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Outcome Of Benign Breast Tumor Excision Using Ultrasound-Guided Vacuum Assisted Breast Biopsy: A Literature Review

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Abstract

Introduction. Benign breast tumors have a significant incidence among breast diseases that cause anxiety for patients. Surgical management is one of the managements. Vacuum-assisted breast biopsy (VABB) could be applied to tumors with a size of less than 3 cm or multiple lesions. One of its techniques is guided by ultrasonography (USG). In Indonesia, the ultrasound-guided (USG-guided) VABB has already been applied in several healthcare instances. Nevertheless, there are still opinions about tumor recurrence after the procedure. This study's purpose is to observe the tumor recurrence and patients' satisfaction with benign breast tumor excision with USG-guided VABB.

Method. Literature was reviewed through the Cochrane Database of Systematic Reviews, PubMed, Scopus, and ProQuest from December 2021 to March 2022. All papers identified were screened and identified. The study's level of evidence and quality were assessed using the Centre for Evidence-Based Medicine, University of Oxford criteria 2011.

Results. In total, 1677 studies were found, and after evaluation, 29 studies were relevant—the recurrence rates of benign breast tumors after USG-guided VABB were varied. The lowest being 0% and the highest being 32.6%. Higher recurrence occurs in larger lesion sizes. Moreover, several factors that could be related were lesion size, multiple size, and hematoma in the procedure. Patients' satisfaction was high, including the postoperative scar that is not visible or minimal (5–6 mm).

Conclusion. Benign breast tumor management with USG-guided VABB is a good alternative, with a recurrence rate similar to open excision and high patient satisfaction.

Keywords: benign breast tumor, vacuum-assisted breast biopsy, ultrasound, recurrence, satisfaction

Introduction

Benign breast tumors have a significant incidence of 90% of all breast symptoms. According to Kumar, about 46.66% of benign breast tumors were fibroadenoma in patients aged chiefly 15–25 years old.¹ Breast tumor could cause anxiety for patients, especially if the physical and supporting examinations show the disease. There are several management strategies for benign breast tumors based on clinical findings. Conservative management could be applied to tumors of small size, multiple, young age, or patients who do not want to undergo surgery. Nonetheless, tumor excision is the best management if the tumor can grow and evolve. Most of the techniques for tumor excision are open surgery, which is a simple procedure but comes with postoperative care and scars.^{2,3,4}

Vacuum-assisted breast biopsy (VABB) is one of the choices for benign breast tumor excision that could be applied as a diagnostic and therapeutic procedure. It is an excellent alternative procedure to open surgery as the operative management for benign breast tumors with a size of less than 3 cm or multiple lesions. One of the VABB techniques is guided by ultrasound (USG). The procedure only requires local anesthetic, a small skin incision for single and multiple lesions, and minimal postoperative scar visible.^{4,5} In Indonesia, USG-guided VABB has already been applied in some centers. Nevertheless, there is no publication about the superiority of VABB procedures in Indonesia, which have more patient benefits. There are still opinions about tumor recurrence after the procedure. Therefore, this literature review is aimed at observing the tumor recurrence and patients' satisfaction with benign breast tumors undergoing tumor excision with USG-guided VABB.^{6,7}

Method

Literature was carried out using an online database system: Cochrane Database of Systematic Reviews, PubMed, Scopus, and ProQuest. The

keywords used were based on PICO: P (patients with benign breast tumor); I (operative management with the ultrasound guided VABB); C (none); O (benign breast tumor recurrence, patients' satisfaction). The search was carried out from December 2021 to March 2022.

All articles identified were screened. Those that met the criteria above and were in English were included. In contrast, those excluded were tumor suspicion of malignancy, VABB techniques guided by any other methods than ultrasound, and no outcomes of benign breast tumor recurrence or patients' satisfaction and not written in English. The study's level of evidence and quality were assessed using the Centre for Evidence-Based Medicine, University of Oxford criteria 2011. The risk of bias was assessed by examining the methodology of each study. An independent board review has approved this literature review.

Results

In total, 1677 articles were found (Figure 1), of which 1627 were discarded for non-relevance. Of the remaining 50 articles retrieved for more detailed evaluation, 21 were discarded for not meeting inclusion criteria, leaving 29 relevant and reviewed articles. Of 29 selected articles, 1 study was meta-analysis, and 28 were non-randomized cohorts. All reviewed articles were analyzed using critical appraisal tools from CEBM appraisal tools from Oxford University based on the study method. Critical appraisal used for the articles is based on CEBM appraisal tools. This study used appraisal tools for prognosis (28 articles) and meta-analysis (1 article). In the prognosis group, we found that most of the articles defined a representative sample of patients assembled at a common point in the course of their disease. One article should have mentioned the point. All articles had sufficient, long, and complete follow-ups, which were mentioned clearly in the articles.

The articles analyzed did not mention the blind method for the result. One meta-analysis had a clear question (PICO) in the article. There is a

likely possibility that important, relevant studies should have been included. The criteria used to select articles for inclusion were appropriate. The results were similar from study to study.

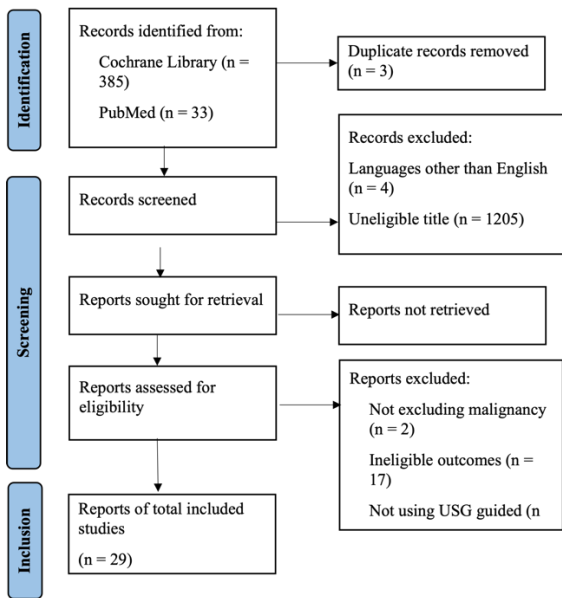


Figure 1. Literature search using PRISMA flow

One systematic review and five cohort studies were acquired based on inclusion-exclusion criteria. A critical appraisal assessing each study's validity was conducted based on the CEBM checklist for cohort studies and the checklist for systematic review studies. All the studies met the valid and reliable study criteria based on the appraisal. Cohort Studies details are presented in Table 1, including data such as author, year of publication, study sample's characteristics, treatment, and outcome summary. Table 2 presents some information acquired from the systematic review study included in this review.

Benign breast tumor recurrence

The recurrence rates of benign breast tumors after USG-guided VABB were varied, with the lowest being 0% and the highest being 32.6% (Table 1). Mei et al. reported similar recurrence rates between USG-guided VABB and open excision for benign breast tumors (23.1%). The recurrence-free survival was not significantly different between the two groups (83.1% for VABB groups and 95.8% for open excision groups, respectively).⁸ Research by Ouyang et al. reported that there was no significant difference in recurrence rate and 5-year recurrence-free survival between USG-guided VABB and open excision. The recurrence rate of VABB was 11.1%, higher than the recurrence rate of open excision, which was 6.8%. Management using VABB was performed for lesions with a mean diameter of 1.7 cm.⁹ In a meta-analysis study by Yoo et al., the recurrence rate in the VABB procedure was higher than in open excision, yet there was no significant difference. Complete excision was successfully performed in lesion diameter <1.5 cm.¹⁰

Kibil et al. reported no recurrence after VABB management, with a mean lesion size of 8 mm (8-14 mm).¹¹ Huber et al. also had no recurrence with a mean lesion size of nine mm.¹² Shang et al. reported that tumor size <3.3 cm had a significant difference in recurrence rate compared with tumor size >3.3 cm, where recurrence rate for tumor size <3.3 cm was 8%.¹³ Jiang and Li reported that factors related to tumor recurrence were tumor size, multiple tumors, and hematoma during the procedure.^{14,15} In a multivariate analysis by Li et al., significant factors

Table 1. Summary of recurrence rates

Author (year)	Study design	Type of benign breast tumor	Excision technique	Excision technique comparison (if mentioned)	Recurrence rate	Follow-up duration
Yoo et al (2021)	Meta-analysis of cohort studies (1)	Benign breast tumor	USG-guided VABB	Open surgery	0.039 (estimated rate of recurrence)	Not mentioned
Mei et al (2021)	Non-randomized cohort studies (3)	Benign desmoid tumor	USG-guided VABB	Open surgery	23.10%	41 (5–110) months
Fine et al (2003)	Non-randomized cohort studies (3)	Benign breast tumor	USG-guided VABB	None	17%	6 months
Jiang et al (2013)	Non-randomized cohort studies (3)	Benign breast tumor	USG-guided VABB	None	4.40%	25.5 (1–60) months
Ko et al (2012)	Non-randomized cohort studies (3)	Benign intraductal papilloma	USG-guided VABB	Open surgery	3.70%	25 (18–42) months
Li et al (2013)	Non-randomized cohort studies (3)	Benign breast tumor	USG-guided VABB	None	3%	34 (18–76) months
Yi et al (2013)	Non-randomized cohort studies (3)	Benign intraductal papilloma	USG-guided VABB	None	0.70%	33 (16–73) months

Table 1. Summary of recurrence rates (cont.)

Author (year)	Study design	Type of benign breast tumor	Excision technique	Excision technique comparison (if mentioned)	Recurrence rate	Follow-up duration
Ouyang et al (2015)	Non-randomized cohort study (3)	Benign phyllodes tumor	USG-guided VABB	Open surgery	11.10%	35.5 months
Chau et al (2020)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	None	2.80%	12.8 (1.3-67.4) months
Choi et al. (2019)	Non-randomized cohort study (3)	Benign non-atypia papilloma	USG-guided VABB	Open surgery	3.60%	24-56 months
Wang et al(2019)	Non-randomized cohort study (3)	Benign intraductal papilloma	USG-guided VABB	None	9.60%	61.26 (14-72) months
Lopez et al (2017)	Non-randomized cohort study (3)	Benign phyllodes tumor	USG-guided VABB	None	9%	27.7 (22-38) months
Kibil et al. (2013)	Non-randomized cohort study (3)	Benign intraductal papilloma	USG-guided VABB and mammography	None	0	5 years (14 months - 10 years)
Huber et al. (2003)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB and mammography	None	0	6 months
Kim et al. (2008)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	None	32.60%	35 (24-60) months
Park et al (2018)	Non-randomized cohort study (3)	Benign phyllodes tumor	USG-guided VABB	None	7.46%	27.8 (10-47) months
Kibil et al. (2013)	Non-randomized cohort study (3)	Benign non-atypia papilloma	USG-guided VABB and mammography	None	0	Not mentioned
Bugdayci et al. (2017)	Non-randomized cohort study (3)	Fibroadenoma	USG-guided VABB	None	15%	3 years
Shang et al (2019)	Non-randomized cohort study (3)	Benign phyllodes tumor	USG-guided VABB	None	17.20%	35 (12-86) months
Maxwell et al. (2009)	Non-randomized cohort study (3)	Benign papilloma	USG-guided VABB	None	11.50%	Not mentioned
March et al (2003)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	None	24%	Not mentioned
Slanetz et al (2011)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	None	8%	10.2 (6-20) months
Quinn-Laurin et al (2017)	Non-randomized cohort study (3)	Benign complex cyst	USG-guided VABB	None	0	34.9 (24-99) months

Author (year)	Study design	Type of benign breast tumor	Excision technique	Excision technique comparison (if mentioned)	Recurrence rate	Follow-up duration
Park et al (2018)	Non-randomized cohort study (3)	Benign phyllodes tumor	USG-guided VABB	None	7.46%	27.8 (10-47) months
Thurley et al (2009)	Non-randomized cohort study (3)	Fibroadenoma	USG-guided VABB	None	11%	6 months
Vargas et al. (2006)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	None	1%	Not mentioned
Grady et al (2008)	Non-randomized cohort study (3)	Fibroadenoma	USG-guided VABB	None	15%	22 (7-59) months
Sperber et al (2003)	Non-randomized cohort study (3)	Fibroadenoma	USG-guided VABB	None	0%	2 years

Table 2. Summary of patients' satisfaction

Author (year)	Study design	Type of benign breast tumor	Excision technique	Satisfaction assessment method	Patients' satisfaction
Fine et al (2003)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	Questionnaire at 10-day and 6-month follow up	82% (57% delighted)
Li et al. (2013)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	Not mentioned	97% satisfied
Yi et al. (2013)	Non-randomized cohort study (3)	Benign intraductal papilloma	USG-guided VABB	Not mentioned	Satisfied, not to mention the percentage
Fine et al (2002)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	Questionnaire about general satisfaction based on aesthetic results and scar appearance	97% satisfied
Huber et al. (2003)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided and mammography-guided VABB	Questionnaire	99% satisfied (82% very satisfied)
March et al (2003)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	Questionnaire at intervention day and 2-5 days and 6 months postoperatively	97% satisfied
Slanetz et al (2011)	Non-randomized cohort study (3)	Benign breast tumor	USG-guided VABB	Not mentioned	All patients recommended the VABB technique

for tumor recurrence were lesions >2 and hematoma during the procedure.¹⁵ Kim reported that the lesion size could affect recurrence related to hematoma, which could confuse the procedure.¹⁶

Patients' satisfaction

A list of studies analyzing patients' satisfaction is concluded in Table 2. In Huber's study, 99% of patients were satisfied with postoperative scar aesthetically.¹² Fine et al. reported that the patients were well satisfied (97%) with 5-6 mm sized scar.¹⁷ The patients' anxiety had drastically decreased after the VABB procedure. March et al. had 19% of patients with no visible scar, and 81% of patients had minimal scar with size 2-9 mm.¹⁸

Discussion

Benign breast tumor recurrence

The varied recurrence rates of benign breast tumors after USG-guided procedures were recorded. Five out of twenty-nine studies reported no tumor recurrence. The size of those lesions excised was varied, with a mean size of 7-8 mm. No recurrence rate reported by five studies could result from complete excision by USG-guided VABB. The complete excision could be affected by operator experience and equipment used related to lesion size.^{11,12,16,17,19}

The recurrence rate in USG-guided VABB does not have a significant difference compared with the open excision technique, and the difference in tumor excision technique does not affect the recurrence rate. This study aims to observe the recurrence rate of USG-guided VABB. Based on the result of this literature review, the recurrence rate is meager. Tumor recurrence risk factors were hematoma, technical procedures, lesion size, and multiple lesions. Several studies reported varying lesion sizes associated with recurrence. There was a hypothesis that an undetected microscopic lesion could affect the recurrence because it was not excised. Larger lesion sizes could increase the risk of hematoma or fluid residual in the wound defect. Hematoma could disturb ultrasound imaging, so the evaluation of residual lesions was disturbed. Therefore, the defect was recommended to be compressed within an adequate duration.^{14-16,23}

Thus, the recurrence rate of USG-guided VABB is like open excision, and the technique can be recommended as one of the managements of benign breast diseases that fulfill the requirements for the application of USG-guided VABB.

Patients' satisfaction

The patient's satisfaction after the USG-guided procedure was relatively high. The scar was aesthetically satisfying, with no visible scars or minimal-sized scars (5-6 mm). Moreover, for multiple lesions excised, only one incision was needed. Other satisfactions were shorter procedure duration, more comfort, and no significant changes in breast appearance.^{23,24}

We have findings about the superiority and inadequacy of USG-guided VABB, but they are not the focus of this study. Based on the articles analyzed in this literature review, USG-guided VABB can be applied in outpatient clinics with local anesthesia. The technique can remove benign breast tumors with minimal skin incision, with side effects of minimal postoperative pain and satisfying wound healing. Tumor removal with the technique is quite rewarding, which is 99% of tumor removal. Postoperatively, some patients express their satisfaction with the good aesthetic result and invisible or minimal scars. The inadequacy of the technique is hematoma intraprocedural, which could affect the

evaluation of the tumor with USG, mainly because the visual is affected. Thus, the technique should be aborted or converted to another technique.^{17,25}

Conclusions

The recurrence rate of benign breast tumors after being excised with USG-guided VABB varied from 0% to 32.6%. Patients' satisfaction with the procedure is high (82-99%), with no visible or minimal scar.

Disclosure

The authors declare no conflict of interest.

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Role of authors

Conceptualization ELAK GW, Data curation ELAK, Formal analysis ELAK GW, Funding acquisition ELAK GW, Investigation ELAK GW, Methodology ELAK GW, Project administration ELAK Resources ELAK GW, Software ELAK, Supervision GW, Validation ELAK GW, Visualization ELAK, Writing original draft preparation ELAK, Writing review and editing ELAK GW.

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