Use of Axillary Fold, Parallel Double Incision, Minimally Invasive Surgery Combined with Ion Electrocautery for Axillary Bromhidrosis

F Chen, L Zhang

ABSTRACT

Objective: Axillary bromhidrosis is an autosomal dominant genetic disease characterized by unpleasant odor caused by interaction between apocrine gland discharge and bacteria. Many treatments have been developed for axillary bromhidrosis. Surgical resection of the apocrine glands is the most effective and is irreversible, but the risk of postoperative complications is very high. This study aimed to evaluate the efficacy and adverse effects of a new surgical procedure.

Methods: From January 2012 to May 2015, 124 patients with axillary bromhidrosis visited the plastic surgery outpatient department at the China-Japan Union Hospital of Jilin University and underwent axillary fold, parallel double incision, minimally invasive surgery combined with ion electrocautery.

Results: Treatment outcomes were assessed in outpatient follow-up for 6 months. A total of 19 patients were lost to follow-up and excluded from this study. We confirmed apocrine gland destruction through histopathological examination. During follow-up, we monitored wound healing, hematoma formation, necrosis, infection, residual odor, postoperative pain, immobilization, and overall satisfaction. Among 105 patients, 101 (96.2%) had complete elimination of malodor at the end of the study; 99 were completely satisfied with the treatment, 4 were partly satisfied, and 2 were dissatisfied. The recurrence rate was 3.8%. The most common postoperative complication was transient ecchymosis (23.6%).

Conclusions: Axillary fold, parallel double incision, minimally invasive surgery combined with ion electrocautery is a simple and effective treatment for axillary bromhidrosis.

Keywords: Axillary osmidrosis, ions electrocautery, minimally invasive

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From: Department of Plastic Surgery, China-Japan Union Hospital of Jilin University, Changchun 130033, China.

Correspondence: Mr L Zhang, Department of Plastic Surgery, China-Japan Union Hospital of Jilin University, Changchun, 130033, China. Email: cnbdoc@126.com

INTRODUCTION

Axillary bromhidrosis is a condition of excessive or abnormal odor caused by the interaction between apocrine gland secretions and bacteria (Staphylococcus aureus, gram-negative bacilli) (1, 2). The odor is due to microbial conversion of apocrine secretions into short-chain fatty acids such as isovaleric acid and volatile sulfur compounds such as 3-sulfanylhexan-1-ol. These can be detected at a few parts per billion to parts per trillion by the human nose, and indicate an unhygienic state (3). Postpubertal axillary odor is common in black and white populations. However, because of cultural values in Asian countries, the odor often results in social and psychological problems, including depression and anxiety, and has negative social impact (4, 5). Thus, patients commonly seek treatment.

Many different treatments have been described, and can be divided into surgical or nonsurgical therapy. There are 3 traditional surgical procedures: subcutaneous tissue excision, simultaneous removal of all subcutaneous tissue and overlying skin, and partial removal of subcutaneous tissue and overlying skin (6). Minimally invasive surgeries for axillary bromhidrosis include endoscopic sympathectomy, liposuction curettage, and others. Nonsurgical methods include topical antiperspirants, botulinum toxin injection, radiofrequency energy, and laser therapy (7-10), but these only alleviate symptoms temporarily (11). Treatment of axillary bromhidrosis with surgical resection of the apocrine glands remains the most effective and irreversible method. However, it carries a high risk of postoperative complications such as delayed wound healing, extensive scarring, infection, or axillary nerve damage (12, 13). While nonsurgical methods may reduce the risk of postoperative complications, recurrence rates increase. Therefore, to reduce postoperative complications and the recurrence rate, we used axillary fold, parallel double incision, minimally invasive surgery combined with ion electrocautery for axillary bromhidrosis.

MATERIAL AND METHODS

Patients

From January 2012 to May 2015, 124 patients (89 females and 35 males) with axillary bromhidrosis visited the plastic surgery outpatient department at the China-Japan Union Hospital of Jilin University and underwent treatment with the new procedure. In this study, 14 patients were 16-20 years old, 76 were 21-30 years old, 22 were 31-40 years old, and 12 were older than 41 years. This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of China-Japan Union Hospital of Jilin University. Written informed consent was obtained from all participants. Axillary fold, parallel double incision, minimally invasive surgery combined with ion electrocautery

The patients were placed in the supine position with hands behind the head. Both axillae were fully exposed (axillary area range from 4 cm × 6 cm to 6 cm × 9 cm). The axillary hairline was marked, and a 2-cm parallel double incision was made 1 cm beyond the outline and axillary folds (Figure 1A). The skin was sterilized with iodophor and draped. A local anesthetic solution was prepared using 100 ml of 0.25% lidocaine and 0.5 ml epinephrine (or 800 ml chloroprocaine, 0.5 ml epinephrine, and 120 ml normal saline), and each axilla was injected with 40-50 ml. Mild compression was applied for 2 min to promote anesthetic infiltration.

The double incision was made using a no. 13 blade, and seam pull wires were placed on both sides of the incisions. The loosened layer between the dermis and subcutaneous tissue was dissociated with ophthalmic scissors to the marked range, and a subcutaneous tunnel was made. The apocrine glands attached to the dermis were removed with ophthalmic scissors. Yellow apocrine granules appeared by everting the thin flap (Figure 1B). High-temperature electric ion cautery was applied to the apocrine glands using a Multi-Purpose Electric Ion Operating Apparatus

set at 9 J. When the axillary hair easily broke off with a hemostatic forceps, the hair follicles and apocrine glands had been destroyed. The tunnel was repeatedly washed with normal saline, and free subcutaneous tissue fragments were extruded, along with fat particles and liquid. Clean gauze and styptic powder were used to dry the area. The wounds were closed with interrupted 5-0 absorbable suture and drain tubing was placed. A loose, bulky compressive dressing was placed in the axilla and an elastic figure-8 bandage was placed around the shoulder (Figure 1C). The total procedure required about 60 min for one patient.

Preoperative considerations

Before the operation, the severity of axillary bromhidrosis was classified using the system described by Park and Shin (9). We objectively and carefully explained to the patient the surgical method and advantages. We examined the axillae for infection; a routine examination was preformed; female patients were not treated during their menstrual periods, and patients were instructed to avoid aspirin and other anticoagulant drugs for 1 week before surgery; bathing a day in advance and wearing cotton underwear were advised.

Postoperative management

Limited general activity was advised for 1 day after the operation, with avoidance of overuse of the upper limbs, including elevation, reaching, and heavy lifting. Prophylactic anti-inflammatory treatment was administered for 3 to 5 days. Dressings were changed every other day with monitoring of the subcutaneous tissue; any hematoma was treated with drainage and aspiration. Recombinant bovine basic fibroblast growth factor was applied around the wound. Bulky compressive dressings were used for at least 6 days, and sutures removed on the 12th day (Figure 1D). Avoidance of strenuous upper limb activity was required, and basketball, weightlifting, and swimming were prohibited to facilitate wound healing.

On postoperative days 7, 14, 30, 60, 120, and 180, we evaluated the severity of remaining odor, postoperative pain, reduced mobility, and overall satisfaction. Patients reported complete or partial satisfaction, or dissatisfaction. Pain and limitation of mobility were recorded on a 10-point scale, with lower scores indicating less severity (14).

RESULTS

From January 2012 to May 2015, 124 patients (89 females and 35 males) with axillary bromhidrosis underwent the new procedure, with follow-up for at least 6 months. The study excluded 19 patients who were lost to follow-up. Among 105 patients, 101 (96.2%) had complete elimination of malodor at the end of the study. Of these, 100 were completely satisfied with the treatment, 4 were partially satisfied, and 1 was dissatisfied (Table 1). The recurrence rate was 3.8%. The odor in patients with recurrence was significantly reduced compared to that prior to surgery. The most common postoperative complication was transient ecchymosis (23.6%), which regressed spontaneously in 1-2 weeks. Hematoma was observed in 10 cases, and was caused by removal of the bandage without permission in 2 cases. Ten cases of hematoma required aspiration; with local pressure and symptomatic treatment, normal healing occurred within 2 weeks. Skin necrosis was observed in 3 cases. The wound healing time was 12.7 days on average (Figure 2).

DISCUSSION

The social life of patients with axillary bromhidrosis is severely affected because of excessive malodor. Traditional surgical treatment is removal of axillary skin to reduce the number of sweat

glands and amount of secretion. This can lead to a higher cure rate and a lower rate of recurrence, but can result in complications such as axillary nerve damage, postoperative pain, hemorrhage, edema, hematoma, and severe limitation of mobility (12, 13, 15). Thus, many patients prefer minimally invasive therapies (16, 17). While nonsurgical methods can reduce the risk of postoperative complications, the recurrence rate is higher. This highlights the need for a combination of surgical and nonsurgical methods. To maximize the advantages of surgery and minimize the risk of complications and adverse effects, we combined subcutaneous tissue removal and ion electrocautery (4, 18).

Among the 105 patients in our study, the recurrence rate was 3.8% and skin necrosis was observed in 3 cases. The incidence of subcutaneous hematoma was significantly reduced. There were no severe complications including vessel or nerve injury, excessive scarring, or incision disruption. The axillary tissue was submitted for pathological analysis (Figure 3). Preoperative biopsy showed apocrine glands mainly in the subdermal 0.5 cm. The deeper the tissue below the subdermal 0.5 cm, the fewer the apocrine glands, until none were observed (9, 19, 20). A large number of apocrine glands were also distributed around the vascular network of the subdermal and deep dermis. The subcutaneous trimming method used in the past often left residual perivascular dermis and apocrine intradermal glands because of concern that the repaired skin would be too thin for effective wound healing or would result in flap necrosis. Therefore, we used ophthalmic scissors combined with ion electrocautery to further reduce the risk of recurrence.

The new procedure has the following advantages

The location of the incision: The incision is made along the axillary fold in the direction of striae, and is thus hidden and is not under tension. This method can reduce the risk of wound infection, dehiscence, or delayed healing. Furthermore, there is no obvious scar or movement limitation.

The parallel double incision: Compared with a single incision, the double incision is more conducive to surgery and stripping for the same range. With a single incision, apocrine glands can only be removed in a semi-blind operation, but with a double incision, the flap can be fully everted and the apocrine glands completely exposed. With a direct-look operation, the recurrence rate is further reduced.

The use of charged ion electrocautery: The treatment principle of the electric ion therapeutic instrument is the use of high frequency current and a metal stylus with diameter of 0.1-1; when placed near the apocrine glands, the stylus and organizations create a minimal air gap and generate high electric field strength to ionize gas molecules and produce a plasma flame. When set for high output, the instrument instantly generates a temperature of about 3,000°C, so that the affected tissue vaporizes and disappears; moreover, there is a thin solidified layer below the gasification layer, which can prevent bleeding, protect the surface tissue, and promote rapid wound healing. When set for low output, the instrument can coagulate the affected tissue, with carbonization and gasification to necrosis.

The retention of preoperative axillary hair: Unlike other methods, there is no preoperative skin preparation, but axillary hair is removed after the electrical ions destroy the apocrine glands. Destruction of hair follicles and apocrine glands is confirmed by gentle traction with a hemostat. If the extent of damage is insufficient, surgery should continue.

Dressing fixation of the surgical site: Postoperatively, sterile gauze with a loose compression dressing is applied, and an elastic figure-8 bandage is wrapped around the shoulder securely to limit shoulder motion. This can promote dressing fit to the incision, aid in hemostasis and drainage of exudate, reduce hematoma formation, and promote wound healing.

CONCLUSION

This new procedure includes the following: incision along the axillary fold to minimize scarring, flap eversion under direct vision, direct ion destruction of apocrine glands to reduce the relapse rate, full axillary compression, and early postoperative upper limb immobilization to reduce complications. This procedure is an optimal therapeutic strategy for axillary bromhidrosis.

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Table 1: Postoperation evaluation

	7day	**14day**	**30day**	**60day**	**120day**	**180day**
Postoperation subject assessment						
Totally satisfied	102	103	102	101	100	100
Partially satisfied	3	2	2	3	4	4
Regretful	0	0	1	1	1	1
Osmidrosis grading system						
Grade 0, 1(pre-/postoperatively)	0/10	105	104	103	101	101
Grade 2	5	0	1	2	4	4
Grade 3	57/0	0	0	0	0	0
Complication	48/0					
Ecchymosis		2	0	0	0	0
Hematoma	82	0	0	0	0	0
Skin necrosis	10	3	1	0	0	0
Scar	3	0	0	0	0	0
Infection	10	0	0	0	0	0
Movement limitation	100	0	0	0	0	0
Vessel or nerve injury	0	0	0	0	0	0

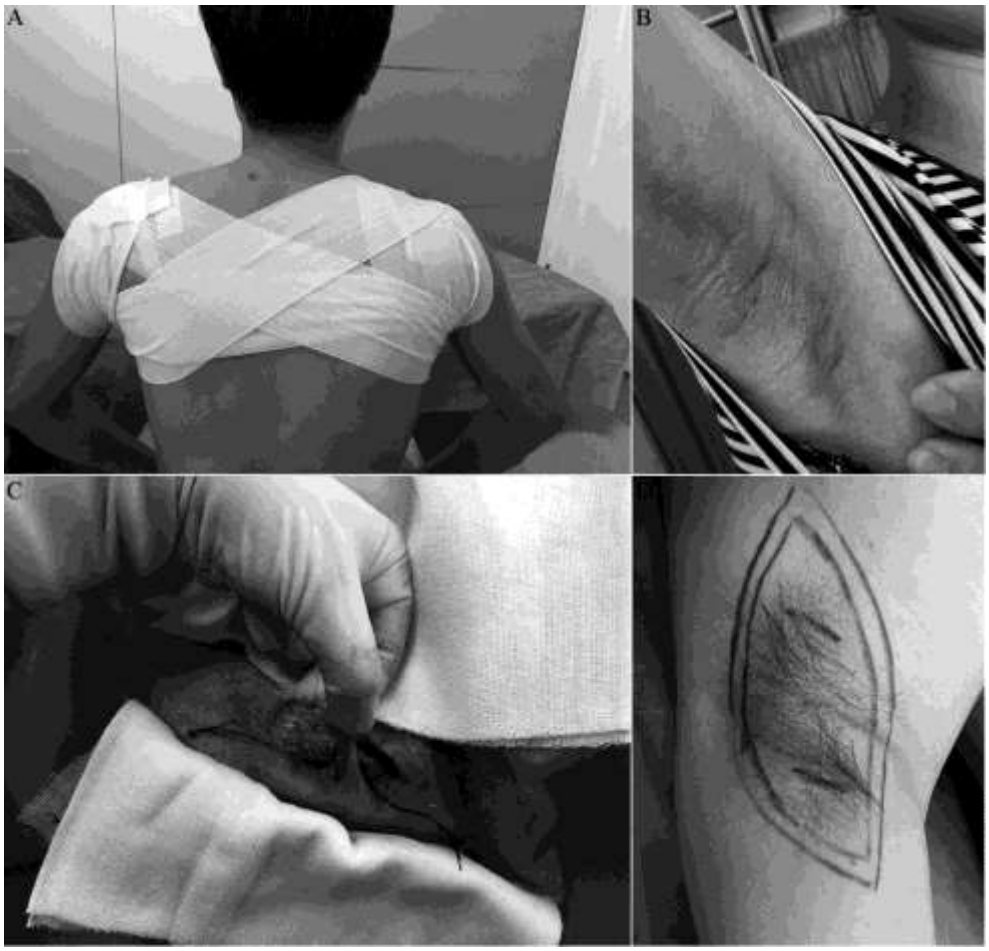

Fig. 1: Procedure.

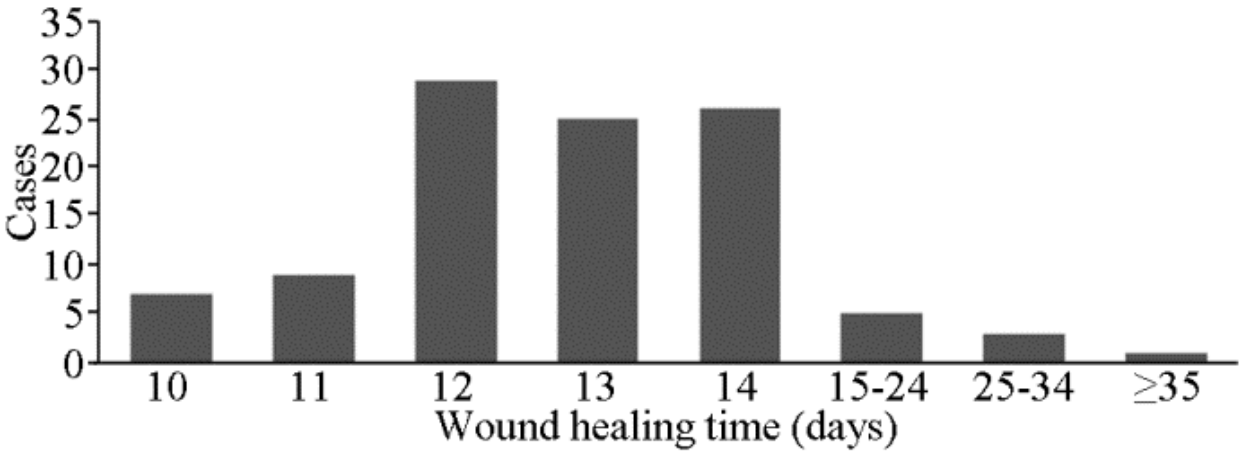

Fig. 2: The wound healing time condition.

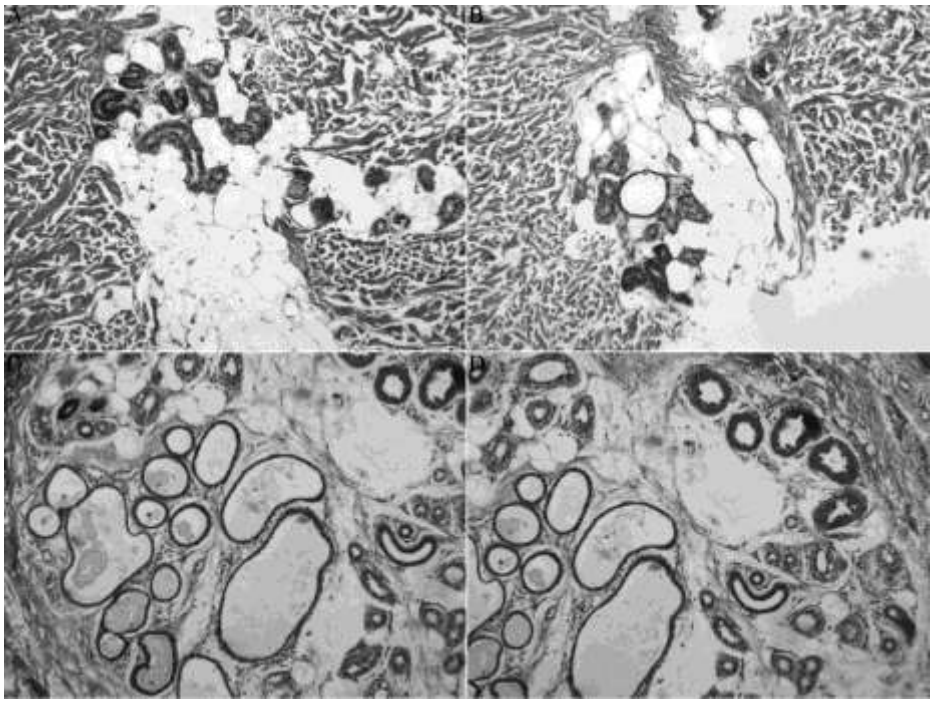

Fig. 3: A, B: Before surgery; C, D: After surgery.