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Original Paper

The Influence of Body Mass Index on the Outcomes of Video-assisted Thoracoscopic Sympathectomy for Primary Hyperhidrosis Patients

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Abstract

Background: *Primary hyperhidrosis (PH) is an autonomic disorder described as having excessive sweating in greater amounts than physiologically needed for thermoregulation. The aim of this retrospective study is to investigate the effect of body mass index (BMI) on surgical outcomes of bilateral video-assisted thoracoscopic sympathectomy (VATS) for PH patients from Arabian ethnic group.*

Methods: *Between January 2009 and December 2018, a total of 79 patients underwent VATS as a treatment for PH at Jordan University Hospital. Postoperative assessment was done via patients' subjective reporting of their satisfaction with the outcome of performed procedure.*

Results: *The mean age of the studied population was 23.2 ± 4.5 years, of which 34 (43%) were males and 45 (57%) were females. Satisfaction with the outcome of VATS was significantly associated with having dry palms as a desirable outcome ($p < 0.001$), and with older age ($p = 0.002$). BMI was neither significantly associated with their satisfaction ($p = 0.128$), nor with compensatory hyperhidrosis (CH) ($p= 0.859$).*

Conclusion: *VATS is considered an effective treatment for PH, with high rates of patient's satisfaction. Neither the level of satisfaction nor the occurrence of CH was associated with patients' BMI.*

Keywords

Primary hyperhidrosis, Body mass index, video-assisted thoracoscopic sympathectomy, compensatory hyperhidrosis

1. Introduction

Primary hyperhidrosis (PH) is a chronic autonomic disorder described as having excessive sweating, which is greater than the physiological response for thermoregulation, that is often in response to emotional stimuli (Araujo et al., 2009; Chou, Kao, Lin, Chang, & Huang, 2006; Dobosz, Cwalina, & Stefaniak, 2017). PH has an estimated population incidence of nearly (0.6-3%), and can considerably reduce the quality of life of the patients due to its social and emotional impact (Araujo et al., 2009; Chou et al., 2006; de Campos et al., 2005; Dobosz et al., 2017; Walling & Swick, 2011).

PH usually occurs due to autonomic neuronal dysfunction that affects areas with higher concentration of eccrine glands such palms, axillary area, and soles. It can also affect the face and scalp less commonly, causing apparent psychological consequences (Lakraj, Moghimi, & Jabbari, 2013; Walling & Swick, 2011; Abojaradeh, 2019). Several treatment options are available for PH, including local antiperspirants, systemic anticholinergic agents, iontophoresis, and botulinum toxin. Nevertheless, the aforementioned treatment options can only alleviate the symptoms transiently (Grabell & Hebert, 2017; Lakraj et al., 2013; Walling & Swick, 2011).

Video-assisted thoracoscopic sympathectomy (VATS) is currently considered the method of choice for the treatment of PH, since it is considered a safe, effective, and minimally invasive procedure (Alric et al., 2002). However, the most concerning side effect of this procedure is compensatory sweating (CS), which affects approximately 35-97% of patients postoperatively, being the most common cause of patients dissatisfaction (Mark Chwajol et al., 2009; Riet, Smet, Kuiken, Kazemier, & Bonjer, 2001).

Body mass index (BMI) is the ratio of a patient's height to his or her weight that is used as an indicator and estimate of body fat (Who, 2004). While previous studies indicated that overweight or obese patients present with more severe sweating than that of the general population (Dobosz et al., 2017), Wolosker et al. (2013) observed that patients with BMI <25 kg/m^2 tend to have lower mean age at time of presentation with PH and poorer quality of life before treatment. Several previous studies investigated the relationship between PH, CS and patients' satisfaction post-VATS. Notably, some of these studies found positive correlation between BMI and CS (de Campos et al., 2005; Dobosz et al., 2017), while others were not able to establish significant correlation between them (Chwajol et al., 2009).

The aim of this study is to evaluate the influence of body mass index (BMI) on patient's satisfaction and CS in PH patients from Arabian ethnic group after VATS.

2. Method

2.1 Study Design

We retrospectively reviewed patients who were admitted to Jordan University Hospital with the diagnosis of PH between January 2009 and December 2018. A total of 79 patients who underwent one VATS as a treatment for primary hyperhidrosis were included in this study.

2.2 Inclusion and Exclusion Criteria

The study included Jordanian patients from Arabian ethnic group diagnosed with PH. The affected body sites in included patients were palms, axillary area, and soles regardless of whether the presentation was unilateral or bilateral. On the other hand, we excluded patients with previous VATS or previous cardiothoracic surgeries.

2.3 Operative Technique

Bilateral VATS was the interventional technique used for all included patients in our study. General anesthesia using one-lung ventilation technique with a double-lumen endotracheal tube was used for all patients in in a semi-sitting position inclined at 60 °, with their arms in abduction (Campos, 2007).

Patients were placed in a semi-prone position for each side on which the procedure will be performed, the ipsilateral arm was abducted, and they were put in a mild anti-Trendelenburg position. Two 5-mm incisions were made, and thoracoscopic ports were placed in the fourth intercostal space on the mid-axillary line and the third intercostal space anterior to the mid-axillary line. After identifying the first rib, sympathectomy was performed using controlled intermittent electrocauterization. The first division was kept intact to prevent horner syndrome and facial flushing. When present, the nerve of Kuntz was ablated using the same electrocautery technique to prevent relapse of the health status immediately before and six months after surgery (Robertson, Russell, & Kirk, 2006).

Postoperative chest X-ray was done to rule out the presence of a significant pneumothorax, haemothorax, or pleural effusion, and drains were removed within 24-48 hours post-operatively in the absence of post-operative complications. Patients were followed-up after discharge at outpatients clinics, and post-operative assessment was done via patients' subjective reporting of their satisfaction with the outcome of performed procedure.

2.4 Statistical Analysis

For statistical analysis, SPSS (version 21.0, Chicago, USA) was used. The data were analyzed using the Pearson Chi-squared test and Fisher's exact test for categorical variables. Independent sample t-test was used to compare the mean age, mean BMI, and mean duration of symptoms between different factors. Regression analysis was used to predict factors correlated to the duration of symptoms. The statistical significance was considered as p-value < 0.05.

3. Result

This study recruited 79 patients with a mean age of 23.2 ± 4.5 years, of which 34 (43%) were males, and 45 (57%) were females (Table 1). The mean BMI was significantly higher in males (25 ± 4.5 kg/m^2; $p = 0.023$) compared to females (22.9 ± 3.1 kg/m^2). Upon investigating the educational level of the patients, 64 of the patients held bachelor's degree (81%), while 9 (11.4%) held high school certification, 2 (2.5%) held a diploma, 1 (1.3%) held master's degree, and 3 (3.8%) held a medical degree.

Table 1. Demographics of the Included Patients

Characteristic	*Distribution*
Mean age	23.2 ±4.5
Mean BMI	23.8 ±3.9
Mean duration of symptoms	8.5 ±4.3
Male (n/ %)	34/ 43%
Educational level (n/ %)	
bachelor's degree	64/ 81%
high school certification	9/ 11.4%
Diploma	2/ 2.5%
master's degree	1/ 1.3%
medical degree	3/ 3.8%

*BMI: body mass index.

The most common presenting chief complaint of the patients was excessive sweating of both palms and soles (49.4%), followed by excessive sweating of both palms (38%), excessive sweating of palms and axilla (5%), excessive sweating of axilla (5%), excessive sweating of right palm only (1.3%), and excessive sweating of the face and palms. The mean duration of these symptoms was 8.5 ± 4.3 years, and it was higher in females (9.4 ± 4 years; p = 0.036) when compared to males (7.4 ±4.4 years). Moreover, it also tends to increase with the increase in age (R= 0.24; p= 0.035) (Figure 1).

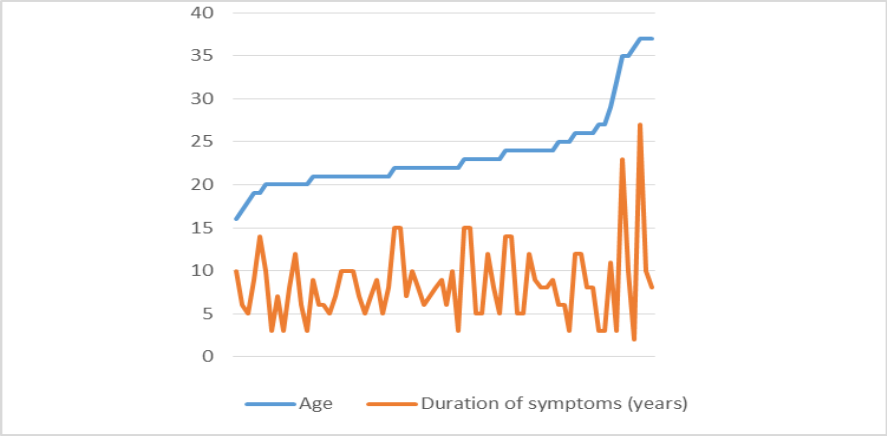

Figure 1. Regression Analysis Showed that the Duration of Symptoms Tends to Increase with Increasing Age (R = 0.24; p = 0.035)

The surgical procedure performed for all of the 79 patients was electrocauterization of the sympathetic chain at two levels, T2 and T3, and the mean postoperative hospital stay was 2.7 ± 1.1 days. Only two

patients (2.5%) developed pleural adhesions as an intra-operative complication.

Out of 79 patients, 70 (88.6%) were satisfied with the outcome of the operation, while only four patients reported compensatory hyperhidrosis (5.1%). Satisfaction with the outcome of the surgical intervention was significantly associated with having dry palms as a desirable outcome ($p = 0.000$) since 67 out of the 70 patients (95.7%) reported having dry palms directly after the operation. Also, it was significantly associated with age ($p = 0.002$), as patients who were satisfied with the surgical outcome had a higher mean age (23.4 ± 4.8 years) compared to those who reported dissatisfaction with the surgical outcome (21.3 ± 0.9 years). Even though BMI was not significantly associated with the satisfaction with the primary surgical outcome ($p = 0.128$), higher BMI was significantly associated with dry hands as a desirable outcome ($p = 0.044$), with mean BMI of 24.1 ± 4.1 kg/m^2 for those who had dry hands as an outcome, while it was 22.5 ± 2 kg/m^2 for those who did not report dry hands as a primary outcome. Moreover, there was no significant correlation between BMI and compensatory hyperhidrosis ($p = 0.859$).

4. Discussion

In this study we evaluated the influence of BMI in Arabian PH patients on their satisfaction and CS after the performance of VATS. Remarkably, higher BMI was significantly associated with dry hands as a desirable outcome, while no significant correlation was found between BMI and CS. Additionally, BMI was not significantly associated with the satisfaction rates of the primary surgical outcome.

Although the pathophysiology of this chronic autonomic disorder is still unclear, it is mainly triggered by hyperstimulation or overactivity of the sympathetic nervous system (Lakraj et al., 2013). Obesity can be associated with increased sweating due higher physiological stress on the body (Hoeldtke et al., 2001). This can be explained by having thicker layers of skin fat in the subcutaneous tissue, for which the body resort to evaporation to compensate for the difficulties in losing heat through convection and irradiation (de Campos et al., 2005).

The diagnosis of PH is mainly clinical, with a history of excessive sweating in affected areas, starting in childhood for most of the patients and increasing in severity at the ages of hormonal and sexual maturation during adolescence (Romero, Haddad, Miot, & Cataneo, 2016). The severity of hyperhidrosis has been linked to several factors, such as ethnic composition, geographical location, climate and body weight. Previous literature showed that overweight or obese patients present with more severe sweating than that of the general population (Dobosz et al., 2017). On the other hand, Liu et al. (2016) found that BMI does not play a significant role in the prevalence of primary hyperhidrosis in general, or in specific anatomic subtypes of PH, and that increased BMI is associated with increased likelihood of developing late-onset hyperhidrosis for those with a BMI more than 24.9 Kg/m^2.

Medical management is the first line therapy for the treatment of PH patients, including the use of topical antiperspirants, anticholinergic drugs, iontophoresis and botulinum toxin injections. Sweat glands excision and liposuction are surgical options used to alleviate hyperhidrosis symptoms (Haider

& Solish, 2005; Shelley, Talanin, & Shelley, 1998; Stolman, 1998). Unfortunately, medical treatment for hyperhidrosis is often unsuccessful, with most of the patients reporting transient response to the treatment (Haider & Solish, 2005).

VATS is the most effective and most frequently used interventional technique used for PH patients, and it has been linked with better outcomes, low morbidity and mortality, accelerated patient recovery and higher rates of patient satisfaction (Cohen, Levi, Pinsk, & Mares, 1998; Little, 2004). Several post-operative complications have been linked to VATS, such as pneumothorax, hemothorax, chylothorax, pleural effusion, wound infection, intercostal neuralgia, Horner's syndrome, and permanent bradycardia (Rodr ǵuez et al., 2008). However, CS, which is defined as increased sweating postoperatively in body areas that were not affected preoperatively, is considered the most frequent and the most debilitating postoperative complication reported by the patients(Mark Chwajol et al., 2009; Riet et al., 2001). Furthermore, severe CS significantly decrease the satisfaction rates (Mark Chwajol et al., 2009).

Although our study showed a low rate of CS (5.1%), the reported incidence of this complication varied in the literature, ranging between 35% and 97%, which can be attributed to t methods used to quantify CH (Araujo et al., 2009; Mark Chwajol et al., 2009; de Campos et al., 2005; Dobosz et al., 2017; Riet et al., 2001). Recent studies proposed that avoiding the T2 ganglion might decrease the risk of CS (Yazbek et al., 2005), while Both T3 and T4 VATS are effective and has high success rates (Hamouri et al., 2018).

Several studies found positive correlation between BMI and the rate of CS (de Campos et al., 2005; Dobosz et al., 2017), with significant CS on both subjective and objective evaluations 12 months post-operatively (Dobosz et al., 2017). In this study we did not find a significant correlation between BMI and compensatory hyperhidrosis ($p = 0.859$). Since only 5.1% of patients developed CS in our study, further studies including more patients may be necessary to fully explore this issue. In addition, we recommend future studies to investigate the influence of other factors on CS, such as climate, ethnic group and genetic contribution (Ro, Cantor, Lange, & Ahn, 2002).

The main limitation of this study is that it was conducted retrospectively. Post-operative assessment was done via patients' subjective reporting, and depending on the patient's judgment. Moreover, it is highly encouraged to use the development of the Hyperhidrosis Quality of Life Index (HidroQOL) in further studies to assess quality of life impacts in hyperhidrosis patients (Kamudoni, Mueller, & Salek, 2015).

In conclusion, neither the level of satisfaction nor the occurrence of CS correlated with patients' BMI in Jordanian PH patients. Although we believe the findings of the present study to be compelling, prospective and longitudinal replication of these data is undoubtedly warranted in order to identify risk factors of PH and post-operative CS in Jordanian patients.

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