EJGO European Journal of Gynaecological Oncology

Original Research

Effect of automated breast volume scanner (ABVS) census on HAMA and HAMD scores of patients with breast hyperplastic nodules smaller than 1 cm

H. Zhao[1], Q. Cao[1], J. Wang[2], Q. Wang[1], Z. Wang[2]

[1]*Department of Breast Surgery, the Fourth Hospital of Shijiazhuang, Shijiazhuang*
[2]*Department of Oncology, People's Hospital of Hebei Province, Shijiazhuang (China)*

Summary

Objective: To investigate the effect of automated breast volume scanner (ABVS) census on the quality of life of the patients with breast hyperplastic nodules < 1 cm. *Materials and Methods:* From March 2014 to February 2016, 1,366 subjects were screened in the Fourth Hospital of Shijiazhuang. Hamilton Anxiety Scale (HAMA) and Hamilton Rating Scale for Depression (HAMD) were compared between the subjects received ABVS and those received color Doppler ultrasound. Then the 289 patients with breast hyperplastic nodules < 1 cm were divided into groups according to the different clinical manifestations and surgical methods to compare their HAMA and HAMD scores. *Results:* There were significant differences in HAMA and HAMD scores between the subjects received color Doppler ultrasound and those receiving ABVS examination ($p < 0.05$). HAMA and HAMD scores were also statistically different ($p < 0.05$) in terms of the different clinical manifestations and surgical methods. *Conclusion:* ABVS examination can detect early-stage of hyperplastic nodules more accurately the conventional color Doppler ultrasound and guide the patients for further treatment.

Key words: ABVS census; Breast hyperplastic Nodules < 1 cm; HAMA and HAMD scores; Clinical intervention.

Introduction

The treatment of breast hyperplastic nodules requires not only to take into account physical problems, but also to meet the psychological needs of the patients, in order to truly improve their quality of life. Breast cancer develops from hyperplasia to atypical hyperplasia, and then to cancer, which has been internationally recognized as the cancerous three steps by the medical scientists. Clinically, breast hyperplastic nodules must be closely observed and regularly checked in order to achieve early diagnosis and treatment for breast cancer [1-7]. The current trend of breast cancer apparently occurs more and more at a younger age [4, 5], which makes women with breast hyperplastic nodules feel uneasy, especially for those with obvious clinical symptoms. It will often have a serious impact on the daily life, thus their Hamilton Anxiety Scale (HAMA) and Hamilton Rating Scale for Depression (HAMD) scores are inevitably increased. For these patients, advanced means for early diagnosis and treatment of breast disease are more urgently required [6-9]. Automated breast volume scanner (ABVS) can detect breast hyperplasia nodules smaller than 1 cm earlier than conventional color Doppler ultrasound, which may be helpful to the women with anxiety and depression. ABVS will undoubtedly be more helpful to patients who have discovered breast hyperplastic nodules on physical examination and require to have a more scientific understanding of their own breast health. After receiving ABVS, their HAMA and HAMD scores will be significantly reduced [10, 11]. In addition, timely clinical interventions can significantly reduce the HAMA and HAMD scores in women who have breast hyperplastic nodules smaller than 1 cm [11], while clinical intervention with advanced equipment is certainly a better choice for them. Therefore, mammotome (MMT) surgery can better relieve their anxiety and depression factors for these people. Practice has proved that ABVS not only helps many women to understand their own breast health, but also guides them to timely choose clinical intervention, in order to reduce their HAMA and HAMD scores [11, 12].

Materials and Methods

A total of 1,366 women who received breast screening at the Fourth Hospital of Shijiazhuang, China from March 2014 to February 2016 were selected as the subjects. Consequently, the 289 patients with breast hyperplastic nodules < 1 cm were divided into two groups according to the clinical manifestations. The 121 cases accompanied with pain, with mean age of 35.75 ± 10.06 years, a history of 6.10 ± 2.16 years, and the average number of nodules of 3.22 ± 1.09, were grouped into pain group, while the remaining 168 cases were grouped into non-pain group, with an average age of 35.96 ± 10.28 years, a history of 6.18 ± 2.07 years, and the average number of nodules of 3.29 ± 1.10. The education, economic status, and eating habits were comparable between the two groups ($p > 0.05$). Those taking endocrine drugs or those with

Revised manuscript accepted for publication June 20, 2018

Table 1. — *Comparison of the HAMA and HAMD scores in the subjects before and after conventional color Doppler ultrasound.*

Group	Number of cases	HAMA scores	*t* value	*p* value	HAMD scores	*t* value	*p* value
Before	1,366	18.33 ± 2.75	4.221	< 0.05	19.02 ± 2.31	3.024	< 0.05
After	1,366	14.20 ± 2.05*			15.42 ± 2.90*		

**p < 0.05 vs. before.*

Table 2. — *Comparison of the HAMA and HAMD scores between ABVS group and conventional color Doppler ultrasound group.*

Group	Number of cases	HAMA scores	*t* value	*p* value	HAMD scores	*t* value	*p* value
2D-color Doppler	1,366	14.20 ± 2.05	4.031	< 0.05	15.42 ± 2.90	3.235	< 0.05
ABVS	1,366	11.08 ± 1.78*			11.47 ± 2.02*		

**P<0.05 vs. 2D-color Doppler ultrasound.*

Table 3. — *Comparison of the malignant tendency scores of nodules between pain and non-pain groups.*

Group	Number of cases	Scores of nodules	*t* value	*p* value
Pain	121	11.36 ± 1.27	0.026	> 0.05
Non-pain	168	11.66 ± 1.31		

mental disorders were excluded from this study. This study was conducted in accordance with the declaration of Helsinki, with approval from the Ethics Committee of the Fourth Hospital of Shijiazhuang, and written informed consent was also obtained from all participants.

ABVS was performed using an ultrasound system. Patients were places in supine or contralateral oblique position (if the breast was large, the body tended to the opposite side), arms were lifted, and outreached as much as possible to fully expose the breasts and armpits. According to the size of the breasts of patients, the optimal conditions including the frequency, the deep focusing area, and overall gain were preset to obtain the best image results. Each side of the breast was comprehensively and systematically scanned at the conventional median and lateral positions, taking 65 seconds for each position. The system can automatically obtain 15.4×16.8× 6.0-cm volume data for each scan and the image acquisition layer spacing was 0.5 cm.

Palpation satisfaction rating: 1 point, the hyperplastic nodules cannot be touched at any position of the patient, 2 points, the hyperplastic nodules cannot be touched at the erect position but can be vaguely touched at the supine position, 3 points, the hyperplastic nodules can be vaguely touched at the erect position and obviously touched at the supine position, and 4 points, the hyperplastic nodules can be obviously touched at any position.

Hardness scoring of nodules: 1 point, the hyperplastic nodules are soft as fat, 2 points, the hyperplastic nodules are slightly tough as muscle, 3 points, the hyperplastic nodules are tough as the tip of the nose, and 4 points, the hyperplastic nodules are hard as the forehead.

ABVS parameters: 1 point, hypoechoic nodules can be seen without blood flow or sound shadow, and the image clarity is poor, 2 points, hypoechoic nodules can be seen without blood flow or sound shadow, and the image clarity is good, 3 points, hypoechoic nodules can be seen with blood flow but without sound shadow, and the image clarity is good, and 4 points, hypoechoic nodules can be seen with blood flow and sound shadow, and the image clarity is good.

Molybdenum target parameters: 1 point, no image of nodules can be seen, 2 points, nodules can be seen vaguely, 3 points, nodules can be seen clearly, and 4 points, not only nodules but also the calcification point can be clearly seen.

HAMA and HAMD scoring [13]: HAMA was scored as 0 to 4 for asymptomatic, mild, medium, severe, and extremely severe respectively by 14 items according to the psychological anxiety and somatic anxiety. The higher total score represented the more serious anxiety of the patient. HAMD was also scored as 0 to 4 for asymptomatic, mild, moderate, severe, and extremely severe respectively by seven items including the body weight, day and night changes, slowness, sleep disorders, despair, and anxiety/somatization. The higher the total score, the more depressed the respondent was. The questionnaires were given at the medical examination center, and filled out with the guidance of the staff from Department of Breast Surgery. Then all of the questionnaires were returned.

SPSS17.0 software was used for the statistical analysis. Measurement data were presented as mean ± standard deviation (SD). *T*-test was carried out if the data were in normal distribution, or the rank sum test was used. $P < 0.05$ was regarded as statistical significance.

Results

The HAMA and HAMD scores of the screening subjects improved after the conventional two-dimensional color Doppler ultrasound and ABVS examinations, but the improvement after the ABVS census was more significant ($p < 0.05$, Tables 1 and 2). The malignant tendency scores of nodules were not significantly different between pain and non-pain group ($p > 0.05$, Table 3), but the HAMA and HAMD scores in pain group were significantly higher than those in the non-pain group ($p < 0.05$, Tables 3 and 4). The scores of HAMA and HAMD in both pain and non-pain groups significantly improved after surgery as compared with those before surgery, especially in the cases received MMT treatment ($p < 0.05$, Tables 5-7).

Discussion

In the breast clinics, about 50-70% of women are found to have breast hyperplasia. The patients discovering breast hyperplastic nodules by color Doppler ultrasound may have negative psychological impact, especially for those with

Table 4. — *Comparison of the HAMA and HAMD scores in the subjects between pain and non-pain groups.*

Group	Number of cases	HAMA scores	*t* value	*p* value	HAMD scores	*t* value	*p* value
Pain	121	17.38 ± 3.26	6.325	< 0.05	16.37 ± 2.78	6.319	< 0.05
Non-pain	168	13.42 ± 3.09*			13.72 ± 3.01*		

**p < 0.05 vs. pain group.*

Table 5. — *Comparison of the HAMA and HAMD scores of the 31 subjects in pain group between before and after surgery.*

Group	Number of cases	HAMA scores	*t* value	*p* value	HAMD scores	*t* value	*p* value
Before surgery	31	19.32 ± 2.29	9.309	< 0.05	19.98 ± 2.56	9.223	< 0.05
After surgery	31	11.01 ± 2.11*			11.02 ± 2.09*		

**p < 0.05 vs. before surgery.*

Table 6. — *Comparison of the HAMA and HAMD scores of the 22 subjects in non-pain group between before and after surgery.*

Group	Number of cases	HAMA scores	*t* value	*p* value	HAMD scores	*t* value	*p* value
Before surgery	22	16.08 ± 2.19	6.408	< 0.05	16.44 ± 2.01	6.311	< 0.05
After surgery	22	10.26 ± 2.27*			10.09 ± 2.25*		

**p < 0.05 vs. before surgery.*

Table 7. — *Comparison of the reduction of HAMA and HAMD scores between conventional surgery and mammotome product surgery.*

Group	Number of cases	Reduction of HAMA	*t* value	*p* value	Reduction of HAMD	*t* value	*p* value
Conventional	19	3.18 ± 0.49	4.116	< 0.05	3.04 ± 0.51	4.017	< 0.05
MMT	34	5.23 ± 0.97*			5.29 ± 0.85*		

**p < 0.05 vs. conventional surgery.*

clinical manifestations, such as irregular pain, palpable nodules, and mass. These women urgently require more credible and scientific knowledge of their own breast health. HAMA and HAMD scoring for such patients can help to understand the impact of breast hyperplastic nodules on the quality of life. The introduction of 3D color Doppler ultrasound into clinical examination can greatly increase the detection rate of breast hyperplastic nodules [14, 15], which is especially applicable to the breast hyperplasia patients with a family history or non-response to drug therapy, because these populations worry about their breast health and believe that advanced equipment has an accurate results [16]. ABVS can find more hyperplastic nodules and more clearly determine the nodule boundaries, internal echo, blood flow status, the back sound attenuation, fine calcification, and converge sign than two-dimensional ultrasound, which is more valuable in assessing the malignant trend of nodules. It does not only guide surgeons to know the surgical indications better, but also make patients believe the results from advanced instruments [10, 11]. Unlike breast mammography examination, ABVS is completely non-invasive and non-radiative, which can be performed repeatedly and is also suitable for pregnant women. Therefore, the introduction of ABVS into the clinics for early diagnosis and treatment of breast cancer has more and more clinical benefits, especially for the women overly worrying, depressing, and anxious about their own breast health. ABVS can effectively relieve their psychological pressure and improve their quality of life [10, 11, 17]. The results of this study showed that although general medical examination can improve women's concerns about breast health, and the introduction of ABVS can relieve their anxiety and depression more effectively. As can be seen from Tables 1 and 2, ABVS can reduce the HAMA and HAMD scores more effective for the women worrying about their breast health than the conventional color Doppler ultrasound.

Clinical manifestations are the main reasons for patients' requirement of clinical intervention, but these are not corresponding to objective tests and illness. Table 3 shows that there was no difference in the malignant tendency scores between the patients with pain and without pain, but the HAMA and HAMD scores of the patients with pain were higher than those of the patients without pain (Table 4). In this circumstance, advanced scientific methods can give correct guidance to the patients with pain so that they can relieve their depression and anxiety and have a clearer understanding of clinical intervention. The breast hyperplasia patients with significant clinical manifestations were more likely to select surgery treatment, because it did lower their HAMA and HAMD scores more significantly than those without clinical presentation (Tables 5 and 6). In addition, the advanced diagnostic equipment provided a scientific

basis for them to understand their condition. Thus, the rapid development of modern medical equipment enables early diagnosis and treatment of breast cancer [12, 18, 19]. In particular, after the introduction of breast 3D color Doppler ultrasound into clinical application, many clinically untouchable and smaller than 1 cm breast hyperplastic nodules have been found. ABVS can find more hyperplastic nodules smaller than 1 cm and provides more objective and scientific judgment and evaluation of the malignant tendency for hyperplastic nodules [11] to assist some patients with severe anxiety and depressive symptoms to reduce their HAMA and HAMD scores.

For patients with breast hyperplastic nodules smaller than 1 cm observed by ABVS examination, surgical treatment is required if the malignant tendency of the nodules is significant. However, hyperplastic nodules smaller than 1 cm are often clinically untouchable. It is difficult to resect the hyperplastic nodules accurately, which challenges the surgeons rigorously. Even the experienced surgeons may have incomplete surgical treatment due to the inaccurate positioning and thereby affecting the pathological findings [10, 20]. Although some problems can be solved by extending the incision or expanding the excision range, it is awkward for the young woman considering their beauty. MMT vacuum peeling technology was initially used for diagnosis; however with the clinical needs of early diagnosis and treatment, this minimally invasive treatment has been used for patients with breast hyperplastic nodules < 1cm, which can not only remove the hyperplastic nodules, but also confirm the diagnosis, achieving a perfect combination between the treatment effect and beauty. So, it is increasingly used clinically [20, 21]. ABVS makes a scientific judgment for the malignant tendency of breast hyperplasia nodules in the early diagnosis, while MMT treatment pathologically confirms the reliability of its judgment and achieves the purpose of early treatment at the same time. Unlike the surgeon's experience in surgery, ABVS-guided breast minimally invasive treatment can be absolutely achieved through the operation of the instrument under the monitoring. Therefore, ABVS-guided MMT treatment for the hyperplastic nodules < 1cm takes into account the early diagnosis, early treatment, esthetics, and no disputes, which makes patients more confident. From Table 7, it can be seen that MMT can reduce HAMA and HAMD scores more significantly. Therefore, with the large demand of patients with breast hyperplasia, the patients' attention to esthetics and the standardization of treatment in hospitals both at home and abroad, ABT-guided MMT has become a scientific, reliable, and credible means for reducing HAMA and HAMD scores and improving the quality of life of patients [21].

In the literature, the development of breast hyperplasia to the nodules increases more than four-fold the potential risk of cancer compared to the general population, especially for women with psychological trauma, marital disharmony, or poor self-regulating ability. Psychiatrics also confirmed that introverted personality, long-term depression, anxiety, and other adverse stimuli will affect the limbic system of the brain, leading to neuro-humoral immune disorders and endocrine disorders, showing decreased level of progesterone and increased estrogen. In addition, labile mood and adverse temper will inhibit ovulation, leading to declined progesterone and relative increase in estrogen levels, which will aggravate breast hyperplasia and exacerbate the risk of carcinogenesis for the women with hyperplastic nodules [12, 22, 23]. With ABVS monitoring and the guidance of ABVS results, the clinical intervention can scientifically improve the suspicion and confusion of the subjects. In particular, ABVS-guided MMT treatment for breast hyperplastic nodules < 1 cm not only eliminates the lesions, but also maintains the beauty, thereby reducing the HAMA and HAMD scores and improving quality of life.

The results of this study showed that the more advanced the examination equipment was, the more valuable it was to relieve the patient's anxiety. Compared with that of the women received conventional 2D color Doppler examination, the decrease of HAMA and HAMD scores was more remarkable in those who received ABVS again. The women with clinical symptoms had greater mental stress, which was verified by the significantly increasing HAMA and HAMD scores in the patients with pain. Clinical surgical intervention had obvious value for reducing the psychological pressure of the patients with breast hyperplastic nodules < 1 cm. In both the pain and non-pain groups, the HAMA and HAMD scores were significantly reduced after surgical intervention and the surgical treatment with the guidance of advanced equipment made the patients more confident than the conventional surgery.

In conclusion, the introduction of ABVS in clinical examination is valuable for improving the quality of life of the women with breast hyperplasia. For patients with breast hyperplastic nodules < 1 cm, MMT treatment can make them happier and more confident. Thus, it is worthy of clinical promotion. However, ABVS examination is time-consuming and costly, it is more suitable for patients with a history of breast hyperplasia, and other susceptibility factors. MMT surgery has certain requirements on the size and site of nodules. Otherwise, there may be hemorrhage and other serious complications. Thus, it can only be carried out with strict indications.

References

[1] Cavalieri E.L., Rogan E.G., Zahid M.: "Critical depurinating DNA adducts: Estrogen adducts in the etiology and prevention of cancer and dopamine adducts in the etiology and prevention of Parkinson's disease". *Int. J. Cancer*, 2017, *141*, 1078.

[2] Houssami N., Turner R.M., Morrow M.: "Meta-analysis of pre-operative magnetic resonance imaging (MRI) and surgical treatment for breast cancer". *Breast Cancer Res. Treat.,* 2017, *165*, 273.

[3] Narkhede A.A., Shevde L.A., Rao S.S.: "Biomimetic strategies to

recapitulate organ specific microenvironments for studying breast cancer metastasis". *Int. J. Cancer*, 2017, *141*, 1091.
[4] van den Ende C., Oordt-Speets A.M., Vroling H., van Agt H.M.E.: "Benefits and harms of breast cancer screening with mammography in women aged 40-49 years: A systematic review". *Int. J. Cancer*, 2017, *141*, 1295.
[5] Welsh J.: "Function of the vitamin D endocrine system in mammary gland and breast cancer". *Mol. Cell Endocrinol.,* 2017, *453*, 88.
[6] Chand A.R., Ziauddin M.F., Tang S.C.: "Can Locoregionally Recurrent Breast Cancer Be Cured"? *Clin. Breast Cancer,* 2017, *17*, 326.
[7] Gernaat S.A.M., Ho P.J., Rijnberg N., Emaus M.J., Baak L.M., Hartman M., *et al*.: "Risk of death from cardiovascular disease following breast cancer: a systematic review". *Breast Cancer Res. Treat.,* 2017, *164*, 537.
[8] Ngeow J., Sesock K., Eng C.: "Breast cancer risk and clinical implications for germline PTEN mutation carriers". *Breast Cancer Res. Treat.,* 2017, *165*, 1.
[9] Ruddy K.J., Van Houten H.K., Sangaralingham L.R., Freedman R.A., Thompson C.A., Hashmi S.K., *et al*.: "Impact of treatment regimen on acute care use during and after adjuvant chemotherapy for early-stage breast cancer". *Breast Cancer Res. Treat.,* 2017, *164*, 515.
[10] Meng Z., Chen C., Zhu Y., Zhang S., Wei C., Hu B., *et al*.: "Diagnostic performance of the automated breast volume scanner: a systematic review of inter-rater reliability/agreement and meta-analysis of diagnostic accuracy for differentiating benign and malignant breast lesions". *Eur. Radiol.*, 2015, *25*, 3638.
[11] Wöhrle N.K., Hellerhoff K., Notohamiprodjo M., Reiser M.F., Clevert D.A.: "Automated breast volume scanner (ABVS): a new approach for breast imaging". *Radiologe*, 2010, *50*, 973.
[12] Yun S.J., Ryu C.W., Rhee S.J., Ryu J.K., Oh J.Y.: "Benefit of adding digital breast tomosynthesis to digital mammography for breast cancer screening focused on cancer characteristics: a meta-analysis". *Breast Cancer Res. Treat.*, 2017, *164*, 557.
[13] Ferbeyre-Binelfa L., Ramírez-Bollas J., Bautista-Piña V., Espejo-Fonseca R., Ruvalcaba-Limón E., Serratos-Garduño E.: "Fibromatosis of the breast. Report of two cases and review of the literature". *Cir. Cir*., 2009, *77*, 313.
[14] Bok S.K., Jeon Y., Hwang P.S.: "Ultrasonographic Evaluation of the Effects of Progressive Resistive Exercise in Breast Cancer-Related Lymphedema". *Lymphat. Res. Biol.,* 2016, *14*, 18.
[15] Emren S.V., Tuluce S.Y., Levent F., Tuluce K., Kalkan T., Yildiz Y. *et al*.: "Evaluation of Trastuzumab-induced early cardiac dysfunction using two-dimensional Strain Echocardiography". *Med. Ultrason.*, 2015, *17*, 496.
[16] Abdullah M.M., Mohamed A.K., Foo Y.C., Lee C.M., Chua C.T., Wu C.H. *et al*.: "Breast Cancer Survival at a Leading Cancer Centre in Malaysia". *Asian Pac. J. Cancer Prev.,* 2015, *16*, 8513.
[17] Stagl J.M., Lechner S.C., Carver C.S., Bouchard L.C., Gudenkauf L.M., Jutagir D.R., *et al*.: "A randomized controlled trial of cognitive-behavioral stress management in breast cancer: survival and recurrence at 11-year follow-up". *Breast Cancer Res. Treat.,* 2015, *154*, 319.
[18] Schapira M.M., Mackenzie E.R., Lam R., Casarett D., Seluzicki C.M., Barg F.K. *et al*.: "Breast cancer survivors willingness to participate in an acupuncture clinical trial: a qualitative study". *Support. Care Cancer,* 2014, *22*, 1207.
[19] Shen S., Zhou Y., Xu Y., Zhang B., Duan X., Huang R., *et al*.: "A multi-centre randomised trial comparing ultrasound vs mammography for screening breast cancer in high-risk Chinese women". *Br. J. Cancer*, 2015, *112*, 998.
[20] Land S.R., Liu Q., Wickerham D.L., Costantino J.P., Ganz P.A.: "Cigarette smoking, physical activity, and alcohol consumption as predictors of cancer incidence among women at high risk of breast cancer in the NSABP P-1 trial". *Cancer Epidemiol. Biomarkers Prev.,* 2014, *23*, 823.
[21] Lumachi F., Basso S.M., Santeufemia D.A., Bonamini M., Chiara G.B.: "Ultrasonic dissection system technology in breast cancer: a case-control study in a large cohort of patients requiring axillary dissection". *Breast Cancer Res. Treat.*, 2013, *142*, 399.
[22] Li M.H., Liu Y., Liu L.S., Li P.X., Chen Q.: "Differential diagnostic value of real-time tissue elastography and three dimensional ultrasound imaging in breast lumps". *Zhonghua Yi Xue Za Zhi*, 2016, *96*, 1515.
[23] Neuhouser M.L., Aragaki A.K., Prentice R.L., Manson J.E., Chlebowski R., Carty C.L., *et al*.: "Overweight, Obesity, and Postmenopausal Invasive Breast Cancer Risk: A Secondary Analysis of the Women's Health Initiative Randomized Clinical Trials". *JAMA Oncol.,* 2015, *1*, 611.

Corresponding Author:
QINYING CAO, M.D.
Department of Breast Surgery
The Fourth Hospital of Shijiazhuang
Shijiazhuang 050000 (China)
e-mail: docqyw@163.com