Aesth Plast Surg (2019) 43:1152–1157
https://doi.org/10.1007/s00266-019-01433-2

ORIGINAL ARTICLE BREAST SURGERY

The Vacuum-Assisted Breast Biopsy System is an Effective Treatment Strategy for Breast Lumps After Augmentation with Autologous Fat Grafting

Shaohua Qu[1] · Wei Zhang[1,2] · Jie Zhang[3] · Qing Zhang[1] · Rongzhao Lu[1] · Ningxia Wang[1]

Received: 14 May 2019 / Accepted: 18 June 2019 / Published online: 1 July 2019

Abstract

Background With the extensive application of autologous fat grafting (AFG) to the breasts, postoperative complications such as breast lumps attract high attention. Breast lumps greatly reduce patient satisfaction and bring mental stress. However, there are few detailed reports about minimally invasive treatment strategies for breast lumps after AFG. Our study aimed to investigate the effectiveness of the vacuum-assisted breast biopsy (VABB) system for patients with lumps after AFG.

Materials and Methods We retrospectively reviewed 37 patients with breast lumps between April 2015 and January 2019. The characteristics of patients and breast lumps were analyzed. Breast lumps were classified into four types, including cystic, solid, complex and calcification. The vacuum-assisted breast biopsy (Mammotome and Encor) was performed for the patients with lumps after AFG. The efficacy, safety, complications and patient satisfactions were recorded during postoperative follow-up periods.

Results Under the guidance of ultrasound, the breast lumps could be thoroughly and accurately excised by the vacuum-assisted biopsy system. No patient experienced breast infections or major complications requiring treatment. Hematoma was observed in only 2 patients and gradually resolved without any special management. With a median follow-up of 29 months, no recurrence was observed. Furthermore, there were no statistical differences in duration of the procedures and complications between the two VABB systems. All the patients recovered well and were satisfied with the cosmetic outcome.

Conclusion The vacuum-assisted breast biopsy system can be used as an effective and minimally invasive approach for the surgical management of lumps after AFG.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Vacuum-assisted breast biopsy system · Breast lumps · Autologous fat grafting

Introduction

Breast augmentation with autologous fat grafting (AFG) was first reported by Bircoll in 1987 [1]. In 2009, the American Society of Plastic Surgeons (ASPS) announced that autologous fat grafting can be used for breast augmentation after the safety and efficiency was proven by Coleman et al. [2, 3]. During the next 10 years, the technology has developed rapidly [4]. Autologous fat grafting to breasts is an easy day-case procedure, leaves minimal scars and creates no foreign body reactions [5]. Nowadays,

Shaohua Qu and Jie Zhang have contributed equally to this article.

✉ Shaohua Qu
qushaohua2009@163.com

[1] Department of Breast Surgery, The First Affiliated Hospital of Jinan University, Jinan University, 613# Huangpu Road West, Tianhe District, Guangzhou 510630, China

[2] Guangdong Provincial Key Laboratory of Malignant Tumor Epigenetics and Gene Regulation, Breast Tumor Center, Sun Yat-Sen Memorial Hospital, Sun Yat-Sen University, Guangzhou, China

[3] Department of Reproductive Medical Center, Guangdong Women and Children Hospital, 521# Xingnan Road, Panyu District, Guangzhou, China

breast augmentation by AFG is widely performed not only in plastic surgery clinics for healthy women but also as a reconstructive surgery for breast cancer patients after mastectomy [6–9].

However, with the extensive applications of breast augmentation with AFG, a range of reported postoperative complications such as breast lumps, fat necrosis, infection and hardness attract high attention [10]. Breast lumps are one of the most common complications after AFG, which affects the further application of this technology in the field of breast plastic surgery. Previous studies revealed that breast lumps were observed in about 8–25% of the patients [9, 11]. Breast lumps significantly reduce patient satisfaction and cause physical or psychological discomfort. Thus, it is urgent to develop efficient strategies to manage these complications. Unfortunately, there are few detailed reports about minimally invasive treatment strategies for breast lumps after breast augmentation with AFG.

The minimally invasive biopsy system, such as Mammotome and Encor, is a vacuum-assisted breast biopsy system (VABB) that can be used for diagnostic biopsy and management of breast disease [12–16]. It is an effective tool to completely excise benign breast lesions such as fibroadenoma and obtain enough suspicious malignant tissues for pathological diagnosis with minimal invasion. Recently, the vacuum-assisted breast biopsy system has been demonstrated to be an effective tool to treat other breast diseases, such as breast abscesses, accessory breast and benign gynecomastia [14, 17]. However, there are few studies on its application in resecting breast lumps after augmentation with AFG.

In this study, we investigated the clinical efficacy of the VABB system in patients with breast lumps after AFG.

Materials and Methods

Patients

Thirty-seven patients who had noticed breast lumps after AFG were recruited retrospectively at the first affiliated hospital of Jinan University between April 2015 and January 2019. A detailed medical history and thorough physical examinations were performed, and none of the patients had a significant past history or chronic illness. The present study was approved by the ethics review board of the first affiliated hospital of Jinan University. The breast lumps were classified into four types according to ultrasound results: cystic lumps, complex lumps, solid and calcification lumps. Cystic lumps contained only oily components and solid lumps contained almost all solid components, whereas complex lumps consisted of mixed oily and solid components. Calcification lumps were defined as those with widespread calcification of the capsule or components. Breast lumps were detected using ultrasound and categorized according to the Breast Imaging Reporting and Data System (BI-RADS). The location, size, number and nature of the lumps were recorded and analyzed.

Main Equipment

The Mammotome biopsy system with an 8G probe (Johnson & Johnson Corp., New Brunswick, NJ) and the EnCor biopsy system with a 7G probe (EnCor®, SenoRx, Aliso Viejo, CA) were used in the present study. Ultrasound (ALOKA, IPE-1701B, Tokyo, Japan) was applied to guide the location of breast lumps.

Procedure of the Treatment with the Vacuum-Assisted Breast Biopsy System

The location of breast lumps was marked under preoperative ultrasound guidance. The patient was placed in a supine position on the operating table with arms abducted. After local anesthesia (1% lidocaine or 1% procaine containing a 1:100,000 mixture of epinephrine) was injected to the excision site and around the lumps, a 5-mm skin incision was made that was positioned either anterior to the axillary line or just inferior or lateral to the identified lesions. Under ultrasound monitoring, the probe was positioned beneath the lumps, completely removing the lump as well as a small section of the surrounding tissues. Vacuum suction was performed especially for those cystic or complex lumps where necessary. The procedure was completed when the ultrasound confirmed no residual lesions. Manual compression and pressure bandage wraps were applied over the wound for 48 h to minimize the occurrence of hematomas. Paraffin sections (4 μm) of removed tissues were stained with hematoxylin and eosin (H&E) for histopathological assessment. Pathological diagnosis was verified by two different pathologists.

Follow-up

The first follow-up visit occurred 3 days after the minimally invasive surgery to evaluate complications. All patients were seen in the out-patient clinic 3 months and 6 months postoperatively, and ultrasound examinations were conducted to evaluate whether there were any residual or recurrence in the breasts. All patients were advised to undergo clinical follow-up with routine evaluation every 6 months thereafter.

Statistical Analysis

In this study, SPSS 20.0 (SPSS Inc, Chicago, IL) was used for statistical analysis. Data were expressed as the mean ± SD. Student's t test and Chi-square test were applied to analyze the statistics between groups, and a p value < 0.05 was considered statistically significant in all cases.

Results

Characteristics of Patients and Lumps

The median patient age was 29 years, median lump size was 2.3 cm, and median number of lumps was four. The median time from breast augmentation surgery to lump diagnosis was 13 months. The prevalence of each lump type was as follows: cystic in 4 patients (11%), complex in 9 patients (24%), solid in 18 patients (49%) and calcification in 6 patients (16%). Among the 37 patients, 4 (11%) patients were classified as BI-RADS grade 2, 20 (54%) as BI-RADS grade 3 and 13 (35%) as BI-RADS grade 4 (Table 1).

The breast lumps were classified into four types according to ultrasound results (Fig. 1). The median lump size was 1.8 cm for the cystic type, 2.6 cm for the complex type, 2.3 cm for the solid type and 3.0 cm for the calcification type. Cystic lumps tended to be smaller compared to the other types. The mean number of lumps per patient was 4 for the cystic type, 6 for the complex type, 5 for the solid type and 3 for the calcification type. The formation of calcification type was longer than the other types (Table 2).

Table 1 Clinical characteristics of patients (n = 37)

Age (y)	29
Size (cm)	2.3
Number	4
Time from AFG (months)	13
Type of lumps	
Cystic	4 (11%)
Complex	9 (24%)
Solid	18 (49%)
Calcification	6 (16%)
BI-RADS	
2	4 (11%)
3	20 (54%)
4	13 (35%)

All Patients were Cured by the Vacuum-Assisted Breast Biopsy System with No Serious Complications

The Mammotome biopsy system was applied in 17 patients and the Encor system was used in 20 patients. There were no statistically significant differences between the two systems according to the mean age and the mean size of the lesions. Furthermore, there was no significant difference in the duration of the procedures between the two systems. In addition, there were no serious complications. No patient experienced breast infections or major complications requiring treatment. Hematoma was observed in 2 patients and gradually resolved without any special management during the follow-up period (Table 3). Both systems were effective and safe to completely remove the breast lumps. All patients recovered well and were satisfied with the cosmetic results. Final pathological examination results reveal that all the lumps were benign and the majority of the lumps were diagnosed as granulomatous inflammation, fat necrosis and calcification.

Patient Follow-up

Postoperative evaluation was made by both the patients and the surgeons at follow-up visits. Patient satisfaction, recurrence, hematomas, infection and scar were evaluated. The 3-day postoperative follow-up examination showed that the wound scars were small with no infection. The ultrasound examinations, which were performed at 3 months after the operation, revealed that all the preoperative lesions had been removed accurately and thoroughly. However, with a median follow-up of 29 months, breast lumps were observed in 2 patients in novel locations, which were different from the preoperative locations. Both the two patients refused further excision of the new lumps. Incision scars were nearly invisible 6 months after the procedure. All the patients recovered well and were satisfied with the cosmetic outcome. After the 6-month follow-up, most of the patients underwent annual routine evaluations.

Discussion

In this study, the clinical efficacy of vacuum-assisted breast biopsy systems in treating breast lumps after augmentation with AFG was retrospectively investigated. We found that both the two vacuum-assisted breast biopsy systems, Mammotome and Encor, could thoroughly remove the lumps without serious complications. To our knowledge, this is the first time that the application of the VABB system to resect breast lumps after AFG has been reported.

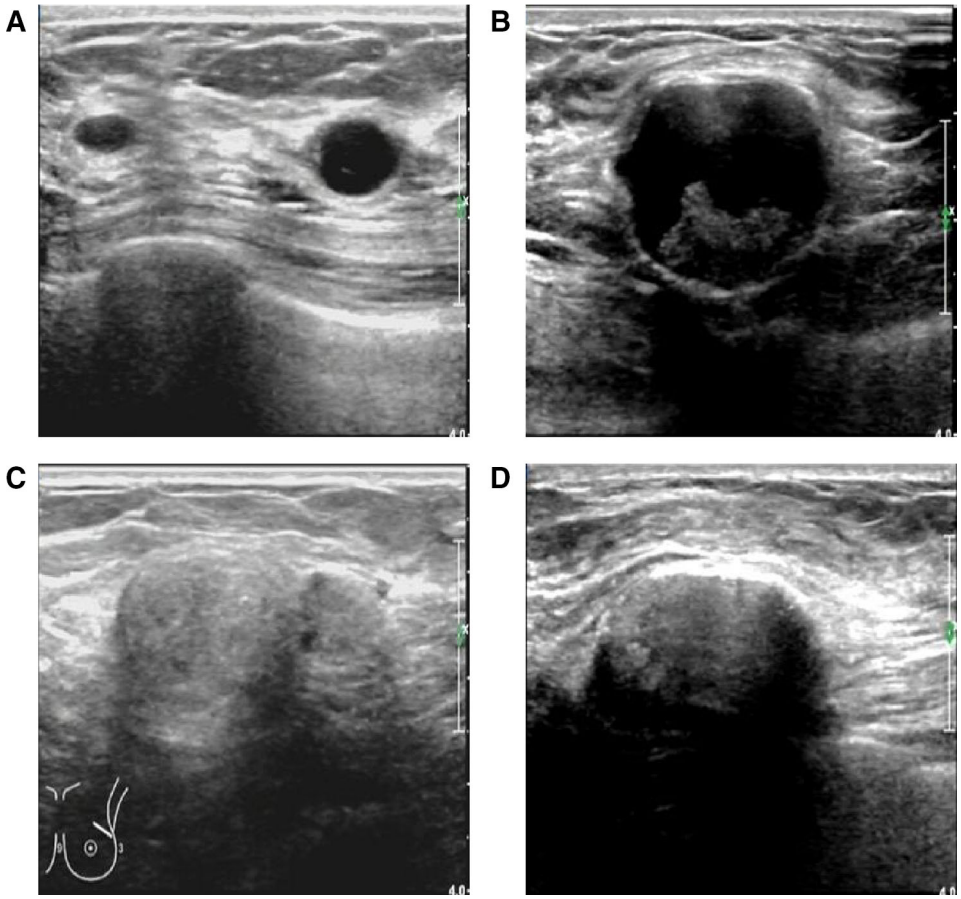

Fig. 1 Four types of breast lumps after autologous fat grafting. **a** Cystic type. **b** Complex type. **c** Solid type. **d** Calcification type

Table 2 Characteristics of breast lumps (n = 37)

	Median size (cm)	Median number	Median time from AFG (m)	BI-RADS classification		
				2	3	4a
Cystic	1.8	4	10	4	0	0
Complex	2.6	6	22	0	6	3
Solid	2.3	5	13	0	12	6
Calcification	3.0	3	27	0	2	4

Table 3 Comparison between the two different vacuum-assisted biopsy systems (n = 37)

	Mammotome	Encor	Total
Number of procedures	17	20	37
Mean age (y)	28	29	29
Mean size (cm)	2.0	2.5	2.3
Mean procedure duration (min)	47	43	45
Complications			
Hematomas	1	1	2

The VABB system could be a novel, safe and effective technique for minimally invasive excision of breast lumps after AFG.

Various complications have been reported to be related to AFG to the breasts, including lumps, fat necrosis, persistent pain, infection, hardness and hematomas. Breast lumps after AFG are thought to be formed as a result of inflammatory reactions and fibrosis of the injected fat, followed by the occurrence of fat necrosis. If the necrotic fat is not completely absorbed, a hard capsule may form around it, creating a solid lesion; if the central component becomes necrotic and liquefies, this may result in the formation of complex or cystic lesions [16, 18]. Furthermore,

solid-type lumps may gradually change into calcification type. Thus, in the present study, the breast lumps after breast augmentation with AFG were classified into cystic, solid, complex and calcification lesions [19, 20].

Traditional methods used to manage lumps after AFG include fine-needle aspiration, liposuction and lumpectomy [19, 21–24]. Fine-needle aspiration was usually performed to treat cystic lumps, and most of the lumps disappeared after aspiration. However, cystic lumps recurred because fluid accumulated within the capsules. Liposuction was used to treat complex and solid breast lumps for about 10 years. It provides minimally invasive treatment for these lumps that were formerly removed by lumpectomy, leaving only a 5 mm scar. However, if the capsule is hard, big or heavily fibrous, it may be difficult to remove the lesion entirely. Lumpectomy was performed to treat calcification-type lumps, which have a widespread calcified capsule surrounding them. However, even inframammary or periareolar incisions could leave an obvious scar.

The minimally invasive VABB system is a diagnostic tool that can be performed under ultrasound guidance. It can accurately locate and obtain enough tissue for histological diagnosis. Furthermore, it is also a therapeutic tool which can completely excise lesions with minimal invasion. In our study, it is the first time that VABB systems were performed to treat the lumps after AFG. Compared to fine-needle aspiration and liposuction, the VABB system could completely resect the capsules. Compared to the lumpectomy, the VABB system could resect multiple lumps, leaving invisible scars.

The ultrasound-guided VABB system can also cause some postoperative complications, of which hematoma is the most common. Fortunately, most lumps after AFG were with inadequate blood supply. Thus, in our study, only 2 patients developed hematomas that gradually resolved without special management. The two systems used in our hospital differ in the size of the probe, with the Mammotome system using an 8G probe and the Encor system using a 7G probe. Both systems could completely remove the lumps with good cosmetic outcomes. Furthermore, there was no significant difference in the duration of the procedures between the two systems, suggesting that using the ultrasound-guided VABB system to remove the lumps after AFG is feasible and safe.

However, not all breast lumps after AFG are suitable for VABB system. Excessively large lumps or lesions under the pectoralis major muscle are difficult to remove completely using the VABB system. For these patients, lumpectomy or extended lumpectomy is a better choice.

Conclusions

In conclusion, this is the first time that the use of VABB system in the resection of breast lumps after AFG has been reported. We demonstrated that the VABB system is an effective and safe approach for the surgical management of lumps after AFG, improving the accuracy and completeness of excisions and providing a significant cosmetic outcome for well-selected patients. Further studies are encouraged in this area. Moreover, the long-term therapeutic effects require further confirmation with a large-scale clinical trial and long-term follow-up.

Funding This work was supported by grants from the Natural Science Foundation of China (81702598, 81602328), the Science Foundation of Guangdong Province (2017A030313803, 2016A030310175), the Science and Technology Program of Guangzhou (201804010011), Medical Scientific Research Foundation of Guangdong Province of China (A2017235), China Postdoctoral Science Foundation (2015M582471) and the Fundamental Research Funds for the Central Universities (21617315).

Compliance with Ethical Standards

Conflict of Interest Statement The authors declare that they have no conflicts of interest to disclose.

Ethical Approval The present study was approved by the ethics review board of the first affiliated hospital of Jinan University.

Informed Consent All patients signed informed consent forms.

References

1. Bircoll M (1987) Cosmetic breast augmentation utilizing autologous fat and liposuction techniques. Plast Reconstr Surg 79:267–271
2. Coleman SR, Saboeiro AP (2007) Fat grafting to the breast revisited: safety and efficacy. Plast Reconstr Surg 119:775–785 **(discussion 86-7)**
3. Spear SL, Wilson HB, Lockwood MD (2005) Fat injection to correct contour deformities in the reconstructed breast. Plast Reconstr Surg 116:1300–1305
4. Gutowski KA (2009) Current applications and safety of autologous fat grafts: a report of the ASPS fat graft task force. Plast Reconstr Surg 124:272–280
5. Szychta P, Zadrozny M, Rykala J, Banasiak L, Witmanowski H (2016) Autologous fat transfer to the subcutaneous tissue in the context of breast reconstructive procedures. Postepy Dermatol Alergol 33:323–328
6. Claro F Jr, Figueiredo JC, Zampar AG, Pinto-Neto AM (2012) Applicability and safety of autologous fat for reconstruction of the breast. Br J Surg 99:768–780
7. Largo RD, Tchang LA, Mele V et al (2014) Efficacy, safety and complications of autologous fat grafting to healthy breast tissue: a systematic review. J Plast Reconstr Aesthet Surg 67:437–448
8. Leopardi D, Thavaneswaran P, Mutimer KL, Olbourne NA, Maddern GJ (2014) Autologous fat transfer for breast augmentation: a systematic review. ANZ J Surg 84:225–230

9. Krastev T, van Turnhout A, Vriens E, Smits L, van der Hulst R (2019) Long-term follow-up of autologous fat transfer vs conventional breast reconstruction and association with cancer relapse in patients with breast cancer. JAMA Surg 154:56–63
10. Kontoes P, Gounnaris G (2017) Complications of fat transfer for breast augmentation. Aesthetic Plast Surg 41:1078–1082
11. Al Sufyani MA, Al Hargan AH, Al Shammari NA (2016) Autologous fat transfer for breast augmentation: a review. Dermatol Surg 42:1235–1242
12. Park HL, Hong J (2014) Vacuum-assisted breast biopsy for breast cancer. Gland Surg 3:120–127
13. Park HL, Kim LS (2011) The current role of vacuum assisted breast biopsy system in breast disease. J Breast Cancer 14:1–7
14. Wang ZL, Liu G, Huang Y, Wan WB, Li JL (2012) Percutaneous excisional biopsy of clinically benign breast lesions with vacuum-assisted system: comparison of three devices. Eur J Radiol 81:725–730
15. Mariscotti G, Durando M, Robella M et al (2015) Mammotome((R)) and EnCor ((R)): comparison of two systems for stereotactic vacuum-assisted core biopsy in the characterisation of suspicious mammographic microcalcifications alone. Radiol Med 120:369–376
16. Mu DL, Luan J, Mu L, Xin MQ (2009) Breast augmentation by autologous fat injection grafting: management and clinical analysis of complications. Ann Plast Surg 63:124–127
17. Qutob O, Elahi B, Garimella V, Ihsan N, Drew PJ (2010) Minimally invasive excision of gynaecomastia–a novel and effective surgical technique. Ann R Coll Surg Engl 92:198–200
18. Kang D, Luan J (2018) Fat Necrosis After Autologous Fat Transfer (AFT) to Breast: comparison of Low-Speed Centrifugation with Sedimentation. Aesthetic Plast Surg 42:1457–1464
19. Shida M, Chiba A, Ohashi M, Yamakawa M (2017) Ultrasound diagnosis and treatment of breast lumps after breast augmentation with autologous fat grafting. Plast Reconstr Surg Glob Open 5:e1603
20. Mineda K, Kuno S, Kato H et al (2014) Chronic inflammation and progressive calcification as a result of fat necrosis: the worst outcome in fat grafting. Plast Reconstr Surg 133:1064–1072
21. Kwak JY, Lee SH, Park HL, Kim JY, Kim SE, Kim EK (2004) Sonographic findings in complications of cosmetic breast augmentation with autologous fat obtained by liposuction. J Clin Ultrasound 32:299–301
22. de Souza Pinto EB, Abdala PC, Maciel CM, dos Santos Fde P, de Souza RP (2006) Liposuction and VASER. Clin Plast Surg 33(107–15):vii
23. Kim H, Yang EJ, Bang SI (2012) Bilateral liponecrotic pseudocysts after breast augmentation by fat injection: a case report. Aesthetic Plast Surg 36:359–362
24. Lin JY, Song P, Pu LLQ (2018) Management of fat necrosis after autologous fat transplantation for breast augmentation. Plast Reconstr Surg 142:665e–673e