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The Treatment of Axillary Odor: A Network Meta-Analysis

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Background: Axillary osmidrosis (AO) is common in plastic surgery. But there is no perfect way to treat AO. We systematically compared the efficacy of 10 AO treatments with network meta-analysis in order to provide reference for the clinical treatment of axillary odor.

Material/Methods: Chinese and English databases were searched by computer. Some relevant studies were collected for network meta-analysis.

Results: We identified 56 studies, including a total of 8618 patients for meta-analysis. The network meta-analysis showed that 21 out of 45 pairs of 10 AO treatments had no statistical significance. In statistical comparison, subcutaneous curettage and swelling suction subcutaneous pruning were better than a single treatment. In addition, the effects of both laser and electric ion therapy were inferior to those of other treatments. The order of therapeutic effects predicted by surface under the cumulative ranking (SUCRA), curve was swelling aspiration+subcutaneous pruning >subcutaneous pruning >subcutaneous curettage+subcutaneous pruning >spindle excision >botulinum toxin A injection >swelling aspiration >subcutaneous curettage >YAG laser therapy >CO₂ laser therapy >electric ion therapy.

Conclusions: In operative treatment of AO, swelling aspiration+subcutaneous pruning is the best operative treatment, and botulinum toxin A injection is the best in non-operative treatment. Overall, the effect of surgical treatment was more significant than that of non-surgical treatment.

MeSH Keywords: **Meta-Analysis • Surgical Procedures, Operative • Treatment Outcome**

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Background

Axillary osmidrosis (AO) is common in plastic surgery. The mechanism is that the unsaturated branched-chain fatty acids secreted by the apocrine sweat gland (ASG) gland in the axillary region are decomposed by bacteria distributed on the axillary skin to produce a special odor. AO does not result in injury to human physiological function. However, it often affects patients' social interaction and even leads to psychological disorders, especially in Asia where the disturbance caused by AO is more obvious [1].

There are many clinical treatments for AO, but the principle is basically the same, that is, to reduce or completely clear the axillary ASG, reduce the secretion of unsaturated branched fatty acids to reduce or eliminate the special smell of axilla [2]. At present, the main methods of treatment for AO include surgical treatment and non-operative treatment. Surgical treatments mainly include subcutaneous curettage, fusiform skin excision, subcutaneous pruning, swelling aspiration and so on. And non-operative treatments mainly include CO₂ laser, YAG laser, electric ion therapy, botulinum toxin A injection, and so on. There are many studies comparing the curative effect of different treatment methods in the clinic setting, but most of them are 2 or 3 kinds of treatment methods, so it is not possible to evaluate the curative effect of each treatment method synthetically [3]. In order to help doctors to choose the treatment of AO better, we searched papers on clinical controlled studies of axillary osmidrosis which were published up to May 2018 for this network meta-analysis.

Material and Methods

This network meta-analysis was written in accordance with the requirements of the PRISMA extension statement [4].

Search strategy

We searched the PubMed, Embase, Cochrane Library, Wanfang Data Knowledge Service Platform, and China National Knowledge Infrastructure (CNKI) for studies published between January 1, 1990 and May 31, 2018. The search keywords were "Bromhidrosis", "Underarm Odor", "Osmidrosis", "Bromidrosis". In accordance with the request of PRISMA extended statement, the specific search strategy of PubMed is as follows: (((underarm odor) OR bromhidrosis) OR osmidrosis) OR bromidrosis. In this study, we retrieved articles published in English or Chinese only.

Inclusion and exclusion criteria

Studies were included in the network meta-analysis if they met the following criteria: 1) published studies on the treatment

of AO; 2) in the same study, there were no statistically significant difference in age, sex, course of disease and severity of illness between different treatment groups. 3) interventions in the studies included 2 or more of these 8 items: subcutaneous curettage, fusiform skin excision, CO₂ laser, subcutaneous pruning, YAG laser, electric ion, swelling aspiration, and botulinum toxin A injection. 4) The evaluation index of the studies was the cure rate of the AO treatment. Reviews, case reports, comments, and ongoing trials were excluded.

Data extraction and quality assessment

Two reviewers (Sun and Wang) independently extracted data from the included studies. A special data extraction table was designed for the meta-analysis. The first author name, publication year, study location, surgery type, number of patients, and follow-up time were collected. The Newcastle-Ottawa Scale was used to evaluate the quality of the literature, which was evaluated from three aspects: patient selection, comparability, and outcome follow-up. The total score was 9. Less than 6 was classified as low-quality literature.

Outcome measure

The primary outcome was the cure rate of the AO treatment because these data were closely related to patient quality of life.

Statistical analyses

The network meta-analysis was performed using the Stata 14.0. First, 3 or more interventions were divided into all possible combinations of 2 intervention tests, and the software was used to map the evidence network of the intervention measures. Then, the inconsistency factor (IF) and its 95% confidence interval (CI) were used to evaluate the consistency of every closed loop in the evidence network graph. The lower limit of 95% CI equal to 0 was considered as consistency in the closed loop. Otherwise, it was considered that there was obvious inconsistency in the close-loop. The intergroup discrepancies for all outcomes were presented as relative risks (RRs) and 95% CIs respectively. Eventually, based on surface under the cumulative ranking (SUCRA) curve, efficacy of 10 treatments were ranked. The publication bias of the literature was evaluated using funnel diagrams.

Results

Characteristics of eligible studies

A total of 6817 relevant studies were identified in our database search and 1836 duplicate publications were deleted. We excluded 4726 studies due to titles and abstracts that suggested

Figure 1. PRISMA flow diagram.

the studies were obviously irrelevant. In addition, 199 articles (48 case series/reports, 52 literature reviews, 42 articles with no relevant data, 57 articles with no control group) were excluded by reviewing the full text of studies. Finally, 56 studies [5–60] were included in our network meta-analysis. The searching progress is shown in Figure 1.

In the network meta-analysis, 8618 participants were included and there was no significant difference in age, sex, or severity of disease. The included studies were published between 1994 and 2018. The research sites are all in China. The evaluation criteria were the cure rates. The shortest follow-up time was 1 month and the longest was 10 years. The characteristics of the included studies are shown in Table 1.

Meta-analysis

Network graph

Ten treatments formed 45 different pairings, 25 of which were direct pairwise comparisons and 20 were indirect pairwise comparisons. The point-to-point link indicated that there was

Table 1. Characteristics of the 56 included studies.

First author	Year	Country	Surgery type	No. patients	Age	Follow-up (months)	Research type	Literature quality (star)
Zong Yanxia	2005	China	a	88	25	6	Non-RCT	6
			b	9				
Wang Jin	2014	China	c	52	27.2	3	Non-RCT	6
			d	68				
Cai Tiequan	1994	China	c	48	23.2	8.2	Non-RCT	6
			e	56	24.5			
Chen Mingxing	2002	China	c	58	18–35	1	RCT	7
			d	58				
Wang Shuhua	2003	China	c	140	25	12	RCT	6
			b	140				
Yang Shulan	2008	China	c	50	13–60	3–8	RCT	8
			e	50				
Li Chaohui	2005	China	e	90	18–30	3–12	RCT	6
			f	90				
Wang Weiping	2007	China	f	165	27	3	Non-RCT	5
			a+d	145				
Gu Shuguang	2010	China	b	115	18–40	4–60	Non-RCT	6
			b	47				
			c	40				
			d	52				

Table 1 continued. Characteristics of the 56 included studies.

First author	Year	Country	Surgery type	No. patients	Age	Follow-up (months)	Research type	Literature quality (star)
Jiang Wei	2010	China	f	26	28.6	6–18	Non-RCT	6
			g	30				
			d	50				
			a+d	50				
Zhang Likang	2014	China	a	60	23.4	2–6	Non-RCT	7
			b	80				
Guo Xiaochuan	2008	China	a	114	15–47	6–18	Non-RCT	6
			b	42				
			g	30				
Zhang Xiaotao	2013	China	b	45	23.98	6–12	Non-RCT	7
			d	45	23.26			
Zhang Hui	2010	China	b	65	29.6	3	Non-RCT	6
			d	65				
Xie Qixuan	2004	China	a+d	85	25.7	3	RCT	5
			f	70				
Zhang Zhanzhao	2012	China	d	47	25.4	3	Non-RCT	6
			h	39	21.1			
Gu Tingmin	2012	China	b	113	24.5	6–12	Non-RCT	7
			d	205				
Qian Jiang	2003	China	a	31	25	6	Non-RCT	6
			b	18	23.8			
Wang Wanzhi	2006	China	b	23	28.6	3	Non-RCT	5
			d	19	27.4			
Jing Liangyu	2010	China	a	46	27	6–60	RCT	7
			b	54	25			
Lei Tianbing	2014	China	a	60	16–40	6	RCT	6
			d	50				
Li Li	2015	China	d	45	—	6	Non-RCT	5
			g	45				
Zhang Jianzhuo	2014	China	d	40	22.51	6	RCT	6
			g	40	22.7			
Wang Qian	2011	China	d	90	23.53	6–12	RCT	6
			h	100	20.65			
Zheng Ruo	2013	China	a	64	27.6	3	RCT	6
			d	64	27.2			
Jiang Bin	2012	China	a	136	28.7	3	RCT	7
			b	97				
			c	101				

Table 1 continued. Characteristics of the 56 included studies.

First author	Year	Country	Surgery type	No. patients	Age	Follow-up (months)	Research type	Literature quality (star)
Zhang Kaiheng	2012	China	b	33	24	5–72	Non-RCT	6
			d	115				
			g	21				
Liu Cheng	2017	China	d	38	23.3	6–9	Non-RCT	6
			h	23				
			g	23				
Guo Qun	2007	China	b	67	28	6–72	RCT	7
			d	112				
			a+d	177				
Mo Lue	2007	China	a	42	19–27	6	RCT	5
			b	47				
			d	61				
Chen Jie	2011	China	a+d	82	15–40	6–12	Non-RCT	5
			b	58				
			c	40				
Chen Hui	2011	China	b	23	25	6	Non-RCT	6
			g	30				
Jing Liangyu	2010	China	b	54	27	6–60	RCT	6
			c	51	28			
Liu Jianyi	2004	China	b	40	29.6	6	RCT	7
			d	102				
Wu Weiping	2016	China	d	50	27.61	3	RCT	7
			g	50	27.56			
Lin Xia	2012	China	d	45	26	6	RCT	5
			g	33	28			
Huang Haiyan	2011	China	a	105	24.6	6–12	Non-RCT	6
			g	51				
Liang Haisheng	2014	China	a+d	75	25.5	12	RCT	6
			b	75				
Luo Wen Yue	2010	China	c	69	—	6–24	Non-RCT	5
			d	54				
Wu Shuang	2014	China	d	50	37.2	12	Non-RCT	6
			f	50	43.6			
Zhou Jinghe	2015	China	d	108	17–39	3–12	RCT	5
			g	108	18–36			
Yang Xingang	2013	China	b	120	23.5	6–12	Non-RCT	6
			d	120	25			
Zhang Binyu	2012	China	c	32	29	3	Non-RCT	6
			d	58				
			g	48				

Table 1 continued. Characteristics of the 56 included studies.

First author	Year	Country	Surgery type	No. patients	Age	Follow-up (months)	Research type	Literature quality (star)
Zhao Guilan	2010	China	a	90	18–40	6	Non-RCT	5
			f	85				
Shen Bin	2012	China	a	140	24	6	Non-RCT	6
			d	140				
Tan Jianping	2003	China	a	62	16–49	3–60	Non-RCT	5
			b	76				
Cai Mei	2008	China	f	48	24.3	6	Non-RCT	5
			b	79				
Huang Xiaodong	2012	China	d	82	28.5	6	RCT	6
			b	68				
Wu Hailong	2005	China	d	68	26	6	Non-RCT	5
			b	70				
Liu Xiaofeng	2014	China	c	30	29	3–6	Non-RCT	5
			d	58	18–45			
Liu Jianzhong	2008	China	g	36	18–43	3–6	Non-RCT	5
			d	138	28			
He J	2018	China	g	55	26	6–36	Non-RCT	6
			g	91	20			
Chen YT	2015	China	d+g	80	21	56.8	Non-RCT	6
			e	66	29.8			
Cao Han	2016	China	g	19	37.5	6–24	Non-RCT	6
			a	71	26.8			
Li Weiwei	2010	China	d	73	—	3–24	Non-RCT	5
			d	180				
Yu Kefeng	2015	China	g	120	26.4	—	RCT	7
			h	50				
			a+d	29	25.3			
			g	29				

a – subcutaneous curettage; b – fusiform skin excision; c – CO2 laser treatment; d – subcutaneous pruning; e – YAG laser treatment; f – electric ion therapy; g – Swelling aspiration; h – botulinum toxin A injection; RCT – randomized controlled trial; non-RCT – non-randomized controlled trial.

direct evidence of comparison between the 2 interventions. Moreover, the larger the node was, the larger the sample size was. No link indicated no direct comparative evidence (Figure 2).

Inconsistent test

There were 28 triangular rings and 5 quadrilateral rings in this network meta-analysis. The consistency of each closed loop study showed that the inconsistency factor (IF) was 0.01–1.43, and the lower limit of 95% CI was basically 0, which indicated

that the consistency of each closed loop research was better, and the conclusion was more reliable (Figure 3).

Publication bias

The funnel graph was used to detect the publication bias. From Figure 4, we can see that the funnel diagram was basically symmetrical and there was no publication bias.

Figure 2. Network graph: a) subcutaneous curettage; b) fusiform skin excision; c) CO₂ laser treatment; d) subcutaneous skin excision; e) YAG laser treatment; f) electric ion therapy; g) swelling aspiration; h) botulinum toxin A injection.

Figure 4. Funnel plot.

Figure 3. Inconsistency test results.

The network meta-analysis results

There was no statistical significance in 21 of the 45 items of the 10 treatments. In statistical comparison, the cure rate of surgical treatment in AO was better than that in non-operative treatment. And the curative effect of swelling suction subcutaneous pruning was more obvious in the surgical treatment. Among the non-operative treatment measures of AO, botulinum toxin A injection was more effective (Table 2).

Ranking of therapeutic effects of AO

We used Stata 14.0 to plot the SUCRA curve and used the area under the curve (AUC) to predict the therapeutic effect. The larger the AUC was, the better the curative effect. Figure 5 shows that the therapeutic effects of treatments for AO were as follows: swelling aspiration+subcutaneous pruning > subcutaneous curettage+subcutaneous pruning > fusiform dermectomy > botulinum toxin A injection

Table 2. The network meta-analysis results.

a	1.29 (0.92,1.80)	1.21 (0.97,1.51)	0.68 (0.50,0.92)	1.34 (1.07,1.69)	2.78 (1.21,6.37)	0.76 (0.48,1.21)	0.61 (0.44,0.87)	1.05 (0.80,1.36)	1.10 (0.72,1.67)
0.78 (0.56,1.08)	a+d	0.94 (0.71,1.24)	0.53 (0.37,0.75)	1.04 (0.78,1.39)	2.16 (0.92,5.04)	0.59 (0.36,0.96)	0.48 (0.33,0.68)	0.81 (0.59,1.11)	0.85 (0.54,1.35)
0.83 (0.66,1.03)	1.07 (0.81,1.41)	b	0.56 (0.43,0.73)	1.11 (0.94,1.32)	2.30 (1.01,5.22)	0.63 (0.41,0.98)	0.51 (0.37,0.70)	0.87 (0.69,1.09)	0.91 (0.61,1.35)
1.48 (1.08,2.01)	1.90 (1.33,2.71)	1.78 (1.38,2.31)	c	1.98 (1.52,2.59)	4.10 (1.76,9.56)	1.12 (0.71,1.77)	0.91 (0.62,1.33)	1.55 (1.14,2.10)	1.62 (1.04,2.53)
0.74 (0.59,0.93)	0.96 (0.72,1.28)	0.90 (0.76,1.07)	0.50 (0.39,0.66)	d	2.07 (0.92,4.65)	0.57 (0.37,0.87)	0.46 (0.33,0.63)	0.78 (0.64,0.95)	0.82 (0.57,1.17)
0.36 (0.16,0.83)	0.46 (0.20,1.08)	0.43 (0.19,0.99)	0.24 (0.10,0.57)	0.48 (0.21,1.09)	d+g	0.27 (0.11,0.68)	0.22 (0.09,0.52)	0.38 (0.17,0.83)	0.40 (0.16,0.95)
1.32 (0.83,2.09)	1.69 (1.04,2.76)	1.59 (1.02,2.46)	0.89 (0.57,1.40)	1.77 (1.15,2.72)	3.65 (1.48,9.01)	e	0.81 (0.51,1.29)	1.38 (0.89,2.14)	1.45 (0.83,2.52)
1.63 (1.15,2.30)	2.10 (1.47,2.99)	1.96 (1.43,2.70)	1.10 (0.75,1.61)	2.19 (1.59,3.02)	4.52 (1.91,10.69)	1.24 (0.78,1.97)	f	1.70 (1.21,2.41)	1.79 (1.11,2.88)
0.96 (0.73,1.24)	1.23 (0.90,1.68)	1.15 (0.92,1.45)	0.65 (0.48,0.88)	1.28 (1.06,1.56)	2.65 (1.21,5.84)	0.73 (0.47,1.13)	0.59 (0.42,0.83)	g	1.05 (0.71,1.54)
0.91 (0.60,1.38)	1.17 (0.74,1.85)	1.10 (0.74,1.63)	0.62 (0.40,0.96)	1.22 (0.85,1.75)	2.53 (1.05,6.07)	0.69 (0.40,1.20)	0.56 (0.35,0.90)	0.95 (0.65,1.40)	h

Figure 5. Ranking of therapeutic effects of axillary osmidrosis.

>swelling aspiration >subcutaneous curettage >YAG laser therapy >CO₂ laser therapy >electric ion therapy.

Discussion

At present, AO is mainly treated by 2 kinds of methods: non-surgical treatment and surgical treatment. The main applications of non-surgical treatments are botulinum toxin type A injection

treatment and physical therapy such as laser, electric ion, and so on. The main methods of surgical treatments include subcutaneous pruning, subcutaneous curettage, swelling aspiration, fusiform dermectomy, swelling aspiration+subcutaneous pruning, subcutaneous curettage+subcutaneous pruning, and so on. The non-surgical treatments have the advantages of less injury, faster recovery, and less complications, but may result in easier recurrence of AO, which increase the medical burden of the patients. Although surgical treatments of AO have the advantage of being more thorough, surgical interventions may cause physical damage, form scarring, and have more complications. At present, there are no perfect treatments of AO, and clinical treatment methods have both advantages and disadvantages, which also increases the difficulty for doctors to choose the treatments of AO.

Through our network meta-analysis, we found that swelling aspiration+subcutaneous pruning was the best reported treatment of AO. The second was subcutaneous pruning, but there was little difference between subcutaneous pruning and subcutaneous curettage+subcutaneous pruning. There was no significant difference in the effect of fusiform excision, swelling aspiration, and subcutaneous curettage. Botulinum toxin type A injection was the best in non-surgical treatments. There was no significant difference in the effect of CO₂ laser therapy, YAG laser therapy, and electric ion therapy.

Through the inconsistency test, we found that 28 trilateral rings and 5 quadrilateral rings formed good consistency. And funnel diagram was basically symmetrical, which showed there was no publication bias in the included literature. The results of these 2 tests showed that the network meta-analysis of 10 treatments was reliable.

A total of 56 articles including 8618 patients were included in this meta-analysis, and the conclusion was shown to be highly credible. However, this study also had limitations. First, in this study, the cure rate of AO treatment was analyzed only, and the incidence of complications and the effective rates were not comprehensively evaluated, thus the conclusions were limited. Second, because of different cultures and customs, there were few similar studies available in other countries. Chinese patients were the main research groups in our meta-analysis, so we cannot effectively evaluate the curative effect of different treatment measures in other countries. Third, the uneven quality of the literature may affect the reliability of the final conclusions. Fourth, although there was no obvious publication bias as shown by the funnel graph, the existence of potential bias of publication was not excluded.

Conclusions

The network meta-analysis evaluated the treatment measures of AO objectively. The results showed that swelling suction+subcutaneous pruning was the best in surgical treatments of AO. Botulinum toxin A injection was the best in non-surgical treatments of AO. Overall, the effects of surgical treatments were more significant than that of non-surgical treatments. In the future, doctors should choose treatment methods of AO according to the conclusion of this study and their own experience. However, due to the limitations of this study, the conclusion of this network meta-analysis still needs to be further confirmed by some well-designed randomized controlled trials.

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References:

1. Yang H, Xu G, Huang CL et al: Effectiveness and complications of improved liposuction-curettage through mini-incisions for the treatment of axillary osmidrosis. *Plast Surg (Oakv)*, 2017; 25(4): 234–41
2. Jie D, Yan C, Hui C: [Surgical treatment of axillary osmidrosis.] *Chinese Journal of Aesthetic Medicine* 2008; (10): 1555–57 [in Chinese]
3. Yongxian R, Maoliang C: [Progress in the treatment of osmidrosis.] *Chinese Journal of Aesthetic Medicine*, 2016; 25(04): 98–100 [in Chinese]
4. Hutton B, Salanti G, Caldwell DM et al: The PRISMA extension statement for reporting of systematic reviews incorporating network meta-analyses of health care interventions: checklist and explanations. *Ann Intern Med*, 2015; 162(11): 777–84
5. Yanxia Z, Xiaoming Z: Analysis of the efficacy of three methods in the treatment of axillary osmidrosis. *Jiangxi Med J*, 2005; (12): 849–50
6. Jin W, Lei C, Rui X et al: Comparison of efficacy between CO₂ laser perforation and axillary fold small incision trimming in the treatment of axillary osmidrosis. *Anhui Med J*, 2014; 35(07): 973–74
7. Tiequan C, Zhanping X, Fan Z: [Comparative analysis of the efficacy of CO₂ laser and ND: YAG laser in the treatment of axillary osmidrosis.] *Chinese Journal of Laser Medicine Journal*, 1994; (05): 372 [in Chinese]
8. Mingxing C, Huiyun G, Qingfeng L: [Clinical observation of CO₂ laser and conventional surgery in the treatment of axillary Osmosis.] *Chinese Journal of Aesthetic Medicine*, 2002; (06): 537–38 [in Chinese]
9. Shuhua W, Xiuying H: Comparative study on treatment of axillary osmidrosis by carbon dioxide laser vaporization and surgical operation. *Applied Laser*, 2003; (04): 249–50
10. Shulan Y, Shuyan L, Lei T, Xiuli Z: [100 cases of axillary osmosis treated by CO₂ and YAG laser.] *Armed Police Medicine*, 2008; (02): 164–65 [in Chinese]
11. Chaohui L, Liangjin C, Jun D: [Treatment of bromhidrosis by YAG-100 laser in comparison with electron-ion therapeutic machine.] *Laser Journal*, 2005; (03): 93 [in Chinese]
12. Weiping W: [Comparative analysis of different methods in the treatment of axillary osmosis.] *Chinese Journal of Aesthetic Medicine*, 2007; (07): 988 [in Chinese]
13. Shuguang G, Guilan L, Zhijun S: [Analysis of the clinical effect of different methods in the treatment of axillary osmidrosis.] *Chinese General Practice*, 2010; 13(S1): 58–59 [in Chinese]
14. Wei J: [Analysis of the clinical effect of different surgical methods in the treatment of axillary osmidrosis.] *Medical Information*, 2010; 23(12): 4933–34 [in Chinese]

15. Likang Z, Bin M, Liyu W et al: [Comparative study on clinical efficacy of different surgical methods for axillary osmidrosis.] *J Reg Anat Oper Surg*, 2014; 23(02): 172–74 [in Chinese]
16. Xiaochuan G: [Clinical effect of different operative treatments for osmidrosis.] *Med J West China*, 2008; (06): 1253–55 [in Chinese]
17. Xiaotao Z, Linsen F, Hanjie J, Chao Z: Curative effect and prognosis of the treatment of bromhidrosis with traditional surgery or microsurgery methods. *China Medicine and Pharmacy*, 2013; 3(09): 195–96+198 [in Chinese]
18. Hui Z: [Clinical effects of 130 cases of osmidrosis treated by two different resections.] *Journal of Hainan Medical University*, 2010; 16(10): 1336–37 [in Chinese]
19. Qixuan X, Li C, Bimei L: [Comparison of the therapeutic effect of two methods in the treatment of bromhidrosis.] *J Dermatology and Venereology*, 2004; (02): 36–37 [in Chinese]
20. Zhan Zhao Z: [Analysis of the efficacy of two methods in the treatment of axillary odor.] *Clinical Medicine* 2012; 32(10): 70–71 [in Chinese]
21. Tingmin G, Dongqing C, Zhipu S et al: [The clinical comparative observation of two operative treatment for osmidrosis.] *Journal of Practical Dermatology*, 2012; 5(02): 99–101 [in Chinese]
22. Jiang Q, Zihua L, Zhi C et al: [Comparative Analysis of 49 cases of axillary Osmosis treated by two operative methods.] *Chinese Journal of Aesthetic Medicine*, 2003; (02): 150–51 [in Chinese]
23. Wanzhi W, Leilei Y, Jianwen L: [Evaluation of the efficacy of two surgical methods in the treatment of bromhidrosis.] *Yunnan Med J*, 2006; (06): 570–71 [in Chinese]
24. Liangyu J, Yiyi W: [Observation on the curative effect of two operative methods in the treatment of axillary odor.] *Med J West China*, 2010; 22(07): 1244–45 [in Chinese]
25. Tianbing L, Mogui L, Guanzhi L: [Comparison of two minimally invasive surgical methods in the treatment of axillary osmidrosis.] *J Dermatology and Venereology*, 2014; 36(02): 121–22 [in Chinese]
26. Li L, Benxuan S: [Comparative study on the efficacy of two different micro-invasive treatment for axillary bromhidrosis.] *Chinese Journal of Aesthetic Medicine*, 2015; 24(19): 17–19 [in Chinese]
27. Jianzhao Z, Li Y: [Comparison among two small incision procedures in treating axillary osmidrosis.] *China Medical Herald*, 2014; 11(26): 62–64 [in Chinese]
28. Qian W, Xuguang Q, Yeping W et al: [Comparison of two treatment methods for axillary odor.] *Clinical Education of General Practice*, 2011; 9(02): 209–10 [in Chinese]
29. Ruo Z, Rongqia Z, Qian Y et al: Comparison of clinical efficacy between subcutaneous pruning and subcutaneous curettage in the treatment of axillary odor. *Hainan Med J*, 2013; 24(20): 3075–76 [in Chinese]
30. Bin J, Feng Y, Zhikun L: [Comparison of clinical efficacy and complications in three common methods for the treatment of axillary osmidrosis.] *Journal of Medical Science in Central South China*, 2012; 40(06): 600–2 [in Chinese]
31. Kaiheng Z, Zunli S, Yanxian C: [The comparison of clinical efficacy among three procedures on the treatment of axillary osmidrosis.] *Journal of Tissue Engineering and Reconstructive Surgery*, 2012; 8(06): 341–43 [in Chinese]
32. Cheng L: [Clinical analysis of three methods for axillary osmidrosis.] *Dalian Medical University*, 2017 [in Chinese]
33. Qun G, Jingbo Z, Hongchang D: [Clinical analysis of three methods to treat bromhidrosis.] *Jilin Med J*, 2007; (05): 662–63 [in Chinese]
34. Lue M, Tianming W, Xiuying Z: [Comparison of the effect of three surgical methods in the treatment of 150 cases of axillary odour.] *Southern China Journal of Dermato-Venereology*, 2007; (04): 217–19 [in Chinese]
35. Jie C, Dazhong L: [The clinical observation of three treatments with underarm odor.] *Sichuan Med J*, 2011; 32(04): 547–49 [in Chinese]
36. Hui C: [Comparison of the efficacy of four different surgical strategies for axillary osmidrosis and exploration of the role of ApoD in the treatment of axillary osmidrosis patients.] *The Fourth Military Medical University*; 2011 [in Chinese]
37. Liangyu J, Yiyi W: [Comparison of the curative effect and complications between Z-plasty with fusiform excision and laser in treating bromhidrosis.] *J Mil Surg Southwest Chin*, 2010; 12(01): 17–18 [in Chinese]
38. Jianyi L: [Comparison of effects between fusiform incision flap translocation method and horizontal folds micro-incision subcutaneous trimming method for trigomachalia.] *Acta Acad Med Mil Tert*, 2004; (22): 2070–71 [in Chinese]
39. Weiping W: [Comparison of minimally invasive negative pressure aspiration and small incision subcutaneous cutting in the treatment of axillary osmidrosis.] *China Medical Cosmetology*, 2016; 6(06): 20–22 [in Chinese]
40. Xia L, Wang Z, Tao W: [Clinical analysis of two different therapies of axillary osmidrosis.] *China Journal of Modern Medicine*, 2012; 22(07): 91–93 [in Chinese]
41. Haiyan H, Xu X: [Comparison of clinical effects between minimally invasive curettage and minimally invasive curettage in the treatment of axillary osmidrosis.] *Shandong Medical Journal*, 2011; 51(39): 61–62 [in Chinese]
42. Haisheng L, Zengliang L, Longfei W et al: [The clinical effect of minimally invasive scraping and trimming compared with that of fusiform excision of the skin in treatment of bromidrosis.] *Chinese Journal of the Frontiers of Medical Science*, 2014; 6(04): 26–29 [in Chinese]
43. Wenye L, Liyun L: [Comparative analysis of the curative effect between minimally invasive surgery and laser treatment of axillary osmidrosis.] *Journal of Gannan Medical University*, 2010; 30(04): 603–4 [in Chinese]
44. Shuang W: [Minimally invasive body odor surgery compared with ions to curing effect.] *Nei Mongol Journal of Traditional Chinese Medicine*, 2014; 33(07): 33 [in Chinese]
45. Jinghe Z, Huifang X: [The effect comparison of minimal incision vacuum suction and mini-incision excision of apocrine gland in the treatment of osmidrosis.] *Zhejiang J Traumat Surg*, 2015; 20(06): 1058–60 [in Chinese]
46. Xingang Y, Youtong Y: [Comparison of the curative effect of mini – incision ultra – thin skin method and traditional technique in treatment of bromhidrosis.] *J Huaihai Med*, 2013; 31(01): 53–54 [in Chinese]
47. Bingyu Z, Wei Z, Hongmei T: [Comparison of small incision clearance of sweat gland and CO2 Laser and Ultrasonic aspiration in the treatment of axillary Osmosis.] *Acta Acad Med Zunyi*, 2012; 35(06): 523–24 [in Chinese]
48. Guilan Z, Yunping Z, Lunqiong L et al: [Observation on curative effect of small incision subcutaneous curettage and multifunctional electroion surgery in the treatment of axillary osmidrosis.] *Chin J Dermato Venerol Integ Trad W Med*, 2010; 9(05): 322 [in Chinese]
49. Bin S, Jiang Y, Wenjuan W: [Underarm odor comparative study of different surgical methods.] *Chinese Journal of Aesthetic Medicine*, 2012; 21(14): 3–4 [in Chinese]
50. Jianping T, Qiongyao C: [Comparison of three common treatments for axillary odor.] *Guangdong Medical Journal*, 2003; (04): 418–19 [in Chinese]
51. Mei C, Danqi D, Ping F: [Retrospective comparison of three treatment methods for axillary odor.] *Journal of Dermatology and Venereology*, 2008; (03): 30–31 [in Chinese]
52. Xiaodong H, Xiaowu C, Li W: [Clinical analysis on underarm odor treated by two treatment methods.] *China Modern Doctor*, 2012; 50(33): 138–39 [in Chinese]
53. Hailong W: [Comparative observation on the curative effect of axillary osmidrosis resection and CO2 laser treatment.] *Heilongjiang Medicine Journal*, 2005; (06): 459 [in Chinese]
54. Xiaofeng L, Guangzao L, Huaigu W et al: [The effect comparison of the double incision decollement and vacuum suction in axillary horizontal grain in the treatment of osmidrosis.] *J Bengbu Med Coll*, 2014; 39(03): 304–6 [in Chinese]
55. Jianzhong L, Dahai L: [Clinical analysis on treatment of axillary bromhidrosis with 2 operative methods in 193 cases.] *Practical Journal of Medicine & Pharmacy*, 2008; (07): 781–83 [in Chinese]
56. He J, Wang T, Zhang Y et al: Surgical treatment of axillary bromhidrosis by combining suction-curettage with subdermal undermining through a miniature incision. *J Plast Reconstr Aesthet Surg*, 2018; 71(6): 913–18
57. Chen YT, Shih PY, Chen HJ et al: Treatment of axillary osmidrosis: A comparison between subcutaneous laser and superficial liposuction curettage. *J Eur Acad Dermatol Venereol*, 2015; 29(10): 2019–23
58. Han C: [Comparison of the efficacy of different surgical methods in the treatment of axillary odor.] *Journal of Clinical Research*, 2016; (1): 169–70, 171 [in Chinese]
59. Li W, Liu ZF, Cui YN, Zeng A: [Comparison study on the efficacy of three methods for the treatment of osmidrosis.] *Chin J Plast Surg*, 2010; (5): 348–50 [in Chinese]
60. Kefeng Y: [Clinical effect analysis of minimally invasive small incision surgery in the treatment of bromhidrosis.] *Chinese Journal of Aesthetic Medicine*, 2015; (22): 11–13 [in Chinese]