

# Comparison between ultrasound-guided aspiration performed using an intravenous cannula or a conventional needle in patients with peri-prosthetic seroma

Jeeyeon Lee, MD, PhD<sup>a</sup>, Ho Yong Park, MD, PhD<sup>a,c</sup>, Wan Wook Kim, MD, PhD<sup>a</sup>, Chan Sub Park, MD, PhD<sup>a</sup>, Ryu Kyung Lee, MD<sup>a</sup>, Jung Dug Yang, MD, PhD<sup>b</sup>, Joon Seok Lee, MD, PhD<sup>b</sup>, Jin Hyang Jung, MD, PhD<sup>a,\*</sup>

## Abstract

**Background:** Peri-prosthetic seroma after implant insertion for breast reconstruction is a common but difficult-to-manage complication. This study aimed to compare peri-prosthetic seroma duration and the number of aspirations associated with intravenous cannula with those associated with conventional needle.

**Methods:** Seventy-one patients who underwent skin- or nipple-sparing mastectomy and implant insertion were treated for peri-prosthetic seroma. When peri-prosthetic seroma was detected, ultrasound-guided aspiration was performed either by using an intravenous cannula (n=35) or a conventional needle (n=36); however, the method adopted was randomly selected. We analyzed the participants' clinicopathologic factors after medical record review.

**Results:** There were no significant intergroup differences in mean age ( $P=.052$ ), mean body mass index ( $P=.601$ ), total clinical tumor size ( $P=.107$ ), pathologic tumor size ( $P=.269$ ), specimen weight ( $P=.147$ ), implant size ( $P=.313$ ), or operation time ( $P=.595$ ). However, the mean total peri-prosthetic seroma volume was significantly higher (105.80 vs 88.58,  $P=.015$ ) but the number of aspirations was lower (4.48 vs 5.80,  $P=.043$ ) in the intravenous cannula group than in the conventional needle group. Mean peri-prosthetic seroma volume per aspiration was nonsignificantly higher in the intravenous cannula group (26.92 vs 19.14,  $P=.291$ ).

**Conclusion:** Ultrasound-guided aspiration performed using an intravenous cannula was comparable to the procedure performed using a conventional needle. Furthermore, the former method can be safer and effective alternative to manage peri-prosthetic seroma.

**Abbreviations:** ADM = acellular dermal matrix, BIA-ALCL = breast implant-associated anaplastic large cell lymphoma.

**Keywords:** breast, prosthesis, seroma, aspiration

## 1. Introduction

Immediate or delayed breast reconstructions are options for oncoplastic surgery. While partial mastectomy with reconstruction was performed in most cases during the early developmental period of oncoplastic surgery, breast reconstruction after skin- or nipple-sparing mastectomy has recently become considerably popular.<sup>[1]</sup>

In breast reconstruction using implants, the implant is inserted into the cavity after dissecting between the pectoralis major muscle and the thoracic wall. If the created cavity is significantly smaller than the size of the breast implant, the patient may experience chest discomfort or nonspecific pain.<sup>[2]</sup> Contrastingly, if the cavity is significantly larger than the size of the breast implant, the implant may migrate or a peri-prosthetic seroma

Editor: Jimmy T. Efirid.

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (2014R1A5A2009242, 2019R1F1A1063853) and by a grant from the National R&D Program for Cancer Control, Ministry of Health and Welfare, Republic of Korea (1420040). Moreover, this research was supported by a grant of the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health & Welfare, Republic of Korea (HI17C1142). This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean government (MSIT) (NRF-2019R1A2C1006264).

The authors have no conflicts of interest to disclose.

<sup>a</sup> Department of Surgery, <sup>b</sup> Department of Plastic and Reconstructive Surgery, School of Medicine, Kyungpook National University, Kyungpook National University Chilgok Hospital, <sup>c</sup> Joint Institute for Regenerative Medicine, Kyungpook National University, Daegu, Republic of Korea.

\* Correspondence: Jin Hyang Jung, Department of Surgery, School of Medicine, Kyungpook National University, Kyungpook National University Chilgok Hospital, Hoguk-ro 807, Buk-gu, Daegu 41404, Republic of Korea (e-mail: jyh01@knu.ac.kr).

Copyright © 2019 the Author(s). Published by Wolters Kluwer Health, Inc.

This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

How to cite this article: Lee J, Park HY, Kim WW, Park CS, Lee RK, Yang JD, Lee JS, Jung JH. Comparison between ultrasound-guided aspiration performed using an intravenous cannula or a conventional needle in patients with peri-prosthetic seroma. *Medicine* 2019;98:51(e18511).

Received: 29 June 2019 / Received in final form: 4 October 2019 / Accepted: 9 November 2019

<http://dx.doi.org/10.1097/MD.00000000000018511>

may develop. Therefore, the creation of an appropriately sized implant cavity is important, and this can be controlled by the acellular dermal matrix (ADM) that usually covers the lateral to inferior portion of the cavity that does not have an overlying muscle.<sup>[3,4]</sup> After implant insertion for breast reconstruction, a drainage tube is usually inserted and negative pressure is applied to drain the peri-prosthetic seroma.

The drainage tube should be removed after 2 to 3 weeks owing to the increasing risk of an ascending infection that can lead to breast implant failure; the remaining peri-prosthetic seroma can be managed using ultrasound-guided aspiration.<sup>[5-7]</sup> Conversely, if the peri-prosthetic seroma is left unmanaged, the incidence of infection increases and the patient may experience a heavy sensation as well as functional problems. Cosmetic outcomes may worsen because of breast asymmetry.<sup>[8]</sup>

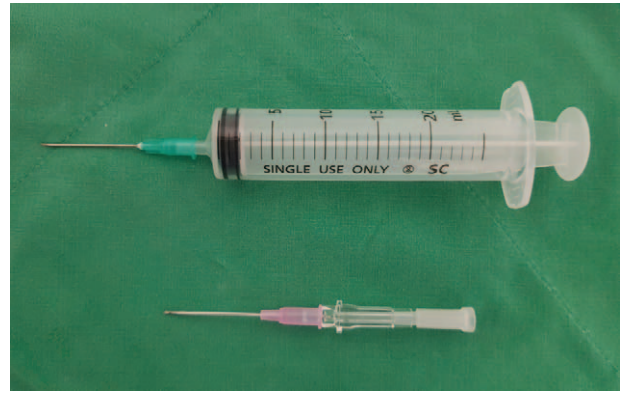
We have previously reported a procedural technique performed using an intravenous cannula to aspirate peri-prosthetic seroma.<sup>[5]</sup> Here, we compared the clinical outcomes of aspiration techniques performed using an intravenous cannula with the outcomes of those performed using a conventional needle.

## 2. Patients and methods

### 2.1. Patients

Between January 2017 and June 2018, a total of 106 patients with breast disease underwent skin- or nipple-sparing mastectomy with immediate breast reconstruction using an implant with or without a latissimus dorsi flap. The drainage tube inserted into the implant cavity was maintained for 14 to 21 postoperative days and removed before the 21st day regardless of the drained volume. The institutional review board of the Chilgok Kyungpook National University Hospital approved the study (2017-04-020). Moreover, a written informed consent was obtained from all patients before registration, in accordance with the Declaration of Helsinki.

A total of 84 patients who complained of discomfort around the implant or in whom the volume of the drained seroma was >10 mL/d when the drainage tube was removed underwent ultrasonography for assessing peri-prosthetic seroma. Among them, 71 patients showed a significant volume (>20 cc) of



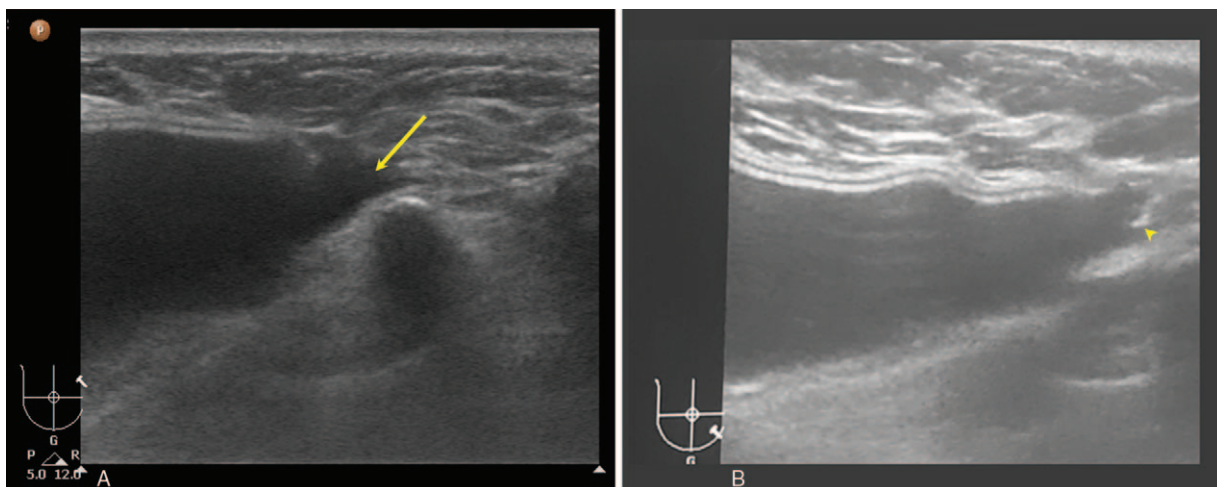
**Figure 1.** Two different devices used for the aspiration of peri-prosthetic seroma. A syringe with a conventional needle (upper) and an intravenous catheter (lower).

peri-prosthetic seroma drainage that may lead to discomfort or pain and underwent an aspiration procedure using an intravenous cannula ( $n=35$ ) or conventional needle ( $n=36$ ) (Fig. 1). The device was randomly selected by physicians, and we prospectively recorded the number of aspirations and total volume of the aspirated seroma.

Based on the clinical records, the patient's underlying disease, histopathologic findings, disease status, additional treatments, total amount of drained seroma during admission, and drainage tube insertion duration were evaluated.

### 2.2. Procedures

A circumferential space around the implant was assessed in a clockwise direction using ultrasonography, and the drainage procedure was determined when the longest diameter of the serous fluid was >2 cm. Once the procedure was chosen, an intravenous catheter or a 10-mL syringe with an 18-G needle was used to puncture betadine-sterilized skin until the needle tip entered the seroma cavity (Fig. 2). Subsequently, the advancement of the intravenous catheter or conventional needle was stopped immediately. In the intravenous catheter group, the guide needle was



**Figure 2.** Ultrasonographic findings of aspiration procedure for peri-prosthetic seroma. (A) Postoperative seroma is clearly visible in the peri-prosthetic space (arrow) and the implant capsule (arrow) and is easily distinguishable from the implant cavity. (B) Freshly punctured peri-prosthetic space by a needle tip (arrow head).

removed, the plastic sheath was advanced, a 20-mL syringe was connected to the plastic sheath, and seroma was aspirated. In the conventional needle group, the seroma was aspirated directly after careful insertion of the needle tip into the seroma cavity to prevent puncture of the breast implant.

Changes in the peri-prosthetic seroma and breast implant were continuously monitored during the procedure using ultrasonography. When the seroma was completely aspirated, the intravenous cannula and conventional needle were removed and the punctured site was compressed with an aseptic gauze. After no additional bleeding or oozing was confirmed, the bandage was applied. The procedure was repeated every 5 to 7 days according to the aspirated volume of peri-prosthetic seroma. When the serous fluid was <10 mL for 7 days, the procedure was stopped. No antibiotics or analgesics were administered to the patients.

**2.3. Statistical analysis**

The statistical analysis was performed using SPSS 12.0 (SPSS, Chicago, IL). The Mann–Whitney *U* test was used for continuous variables, whereas the  $\chi^2$  test was used for categorical variables. Values of *P* < .05 were considered to be statistically significant. Even if the preliminary analysis was not actually conducted before this study, we could obtain a brief result from our previous study.<sup>[5]</sup>

**3. Results**

The mean age and body mass index of the patients were 49.38 years ( $\pm 9.52$ ) and 23.41 kg/m<sup>2</sup> ( $\pm 4.27$ ) in intravenous cannula group and 46.19 years ( $\pm 8.19$ ) and 22.99 kg/m<sup>2</sup> ( $\pm 1.45$ ) in the conventional needle group, respectively. One patient in the conventional group had borderline phyllodes tumor, whereas the others had ductal breast cancer. In the intravenous cannula and conventional needle groups, the mean total clinical tumor size was 4.42 cm ( $\pm 3.02$ ) and 4.63 cm ( $\pm 3.34$ ), while the pathologic tumor size was 4.13 cm ( $\pm 0.71$ ) and 3.98 cm ( $\pm 0.89$ ), respectively. None of the clinical variables differed significantly between the 2 groups. Histologic variables including estrogen receptor status, progesterone receptor status, and HER2/neu gene status as well as treatment

**Table 1**  
**Clinicopathologic factors for patients who underwent nipple- or skin-sparing mastectomy with immediate breast reconstruction using a breast implant.**

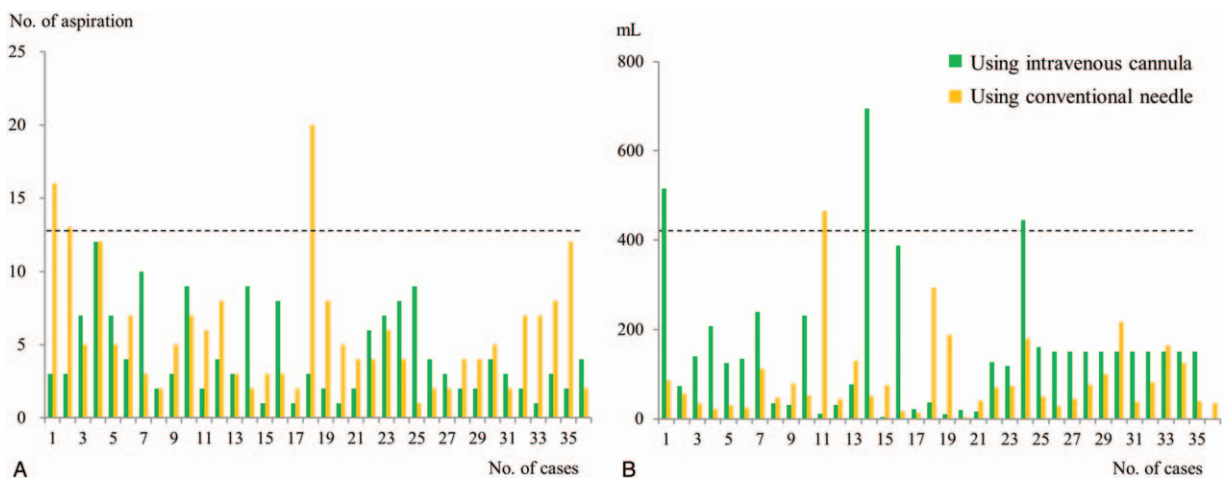
Variable	Intravenous cannula (n=35)	Conventional needle (n=36)	P-value
Age, yr	49.28 $\pm$ 9.52	46.19 $\pm$ 8.19	.052
Body mass index, kg/m <sup>2</sup>	23.41 $\pm$ 4.27	22.99 $\pm$ 1.45	.601
Tumor type			.809
Borderline phyllodes tumor	0	1 (2.8)	
Invasive ductal carcinoma	14 (40.0)	10 (27.8)	
Ductal carcinoma in situ	21 (60.0)	25 (69.5)	
Total extent of clinical tumor size, cm	4.42 $\pm$ 3.02	4.63 $\pm$ 3.34	.107
Total extent of pathologic tumor size, cm	4.13 $\pm$ 0.71	3.98 $\pm$ 0.89	.269
Multifocality	8 (32.0)	9 (25.0)	.732
Estrogen receptor, positive	29 (82.9)	23 (63.9)	.064
Progesterone receptor, positive	24 (68.6)	21 (58.3)	.153
HER2 gene, positive	7 (20.0)	8 (22.2)	.846
Adjuvant chemotherapy	12 (34.3)	8 (22.2)	.543
Adjuvant hormone therapy	24 (68.6)	21 (58.3)	.071

Data are presented as mean  $\pm$  standard deviation or n (%).

variables including chemotherapy or hormone therapy did not show any significant inter-group differences (Table 1).

Between the 2 groups, there were no statistically significant differences in surgery type adopted for treating breast and axillary lymph nodes (*P* = .840 and .168, respectively). Although the surgical time was longer, specimen weight was heavier, and breast implant size was larger in the conventional needle group, the differences were not significant (*P* = .595, .147, .313, respectively). The tube drainage duration, total drained seroma volume, and mean drained seroma volume per day did not differ significantly between the 2 groups.

Although the mean seroma volume drained by the aspiration procedure did not differ significantly between the 2 groups, the number of aspiration and total volume of peri-prosthetic seroma by aspiration procedure were significantly higher in the intravenous cannula group (*P* = .043 and .015, respectively) (Fig. 3). The mean interval of the aspiration procedure was



**Figure 3.** Comparison between ultrasound-guided aspiration performed using an intravenous cannula and that performed using a conventional needle in patients with peri-prosthetic seroma. (A) Number of times ultrasound-guided aspiration was performed using an intravenous cannula or a conventional needle. (B) Total volume of ultrasound-guided aspiration performed using an intravenous cannula or a conventional needle.

**Table 2**  
**Procedure-related factors for patients who underwent nipple- or skin-sparing mastectomy with immediate breast reconstruction using a breast implant.**

Variables	Intravenous cannula (n = 35)	Conventional needle (n = 36)	P-value
Type of surgery			.840
Nipple- or skin-sparing mastectomy with implant insertion	33 (94.3)	33 (91.7)	
Nipple- or skin-sparing mastectomy with latissimus dorsi flap and implant insertion	2 (5.7)	3 (8.3)	
Axillary surgery			.168
Sentinel lymph node biopsy	32 (91.4)	31 (86.1)	
Axillary lymph nodes dissection	3 (8.6)	4 (11.1)	
Operation time, min	279.84 ± 96.77	308.11 ± 109.50	.595
Weight of specimen, g	313.50 ± 185.78	320.45 ± 194.41	.147
Implant size, cc	239.47 ± 91.57	263.85 ± 81.79	.313
Duration of tube drainage, d	12.14 ± 5.09	13.83 ± 5.29	.319
Total volume of drained seroma during tube drainage, mL	691.54 ± 503.09	741.26 ± 595.20	.194
Volume of drained seroma during tube drainage, mL/d	54.79 ± 22.61	78.19 ± 30.34	.095
Number of aspiration procedure	4.48 ± 4.10	5.80 ± 4.24	.043
Total volume of aspirated seroma, mL	105.80 ± 179.15	88.58 ± 90.53	.015
Mean volume of aspirated seroma, mL/time	26.92 ± 33.63	19.14 ± 16.47	.291
Interval of aspiration procedure, d	6.54 ± 1.02	6.19 ± 0.21	.408
Post-procedural complication, hematoma	0	1 (2.8)	.167

Data are presented as mean ± standard deviation or n (%).

similar between the 2 groups, and there was 1 case of a post-procedural complication (hematoma, 2.8%) in the conventional needle group (Table 2).

#### 4. Discussion

Oncoplastic breast surgery has become a standard surgical treatment for breast cancer. This novel concept includes both breast reconstruction after partial mastectomy using various pedicles or free flaps and breast reconstruction after nipple- or skin-sparing mastectomy with or without implant use.<sup>[9]</sup> For breast reconstruction using a tissue expander or breast implant, the cavity is formed on the subpectoral area and the ADM can cover the inferolateral portion of the cavity that lacks the pectoralis muscle.<sup>[10]</sup>

If the implant cavity cannot completely fit the implant size, a peri-prosthetic seroma can occur after breast reconstruction is performed using a tissue expander or an implant.<sup>[11]</sup> If the peri-prosthetic seroma cannot be drained appropriately, the incidence of a postoperative complication would be higher.<sup>[12–14]</sup> Although a closed suction drain located in the implant cavity is very helpful for draining peri-prosthetic seroma, its removal is recommended after approximately 2 weeks because of a higher incidence of an ascending infection that can lead to implant infection and breast reconstruction failure.<sup>[8,15–17]</sup>

To aspirate the peri-prosthetic seroma, Becker et al. used a blunt SeromaCath to prevent breast implant injury.<sup>[18]</sup> They reported that the aspiration technique with a blunt needle is effective for treating seroma and is associated with a minimal risk of implant damage or perforation. However, it was difficult to puncture the skin and the fascia of overlying muscles using a blunt needle, and no specific comparisons were made with the aspiration procedure performed using a conventional needle. In a recent study, the authors compared the effectiveness of managing peri-prosthetic seroma using an intravenous cannula with that using a conventional needle. Because the operator was a physician well-trained in ultrasonography, there were no complications associated with implant damage or perforation in either group. However, the peri-prosthetic seroma was

completely aspirated using the intravenous cannula because it is safer than the conventional needles; this result ultimately reduced the number of aspiration procedures, suggesting earlier recovery, even if the difference was not statistically significant. Further studies involving large-scale breast reconstructions performed using implants are necessary to compare the efficacy of the 2 different aspiration techniques.

The incidence of breast reconstruction using implants has been increasing steadily in the recent years.<sup>[19–22]</sup> Many techniques reportedly prevent the occurrence of postoperative complications, but some problems remain unsolved. Most physicians can use ultrasonography to manage postoperative complications after performing breast reconstruction using implants. A peri-prosthetic seroma can also be easily treated with an ultrasound-guided aspiration technique.<sup>[14,23,24]</sup> However, to minimize damage to breast prosthesis, the physician should be skillful and the device should be safe.

Recently, the breast implant-associated anaplastic large cell lymphoma (BIA-ALCL) has become a clinical issue in patients who undergo implant-based breast reconstruction.<sup>[25–27]</sup> Even if the removal of seroma via aspiration technique during the perioperative period does not reduce the risk of BIA-ALCL,<sup>[28]</sup> the aspiration technique should be easily accessed by any physicians for distinguishing between the remaining benign and malignant seroma.

However, there are several limitations in our study. First, the sample size is not big enough to perform an accurate statistical analysis. However, because there is no specific reference regarding our study, accurate calculation of sample size was impossible. Therefore, we decided on a sample size only to determine whether intravenous cannula technique is comparable with the conventional technique. Second, the procedural result could be different according to the experience of the technician who performs the procedure. However, it has been confirmed that intravenous cannula is safer than a conventional needle with regard to post-procedural complications including injury and implant rupture.

In conclusion, here we found that ultrasound-guided aspiration performed using an intravenous cannula was not inferior to

the procedure performed using a conventional needle. Furthermore, the former technique can be safer and can effectively manage peri-prosthetic seroma; this procedure can be easily performed even by novices and hence, is more useful.

### Author contributions

**Conceptualization:** Jeeyeon Lee, Joon Seok Lee, Jin Hyang Jung.

**Data curation:** Ho Yong Park, Chan Sub Park, Ryu Kyung Lee.

**Formal analysis:** Ho Yong Park, Chan Sub Park, Ryu Kyung Lee.

**Funding acquisition:** Ryu Kyung Lee.

**Investigation:** Chan Sub Park, Ryu Kyung Lee, Jin Hyang Jung.

**Methodology:** Chan Sub Park, Ryu Kyung Lee, Joon Seok Lee, Jin Hyang Jung.

**Project administration:** Jung Dug Yang, Joon Seok Lee, Jin Hyang Jung.

**Resources:** Jung Dug Yang, Jin Hyang Jung.

**Supervision:** Ho Yong Park, Wan Wook Kim, Jin Hyang Jung.

**Validation:** Jung Dug Yang.

**Visualization:** Jung Dug Yang.

**Writing – original draft:** Jeeyeon Lee.

**Writing – review and editing:** Jeeyeon Lee, Jin Hyang Jung.

Jeeyeon Lee orcid: 0000-0003-1826-1690.

### References

- [1] Kummerow KL, Du L, Penson DF, et al. Nationwide trends in mastectomy for early-stage breast cancer. *JAMA Surg* 2015;150:9–16.
- [2] Lu LB, Shoaib BO, Patten BM. Atypical chest pain syndrome in patients with breast implants. *South Med J* 1994;87:978–84.
- [3] Lee KT, Mun GH. A meta-analysis of studies comparing outcomes of diverse acellular dermal matrices for implant-based breast reconstruction. *Ann Plast Surg* 2017;79:115–23.
- [4] Potter S, Browning D, Savovic J, et al. Systematic review and critical appraisal of the impact of acellular dermal matrix use on the outcomes of implant-based breast reconstruction. *Br J Surg* 2015;102:1010–25.
- [5] Jeon HJ PH, Jung JH, Kim WW, et al. Usefulness of ultrasound-guided aspiration using intravenous cannulas for patients with peri-prosthetic seroma. *J Surg Ultrasound* 2017;4:18–24.
- [6] Pittet B, Montandon D, Pittet D. Infection in breast implants. *Lancet Infect Dis* 2005;5:94–106.
- [7] Handel N, Cordray T, Gutierrez J, et al. A long-term study of outcomes, complications, and patient satisfaction with breast implants. *Plas Reconstr Surg* 2006;117:757–67.
- [8] Araco A, Gravante G, Araco F, et al. A retrospective analysis of 3,000 primary aesthetic breast augmentations: postoperative complications and associated factors. *Aesthetic Plast Surg* 2007;31:532–9.
- [9] Piper M, Peled AW, Sbitany H. Oncoplastic breast surgery: current strategies. *Gland Surg* 2015;4:154–63.
- [10] Breuing KH, Colwell AS. Immediate breast tissue expander-implant reconstruction with inferolateral AlloDerm hammock and postoperative radiation: a preliminary report. *Eplasty* 2009;9:e16.
- [11] Cordeiro PG, Jazayeri L. Two-stage implant-based breast reconstruction: an evolution of the conceptual and technical approach over a two-decade period. *Plast Reconstr Surg* 2016;138:1–1.
- [12] Chun YS, Verma K, Rosen H, et al. Implant-based breast reconstruction using acellular dermal matrix and the risk of postoperative complications. *Plast Reconstr Surg* 2010;125:429–36.
- [13] Pinchuk V, Tymofii O. Seroma as a late complication after breast augmentation. *Aesthetic Plast Surg* 2011;35:303–14.
- [14] Brzeziński MA, Jarrell JAt, Mooty RC. Classification and management of seromas in immediate breast reconstruction using the tissue expander and acellular dermal matrix technique. *Ann Plast Surg* 2013;70:488–92.
- [15] Ollech CJ, Block LM, Afifi AM, et al. Effect of drain placement on infection, seroma, and return to operating room in expander-based breast reconstruction. *Ann Plast Surg* 2017;79:536–40.
- [16] Woo KJ, Paik JM, Mun GH, et al. Analysis of factors influencing drain amount, time to drain removal, and seroma formation in patients undergoing immediate expander-implant breast reconstruction. *J Plast Surg Hand Surg* 2018;52:53–9.
- [17] Citron I, Dower R, Ho-Asjoe M. Protocol for the prevention and management of complications related to ADM implant-based breast reconstructions. *GMS Interdiscip Plast Reconstr Surg DGPW* 2016;5: Doc06.
- [18] Becker H, Klimczak J. Aspiration of periprosthetic seromas using the blunt SeromaCath. *Plast Reconstr Surg* 2016;137:473–5.
- [19] Alborno CR, Bach PB, Mehrara BJ, et al. A paradigm shift in U.S. Breast reconstruction: increasing implant rates. *Plast Reconstr Surg* 2013;131: 15–23.
- [20] Hong KY, Son Y, Chang H, et al. Trends in breast reconstruction: implications for the national health insurance service. *Arch Plast Surg* 2018;45:239–45.
- [21] Huang NS, Quan CL, Ma LX, et al. Current status of breast reconstruction in China: an experience of 951 breast reconstructions from a single institute. *Gland Surg* 2016;5:278–86.
- [22] Cemal Y, Alborno CR, Disa JJ, et al. A paradigm shift in U.S. breast reconstruction: part 2. The influence of changing mastectomy patterns on reconstructive rate and method. *Plast Reconstr Surg* 2013;131:320e–6e.
- [23] Moyer KE, Potochny JD. Technique for seroma drainage in implant-based breast reconstruction. *J Plast Reconstr Aesthet Surg* 2012;65:1614–7.
- [24] Michelotti BF, Brooke S, Mesa J, et al. Analysis of clinically significant seroma formation in breast reconstruction using acellular dermal grafts. *Ann Plast Surg* 2013;71:274–7.
- [25] Kaartinen I, Sunela K, Alanko J, et al. Breast implant-associated anaplastic large cell lymphoma - from diagnosis to treatment. *Eur J Surg Oncol* 2017;43:1385–92.
- [26] Clemens MW, Brody GS, Mahabir RC, et al. How to diagnose and treat breast implant-associated anaplastic large cell lymphoma. *Plast Reconstr Surg* 2018;141:586e–99e.
- [27] Collins MS, Miranda RN, Medeiros LJ, et al. Characteristics and treatment of advanced breast implant-associated anaplastic large cell lymphoma. *Plast Reconstr Surg* 2019;143I 3S:41s–50s.
- [28] Ronchi A, Montella M, Argenzio V, et al. Diagnosis of anaplastic large cell lymphoma on late peri-implant breast seroma: management of cytological sample by an integrated approach. *Cytopathology* 2018;29:294–9.