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Original Article

Ultrasound-guided mammotome minimally invasive excision versus traditional surgery for treatment of breast masses

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Abstract: Objective: The goal of this study was to compare the clinical efficacy, complications, and change in VAS rating between ultrasound guided mammotome minimally invasive excision and traditional surgery for treatment of breast masses. Methods: Ninety patients with breast mass included in this study were divided into the control group (treated with traditional surgery, 45 patients) and the study group (treated with ultrasound guided mammotome minimally invasive excision, 45 patients). Clinical response, complications, VAS rating, SF-36 rating and patient satisfaction were compared between the two groups. Results: The overall response rate, patient satisfaction and SF-36 rating are higher in the study group than those in the control group (all *P* values < 0.05), while the incidence of complications and VAS rating are lower in the study group than those in the control group (both *P* values < 0.05). Conclusion: Ultrasound guided mammotome minimally invasive excision can effective relieve pains in patients with breast masses, accelerate mass reduction, decrease incidence of complications, and improve life quality compared with traditional surgery.

Keywords: Ultrasound guided mammotome minimally invasive excision, traditional surgical resection, breast mass, clinical response

Introduction

Breasts are one of the marks of a woman's beauty. With the continuous change in living environment and standard in our country, the incidence of breast mass has significantly increased, and there is a trend that more and more young women are affected with breast mass. It has caused severe harm to the patient's physiological and psychological health [1, 2]. Surgery is the mainstay treatment method for breast masses. Traditional surgery has its limitations due to great surgical trauma, severe postoperative scar, high incidence of complications, generally poor prognosis, and low tolerance and acceptance in patients [3]. Ultrasound guided mammotome minimally invasive surgery is a micro-invasive and safe surgery with small incisions, mild surgical scars, and low incidence of complications. It is more acceptable by patients [4]. The safety and efficacy between this surgery versus traditional surgery have been paid much attention to in clinical practice. This study analyzed the 90 patients with breast mass admitted from December 2016 to December 2018 in The Third People's Hospital of Linyi, and reported the following data.

Materials and methods

Baseline characteristics

This study included 90 patients with breast mass admitted into The Third People's Hospital of Linyi from December 2016 to December 2018, whom were randomized into the control group (45 patients) and study group (45 patients) using a random number table method. There was no significant difference in baseline characteristics between the two groups (P > 0.05, **Table 1** for more details). This study was approved by the Ethic Committee in The Third People's Hospital of Linyi, and had

Table 1. Comparison in baseline characteristics between the two groups ($\bar{x}$ ± sd)

Group	Lesions (n)		Age (year)	Weight (kg)	Mass size (cm)
	Single	Multiple			
Study group (n = 45)	15	30	35.1 ± 5.2	63.52 ± 5.14	1.38 ± 0.21
Control group (n = 45)	18	27	35.2 ± 5.2	63.82 ± 5.01	1.39 ± 0.37
t	0.4306		0.0912	0.2804	0.1577
P	0.5117		0.9275	0.7798	0.8751

obtained informed consents from patients and their family, who signed on the Informed Consent Form.

Inclusion criteria: Patients with a unilateral single breast mass; patients whose mass is defined as benign by BI-RADS classification, and appears to be benign on physical examinations; patients whose mass is less than 3 cm in maximal diameter; patients older than 18 years and younger than 55 years.

Exclusion criteria: Patients diagnosed with breast malignancy postoperatively or complicated with malignancy preoperatively; women in breastfeeding or pregnancy; patients with endocrine or metabolic underlying diseases; patients with immune or hematological diseases; patients with major depression, Alzheimer's disease, schizophrenia or severe psychiatric disorders; patients with severe infection; patients with hematological or coagulation disorders; patients treated before the study.

Methods

Control group (traditional surgical resection): The patient was administered local infiltration anesthesia until satisfactory anesthetic effect was achieved. An incision was made on the skin on the surface of the mass. The skin, subcutaneous tissue, and breast tissue are cut apart sequentially according to related surgical criteria to ensure adequate exposure of the mass. Blunt dissection was done along the margin of the mass with an electric knife. After the mass was removed, bleeding was stopped in a timely manner. The wound was closed mainly with intradermal suture. Morphine, hemostatic treatment, and other supportive care were given from 1 hour until 3 days after surgery. The patient was instructed to seek for medical treatment if there is no relief of pain.

Study group (ultrasound guided mammotome minimally invasive incision): A mammotome minimally invasive incision system (manufacturer: Wuhan Jingcheng Hongye Medical Device Co., Ltd.) was used. The patient was placed in a side-lying or supine position based on the size, location, surrounding structure or other factors of the mass. Puncture was made on the areola margin for masses in the inner quadrants and on the lateral side for masses in the outer quadrants. If there were numerous lesions, spiral excision could be done through the same incision. The 8G rotary knife was routinely disinfected. Puncture was made with a fine needle under the guidance of ultrasound. One percent lidocaine was injected below the mass until satisfactory anesthesia was achieved. The rotary knife was advanced to the bottom of the mass along the route of puncture. After complete excision of the mass, the rotary knife was withdrawn. The wound was compressed for 10-20 minutes to stop bleeding. The incision required no suture to close. It was bound up with elastic bandages for at least 72 hours. Morphine, hemostatic treatment and other supportive care were given from 1 hour until 3 days after surgery. The patient was instructed to seek for medical treatment if there is no relief of pain.

Outcomes and evaluation criteria

Clinical response at 2 weeks after surgery: 1) Complete response was defined as no pain or mass; 2) partial response was defined as alleviation of the pain and 50% reduction of the mass; 3) no response was defined as no change in pain or mass or exacerbation of symptoms. Overall response rate was calculated as the number of complete response + partial response divided by total patient number [5].

Complications assessed 2 weeks after surgery: incision infection, focal hematoma, and skin ecchymosis.

VAS rating assessed 2 weeks before and after surgery: the severity of pain was rated with Visual Analogue Self-rating Scale (VAS). No pain was rated as 0, and extremely severe pain was rated as 10, with a total score of 10. The value of score was proportional to the severity of pain [6].

Table 2. Comparison in clinical response between the two groups (n, %)

Group	Complete response	Partial response	No response	Overall response rate
Study group (n = 45)	16 (35.56)	27 (60.00)	2 (4.44)	43 (95.56)
Control group (n = 45)	10 (22.22)	23 (51.11)	12 (26.67)	33 (73.33)
χ^2				8.4586
P				0.0036

Table 3. Comparison in incidence of complications between the two groups (n, %)

Group	Incision infection	Focal hematoma	Skin ecchymosis	Incidence of complication
Study group (n = 45)	1 (2.22)	1 (2.22)	0 (0.00)	2 (4.44)
Control group (n = 45)	3 (6.67)	4 (8.89)	3 (6.67)	10 (22.22)
χ^2				8.4586
P				0.0036

Table 4. Comparison in VAS rating between the two groups ($\bar{x}$ ± sd)

Group	Before surgery (Scores)	After surgery (Scores)	t	P
Study group (n = 45)	1.15 ± 0.21	1.21 ± 0.11	1.6978	0.0931
Control group (n = 45)	1.18 ± 0.22	2.98 ± 0.25	36.2588	< 0.0010
t	0.6617	43.4720		
P	0.5099	< 0.0010		

Note: VAS, Visual Analogue Self-rating Scale.

SF-36 rating assessed 2 weeks before and after surgery: short Form Health Survey (SF-36) was used to assess the quality of life, including mental health, emotional role functioning, social role functioning, general health perceptions, bodily pain, vitality, physical role functioning, and physical functioning. Higher rating represents better life of quality [7].

Patient satisfaction assessed 2 weeks after surgery: in a total score of 100, 80 or above was defined as very satisfied, 60-79 was defined as satisfied, 59 or below was defined as unsatisfied. Overall satisfaction was calculated as the number of very satisfied plus satisfied divided by total number of patients.

Statistics

Statistics was done with SPSS26.0 software. Quantitative data are shown as mean ± standard deviation ($\bar{x}$ ± sd). Comparison between two groups was analyzed with independent sampled t test. Enumeration data is shown as n (%). Comparison between two groups was analyzed with χ^2 test. $P < 0.05$ represents statistically significant difference.

Results

Comparison in baseline characteristics between the two groups

There was no significant difference between the two groups in age, lesion number, mean weight, or mean mass size as shown in **Table 1**.

Comparison in clinical response between the two groups

Clinical response rate is higher in the study group than that in the control group ($P < 0.05$) as shown in **Table 2**.

Comparison in incidence of complications between the two groups

The incidence rate of complications in the study group was 4.44%, including 1 case of incision infection and 1 case of focal hematoma, while the rate of complications in the control group was 22.22%, including 3 cases of incision infection, 4 cases of focal hematoma, and 3 cases of skin ecchymosis. The incidence of complications was lower in the study group than that in the control group ($P < 0.05$) as shown in **Table 3**.

Comparison in VAS rating between the two groups

There is no significant difference in VAS rating between the two groups before surgery ($P > 0.05$). The study group has significantly lower VAS rating than the control group after surgery ($P < 0.05$) as shown in **Table 4**.

Comparison in SF-36 rating between the two groups

Comparison between groups: There is no significant difference in SF-36 rating between the two groups before surgery ($P > 0.05$). The study

Table 5. Comparison in SF-36 rating between the two groups ($\bar{x}$ ± sd)

Groups	Before surgery (Score)	After surgery (Score)	t	P
Study group (n = 45)	63.85 ± 2.14	95.25 ± 8.14	25.0264	< 0.001
Control group (n = 45)	64.01 ± 2.22	80.15 ± 4.21	22.7484	< 0.001
t	0.3481	11.0531		
P	0.7286	< 0.001		

Note: SF-36, Short Form Health Survey.

Table 6. Comparison in treatment satisfaction between the two groups (n, %)

Group	Very satisfied	Satisfied	Unsatisfied	Treatment satisfaction rate
Study group (n = 45)	16 (35.56)	26 (57.78)	3 (6.67)	42 (93.33)
Control group (n = 45)	11 (24.44)	20 (44.44)	14 (31.11)	31 (68.89)
χ^2				8.7752
P				0.0031

group has higher SF-36 rating than the control group after surgery (P < 0.05). Comparison within each group: Both groups have higher SF-36 rating after surgery than before surgery (P < 0.05) as shown in **Table 5**.

Comparison in treatment satisfaction between the two groups

The study group has higher clinical treatment satisfaction than the control group (P < 0.05) as shown in **Table 6**.

Discussion

Breast masses are common in women. Clinically they are divided into benign and malignant masses. Benign masses are more common, and most are fibromas. Some benign masses may transform into breast cancer if not timely or properly managed, leading to great threatens to life [8, 9]. The incidence of breast masses has significantly increased with continuous increase in life stress and elevation of living standards in women in recent years [10, 11]. For traditional invasive surgeries, postoperative scars of varying sizes easily cause deformity, largely compromising the appearance of the breast, which is not acceptable by most patients. Traditional surgeries are hard to carry out in clinical practice due to the psychological harm it causes to patients, and therefore has its limitations in use [12, 13].

This study showed that clinical overall response rate, patient satisfaction, and SF-36 rating are significantly higher in the study group than those in the control group respectively; while the incidence of complications and VAS rating are significantly lower in the study group than those in the control group. It suggested that ultrasound guided mammotome minimally invasive incision is superior to traditional surgery in safety and efficacy for treatment of breast masses. This superiority may be related to the following aspects: 1) In ultrasound guided mammotome minimally invasive incision, real time imaging helps surgeons to dynamically visualize the lesion, accurately excise the lesion, and find micro lesions in early stage. This will minimize the risk of malignant transformation for the lesions, and thus alleviate the patient's psychological burden, and improve their life quality and prognosis [14-16]. 2) This surgery is more advanced and innovative. Its advantages include minimal invasiveness, small incision, high level of safety, precise localization, mild pain, definite resection effect, no radiation, and easy operation. In addition, it barely causes any postoperative scars, or leads to any aesthetic adverse consequence to the breast due to its small incision which requires no suture to close. Therefore it is feasible in young and unmarried women, and preferred by the majority of female patients. This is another advantage over traditional surgery [17-20].

Based on experience in surgical practice, the following considerations should be taken during ultrasound guided mammotome minimal invasive excision: 1) Observe blood supply in breast tissue, and keep away from large vessels in operation. 2) After the mass is excised, remove a proper amount of surrounding normal tissue to assure no residue of the lesions, and adequately clear the blood in the wound by suction [21]. 3) After the mass is complete excised, pressure dressing should be applied timely for 10-15 minutes. Pressure should be administered on the right site with right force.

Elastic bandages could be used subsequently and the incision does not require suture. Finally check with ultrasound to assure no residual mass or bleeding.

This study has shortcomings in that the small sample and short study duration which compromises the interpretation and generalization of the results. Further studies with larger samples and extended duration are needed to provide more substantial evidence to demonstrate the safety and efficacy of ultrasound guided mammotome minimally invasive excision.

In summary, for patients with breast mass, ultrasound guided mammotome minimally invasive excision provides precise excision of the lesion, alleviates the postoperative pain, reduces the complication incidence, and has improved safety and efficacy, thus improving the prognosis of patients.

Disclosure of conflict of interest

None.

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