukin-1α. The process ultimately leads to fibrosis and subsequent tissue adhesion within the implant site.7

Toward determining the potential value of using PGA in the LD donor site, we conducted a clinical study to investigate the incidence of postoperative seroma formation and resolution using a PGA fabric in the LD flap donor site.

MATERIALS AND METHODS

Case and Controls

This study was approved by the Institutional Review Board of Kindai University. The subjects (n = 20) were the patients who underwent the PGA implantation surgery between 2010 and 2016. Controls (n = 18) were randomly selected from the patients who underwent the surgery without PGA implantation between 2000 and 2010 and matched for the clinical profiles indicated in Table 1.

The study cohort consisted of 38 consecutive female patients who underwent LD flap reconstructions. Primary 1-stage breast reconstruction using an LD flap was performed on patients who underwent breast-conserving surgery of more than 2 regions or skin-sparing mastectomy. Sparing of the nipple and incision of the areola were

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simultaneously performed in patients with a tumor near the papilla.

Clinical Trial
Following breast reconstruction, the LD flap donor site was treated either with (PGA group, n = 20) or without the PGA fabric (control group, n = 18). For the PGA group, a 10 × 10 cm piece of PGA fabric (NEOVEIL, PGA 40 mg/cm³, Gunze Co., Kyoto, Japan) was placed within the incision of LD flap donor site. To prevent the fabric from shifting, its 4 corners were fixed with PGA sutures (4–0 Vicryl; Johnson & Johnson, North Ryde, NSW, Australia) into the underlying tissue (Fig. 1). Skin was closed over the PGA fabric using standard skin closure technique. A single suction drain (SB Drain; Sumitomo Bakelite, Tokyo, Japan) was inserted in the donor site as well as one for the reconstructed breast. A single drain was also installed in the axillary region if axillary dissection had been performed. Only the drainage from the donor site was measured and analyzed for this study. Postoperatively, these drains were removed when the fluid outflow decreased to less than 50 ml/d. Following removal of the drains, serous fluid was removed once weekly by needle aspiration on an outpatient basis.

Evaluation
The PGA group was compared with the control group for: (1) incidence of seromas formation; (2) drainage volume (discharge volume through the inserted drain to donor site); (3) aspiration volume (needle aspiration volume after drain removal); and (4) total discharge volume (drain and aspiration) from the time of seroma development until the time of its resolution. Resolution of seroma was defined as disappearance of serous fluid, which was confirmed by the absence of serous fluid accumulation for at least 2 consecutive weeks by ultrasound imaging.

Statistics
Comparison of seroma fluid measurements in the clinical trial underwent t tests. A P value of 0.05 was used to assign significance.

RESULTS
Table 1 summarizes the patient characteristics and surgical data with no statistically significant differences between the groups for incidence of seroma formation.

The mean total drainage volume was similar between the groups: 1,135 ml (530–1,730 ml) in the PGA group and 980 ml (645–1,650 ml) in the control group. The mean total aspiration volume in the PGA group, 192 ml (0–458 ml), was significantly less than that of the control group (438 ml, P < 0.05; Fig. 2). The mean volume of aspirated serous fluid, measures on a weekly basis, showed significant reduced volumes in the PGA group at 2, 3, and

Table 1. Patient Characteristics

|                | PGA (N = 20) | Control (N = 18) | P    |
|----------------|-------------|-----------------|------|
| Average age (y/o, minimum–maximum) | 45.4 (29–58) | 44.9 (35–58) | 0.85 |
| Mastectomy weight (g, minimum–maximum) | 234 (60–20) | 244 (66–40) | 0.83 |
| BMI (kg/m²) | 21.2 (17.3–28.8) | 21.7 (16.8–28) | 0.66 |
| Seroma formation (%) | 85 (17/20) | 94 (17/18) | 0.36 |

BMI, body mass index.

Fig. 1. Application of PGA fabric to the defect after LD harvest.
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4 weeks compared with those of the control group (Fig. 3). Drain removal was performed by 7.5 days postoperatively in the PGA group and 6.5 days in the control group. The mean time until seroma resolution was 4.1 weeks in the PGA group, whereas it was 6.3 weeks in the control group ($P < 0.01$; Table 2).

**DISCUSSION**

LD flaps are an effective procedure for use in breast reconstruction surgery. Donor-site seromas are known to be the most common complication with high incidence rates that can be extremely problematic to patients.\(^7\)

PGA is a biodegradable synthetic polymer that is degraded with release of glycolic acid, which elevates the local pH and causes inflammation.\(^7\) In a rat pneumothorax model, PGA caused adhesion of the chest wall and lung. Histological observations found macrophages, fibroblast proliferation, and small blood vessels 4 weeks after PGA implantation.\(^14\) On the basis of such induction of fibrosis, PGA has been used clinically in lung surgeries.\(^15\)

The goal of this study was to investigate whether a PGA fabric could be used to reduce the incidence of seroma formation and of time until seroma resolution in patients undergoing breast reconstruction. We found no significant differences in the incidence of seroma or the total discharge volume between the PGA and the control group. However, the PGA fabric showed a reduction in both the aspiration volume and the time until seroma resolution, demonstrating a degree of usefulness for minimizing seroma complications with application of a PGA fabric to the LD donor site. Long-term follow-up indicated that serous fluid accumulation occurred at more cephalad locations in the PGA group compared with the control group (data not shown), which suggests that fibrosis caused tissue adhesion within the site where the PGA fabric was applied. No significant signs of infection were observed in the drained serous fluids, and there were no serious complications in the PGA group that required further treatment.
From the standpoints of cost and effect balance, routine suction-drain device is less costly, but it is insufficient for seroma prevention. Incisional negative pressure wound therapy may work; however, it is not ideal, as the method requires secondary procedure with additional disadvantage of the high cost. Application of a PGA fabric is a simple and effective procedure with low cost, which makes the clinical application relatively safe and easy.

Although this application of a PGA fabric was found to be effective toward improving the postoperative donor-site recovery, the optimal size of the implant is not clear. We used a PGA fabric whose area was smaller than the actual area of the LD donor site. To fully control postoperative seroma, increasing the area of PGA coverage may lead to even better control or prevention of postoperative seroma formation. Further study is needed in this area.

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