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Original Article

Comparison of the clinical effects of small-incision resection and botulinum toxin type A for treating underarm odor

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Abstract: The objective of the study was to investigate the clinical differences between small-incision resection and botulinum toxin type A for treating underarm odor. In the study, patients were divided into the experimental group (62 cases) or control group (60 cases). The experimental group underwent small-incision resection to treat underarm odor, while the control group received botulinum toxin type A. The treatment effects for the two groups were compared after 6 months. The main indicators were the effective rate, complications, and recurrence rates. The study results showed that the differences in total effective rate and complication incidence were not statistically significant between the two groups at 6 months postoperatively. However, the difference in recurrence rate was statistically significant between the experimental group (4.84%) and the control group (90%) at 6 months postoperatively ($P < 0.05$). In summary, small-incision resection sufficiently removed the odor, exhibiting a desirable effect and low recurrence rate. The axillary fossa maintained no obvious scar, and the incision did not affect the shape or function of the armpit. Thus, small-incision resection is a surgical method that should be promoted.

Keywords: Small-incision resection, botulinum toxin type A, stink, operation

Introduction

A study suggests that underarm odor, also known as bromhidrosis, is caused by bacterial decomposition and abnormal secretion of the axillary glands on the skin surface of the armpits [1, 2]. Underarm odor can cause personal discomfort in patients, negatively affect quality of life, and cause social and psychological problems [3, 4]. Many methods to treat underarm odor have been identified, but the surgical removal of the apocrine gland tissue is considered the best method [5-9]. However, early surgical treatment of underarm causes significant trauma, and bilateral axillary scar contracture leads to dysfunction [5, 10-12]. In the current study, we analyzed the therapeutic differences between small-incision resection and botulinum toxin type A for treating underarm odor. Our results may provide a reference for the clinical treatment of underarm odor.

Materials and methods

Clinical data

A total of 122 patients with underarm odor were treated in our department from January 2019 to June 2019. The experimental group consisted of 62 patients: 32 men and 30 women aged 18-42 years, with a mean age of 24.0±4.2 years. The control group consisted of 60 patients: 27 men and 33 women aged 17-38 years, with a mean age of 22.4±3.6 years. Differences in sex, age, underarm mass index, disease duration, smoking history, and drinking history of the patients were not statistically significantly between the two groups.

Design

Patients were placed in the supine position, with their outer upper limbs placed above their

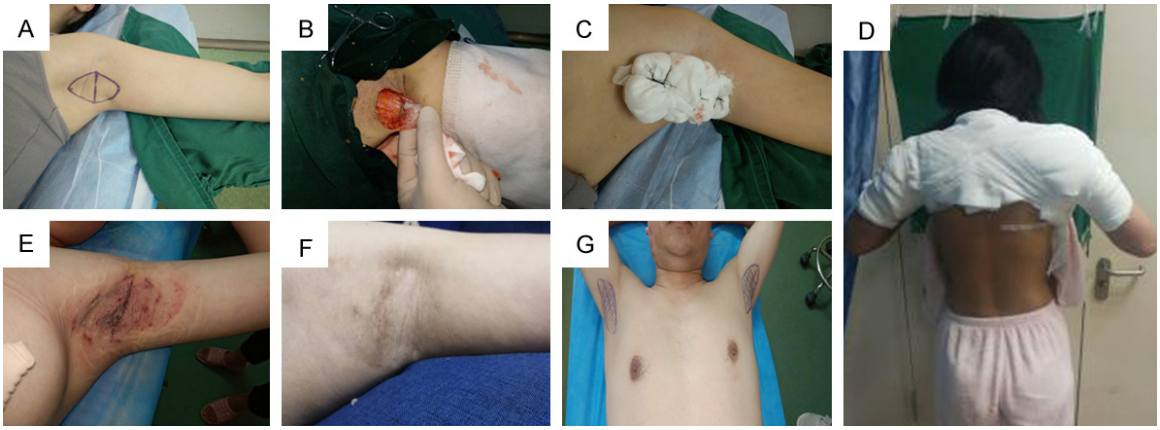

Figure 1. Small-incision underarm odor resection. A. Preoperative design; B. Intraoperative construction of apocrine glands; C. Immediately after surgery; D. Figure-of-eight bandage fixation postoperatively; E. 7 days postoperatively; F. 6 months postoperatively; G. Design before botulinum toxin type A injection (control group).

heads. Methylene blue (Jiangsu Jichuan Pharmaceutical Co., Ltd., Taizhou City, China) was used to draw the surgical range up to the outside 1.0 cm of the hair follicle area. One or two lines were drawn in the axillary fold on the basis of the strip size and then the strip was removed.

Anesthesia

Approximately 20 mL of 2% lidocaine, 100 mL of saline water, and 0.5 mg of 0.1% adrenaline were mixed and then subcutaneously injected into the surgical area at approximately 60 mL per side.

Surgical method

After patients were anesthetized, the skin and subcutaneous tissue were cut using a surgical scalpel with a #11 blade. Separation scissors were used in the shallow and deep fascia to separate and cut the skin on both sides of the fascia. The skin was turned over by using a finger. Tissue scissors were used to remove the apocrine glands and hair follicles, and skin slices were trimmed at full thickness. Bleeding was completely blocked by electrocoagulation. The area was repeatedly washed with saline water to remove the broken tissue. A 5-0 suture was used to stitch the incision, and a surgical scalpel with a #11 blade was used to make 6 micropores in the surgical area to facilitate postoperative drainage. The 2-0 silk thread was used to make 8 rivets outside the surgical area. Vaseline, sterile gauze, a cotton ball, and multilayer cotton were used to fix the surgical area. A figure-of-eight bandage, an appropriate pressure bandage, and an osmidrosis clothing pressure bandage were used. The upper limbs of postoperative patients were immobilized to prevent shoulder activity. Dressing tightness was sufficiently loose to avoid impacting the upper limbs or disrupting blood supply. The bandage was removed 7 days postoperatively, and the external dressing was replaced. Sutures were removed 10 days postoperatively. One week after suture removal, patients began upper-extremity outreach exercises in both limbs to prevent the skin from contracting (**Figure 1**).

Treatment method for the control group

Patients were placed in the supine position, the hair was shaved, and the upper limbs were positioned to expose the armpits. Methylene blue marked the treatment range 1.0 cm outside the hair follicle area. The treatment line interval was 2.0 cm, and the intersection point of the left and right lines served as a treatment point. After diluting the botulinum toxin type A (Lanzhou Institute of Biological Products, Lanzhou city, China) with 2 mL of 0.9% normal saline, 2 U of botulinum toxin was injected at each treatment point. The maximum dose injected into the unilateral axilla was 50 U, and local compression banding was performed for 5 min after injection. Subsequently, patients were monitored for 30 min to observe for adverse reactions (**Figure 1G**).

Table 1. Effect of treatment after 6 months for both groups

Groups	Cases	Efficacy (Cases)			Total efficacy (%)	χ^2	P
		Cure	Effective	Invalid			
Experimental group	62	48	12	2	96.77	1.933	0.38
Control group	60	40	16	4	93.33		

Efficacy evaluation

The control and experimental groups were evaluated for effectiveness, complications, and recurrence rate. Effectiveness was assigned the following scores: (1) Healed: Odor was eliminated, and no axillary odor was noticeable; (2) Effective: Odor symptoms improved, but a slight odor could be detected within 20 cm around the patient; (3) Partial effect: Mild odor was present at 20 cm around the patient; however, it improved relative to the odor before the procedure; and (4) Invalid: Odors were noticeable at 20 cm around the patient, with no substantial relief from previous symptoms. Total effective rate = (number of cured cases + number of effectiveness cases + number of partial effect cases)/total number of cases × 100%.

Statistical analysis

Data were statistically analyzed using the SPSS 19.0 statistical software (IBM Corporation, Chicago, IL, USA). Measurement data were expressed as mean ± standard deviation, categorical variables were summarized by frequency, continuous variables were described by descriptive statistics; Chi-square test was applied for count data. $P < 0.05$ was considered statistically significant.

Results

Total effective rates after 6 months for both groups

At 6 months post-treatment, the total effective rate of the experimental group was 96.77%, and the total effective rate of the control group was 93.33%. The difference in total effective rate between the groups was not statistically significant (**Table 1**).

Incidence of postoperative complications for both groups

In the experimental group, 1 case of skin flap necrosis occurred postoperatively, which healed after 2 weeks of dressing changes (**Table 2**). In 5 cases, the incision formed a postoperative scar, and no subcutaneous hematoma or wound infection were observed. The complication incidence was 9.68%. Among the 60 patients in the control group, 1 patient showed flu-like symptoms and local muscle weakness postoperatively. The difference in complication incidence between the groups was not statistically significant.

Odor recurrence rate for both groups

Follow-up for the 122 cases ranged from 6 months to 2 years. In the experimental group, 3 cases showed recurrence (4.84%); in the control group, 54 cases showed recurrence (90%) six months postoperatively (**Table 3**). The difference in recurrence rate between the two groups was statistically significant ($P < 0.05$).

Discussion

Axillary sweat glands secrete organic substances that are decomposed by bacteria to produce unsaturated fatty acids and ammonia, resulting in underarm odor [1, 11, 13, 14]. The occurrence of underarm odor has a genetic tendency and is subjective to a certain extent; however, no clear clinical diagnostic criteria have been identified [14]. Secretions from the axillary apocrine sweat gland are influenced by sex hormone levels; thus, axillary odor is more severe in adolescence and decreases gradually or disappears in elderly populations [6, 15]. Some studies have suggested that the distribution range of the apocrine sweat glands in the armpit ends at approximately 0.5-1.0 cm outside the armpit hair. Basic treatment methods include both nonsurgical and surgical treatments, which include (a) removing the apocrine sweat glands on the skin surface; (b) inhibiting axillary bacteria; (c) absorbing, or changing the odorous substances produced by bacterial decomposition; and (d) masking the smell with perfume or deodorant [16-18]. Nonsurgical cures can hardly treat underarm odor and can only alleviate or mask the smell because apocrine sweat glands are located in the adipose layer [19]. Therefore, surgery is the only radical treatment method.

Table 2. Postoperative complication incidence for both groups

Groups	Cases	Complications	No complications	Incidence of complications (%)	χ^2	P
Experimental group	62	6	56	9.68	2.288	0.13
Control group	60	1	59	1.69		

Table 3. Recurrence rates of odor for both groups

Groups	Cases	Recurrence	No recurrence	Complication incidence (%)	χ^2	P
Experimental group	62	3	59	4.84	88.838	<0.001
Control group	60	54	6	90.00		

Surgical indications for underarm odor are mainly based on the subjective desire of the patients rather than the severity of the odor [20, 21]. Surgeons should actively communicate with the patient before surgery to explain the occurrence of abnormal smell after normal activities and to eliminate excessive expectations from patients. From clinical practice, we have determined that incision size, postoperative effects, and scar severity are the key concerns of patients; thus, we improved the surgical method on the basis of the distribution range of axillary hair.

Several studies suggest that the distribution zone of apocrine glands is in the subcutaneous superficial layer and that trimming the dermis during surgery is unnecessary. According to other studies, the apocrine glands are located in the subcutaneous superficial layer and deep dermis and should be thoroughly trimmed to the deep dermis during surgery [22, 23]. We currently used a small-incision procedure to trim the apocrine gland for odor treatment. The deep dermis was trimmed during surgery. Postoperative odor was completely eliminated, and the skin survived well. The general steps are as follows. (a) For anesthesia, we used the swelling anesthetic method in which the tissue is fully expanded to temporarily increase the thickness of the local tissue. This technique facilitates mastery of the anatomical layer, reducing bleeding, and reducing the risk of surgery and damage to the deep blood vessels and nerves in the armpit. (b) We determined the incision length depending on the range of axillary hairs, not exceeding the range of axillary hairs on both sides. Using 1 or 2 incision lines, we used separating scissors to separate the shallow and deep fascia and then trimmed them under direct vision. The sweat glands were removed up to 0.5 cm beyond the axillary hairs. (c) Postoperative drainage and pressure dressing were applied as follows. After trimming, we repeatedly washed the wound with saline, and bleeding was stopped by electrocoagulation. Using a surgical scalper with a #11 blade, we trimmed multiple micropores in the surgical area. The effect of drainage after the surgery was exact, and only a small scar remained in the microhole. After appropriate pressure dressing, we covered the incision with gauze and a cotton pad and then applied a figure-of-eight bandage or bandage dressing. Patients were cautioned to keep their upper limbs inactive and avoid shoulder activities. (d) With regard to dressing time, odor treatment required a strictly aseptic type I incision, with no antibiotics required postoperatively. After 7 days, the pressure dressing was removed and changed. If the dressing was too tight or the area was numb, the dressing was loosened, depending on the situation. (e) Most cases of skin necrosis or hemorrhage in postoperative patients were related to skin injury arising from trimming of apocrine glands, incomplete intraoperative hemostasis, or postoperative shoulder activity. Therefore, the operation should be performed carefully, avoiding damage to the tissue, maintaining strict hemostasis during surgery, and with strict postoperative bracing of the upper limbs. (f) In 62 patients, only 1 case of self-proclaimed residual odor was encountered, which was undetected by the surgeon and others nearby and may have been related to psychological factors. The scope of the operation may seem insufficient to this patient. Therefore, surgeons should actively communicate and explain the scope of the surgery to patients beforehand to reduce their expectations related to residual odor and psychological burden to patients.

In this study, the control group was injected with botulinum toxin type A to treat underarm odor. The injection site was located in the apocrine sweat gland; thus, the injection should effectively inhibit the release of neurotransmitter acetylcholine from nerve endings and block the impulse of the neuromuscular junction, thus reducing sweat secretions to treat the underarm odor [21, 22, 24]. The present study also found that at 6 months, the curative effect of small-incision resection in the experimental group was similar to that of botulinum toxin type A in the control group for treating underarm odor; the difference in curative effect between these groups was not statistically significant. Moreover, no significantly differences in postoperative complications such as subcutaneous hematoma, wound infection, skin flap necrosis, or postoperative scarring were found between the control group and the experimental group. However, over time, the recurrence rate in the control group increased. The difference in efficacy between the experimental group and the control group was statistically significant. The difference could be attributed to the unstable duration of botulinum toxin type A. Therefore, small-incision resection effectively treats underarm odor, with a significantly higher long-term efficacy than that of botulinum A injection.

In summary, small-incision resection for treating underarm odor can be accomplished by expanding the scope of trimming, using appropriate postoperative compression bandage fixation, and applying strict postoperative bracing. Small-incision resection provides precise surgical treatment effect, thorough odor removal, lower recurrence rates, less axillary scarring, as well as better morphology and function of the axillary. Thus, this method should be promoted.

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Disclosure of conflict of interest

None.

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