

An epidemiologic study on symptomatic pelvic organ prolapse in obese Chinese women: a population-based study in China

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Background: The aim of this study was to investigate the prevalence and risk factors of symptomatic pelvic organ prolapse in obese Chinese women.

Subjects and methods: We performed a secondary analysis of 3,105 obese women from an observational cross-sectional study conducted between February 2014 and March 2016 in Mainland China. The obesity standard in our study was the Chinese standard (body mass index ≥ 28). All the subjects were asked to complete a questionnaire which included age, job, parity, and so on. Symptomatic pelvic organ prolapse (POP) was characterized as being symptomatic and at stage II or higher. Multivariable logistic regression was used to assess the factors associated with symptomatic POP.

Results: The prevalence of symptomatic POP was 15.84% in obese Chinese women, and there was a consistent increasing trend in the prevalence of POP with increasing age, ranging from 4.78% in women between 20 and 29 years of age to 28.21% in women aged 70 years or older ($P < 0.0001$). Multivariate analysis shows that the independent risk factors were age, chronic cough (> 3 weeks), and gynecological abnormalities. In addition, multiparity was not associated with symptomatic POP in multivariable analysis.

Conclusion: Symptomatic POP affects nearly 16% of obese women in People's Republic of China. The prevalence of symptomatic POP increases significantly with age.

Keywords: epidemiology, pelvic organ prolapse, prevalence, risk factors, obese, China

Introduction

Obesity is a chronic disease that is increasing in prevalence around the world – the mean body mass index (BMI) is increasing worldwide. In developed countries, obesity rates in 2013 were ~18% and 20% in men and women, respectively. Data suggest that the percentage of obesity has increased in most populations over the past 30 years.¹ Measuring BMI is the first step in determining the degree of overweight.

The Chinese adult overweight and obesity prevention and control guidelines, published by the Ministry of Health Disease Control Bureau, suggest that the Chinese obesity standard is a BMI ≥ 28 kg/m². The recommended classification for obesity that was adopted by the National Institutes of Health and the WHO for Caucasian, Hispanic, and black individuals was BMI ≥ 30 kg/m².

A survey on the nutritional health status of Chinese residents has shown that the combined prevalence of overweight and obesity was 29.9% in 2002. In addition, the obesity rates for adults in large cities were up to 12.7%. Not only was the adult obesity rate increasing annually but also there was a significant and continuous increase in the

prevalence of obesity in children and adolescents. Obesity was epidemic in People's Republic of China in 1985–2010.² Pelvic organ prolapse (POP) is a common condition showing an increasing prevalence in the past several decades. When defined by symptoms, POP has a prevalence of 3%–6%, and the prevalence is up to 50% when based on the POP quantification system. Obesity is indicated to be a risk factor for POP. The coexistence of these two disturbing health issues may lead to severe problems in the future; thus, further attention needs to be given to females with POP and obesity. The objective of this research was to investigate the prevalence of and risk factors for symptomatic POP in obese women.

Subjects and methods

Study design and population

This study is a subanalysis of a population-based, cross-sectional study conducted from February 2014 through March 2016 on a range of pelvic floor disorders in Chinese women who were 20 years old or older from the general population. Detailed descriptions of the recruitment process, sampling technique, and data collection have been described previously.³ This study was designed to provide current and reliable data on the prevalence of POP and associated risk factors in the adult female population in People's Republic of China. The sample was collected using a multistage, stratified, cluster sampling method according to geographic region. To represent the economic and cultural diversities of People's Republic of China, the sampling frame was constructed from six populous provinces in the six geographic regions of Mainland China (Gansu in the northwest, Guizhou in the southwest, Shanxi in central China, Liaoning in the northeast, Jiangsu in the east, and Guangdong in the southeast). Approval in the form of written consent was obtained from all eligible participants. All eligible patients were invited to participate in the study, and those who agreed were given a written informed consent form to sign. Ethical approval for the research was sought and obtained from the Research Ethical Committee at the Peking Union Medical College

Hospital in 2014. The study was conducted in accordance with the latest version of the Declaration of Helsinki.

Study questionnaires and physical examination

This survey was conducted under the guidance of the subcommittee for quality control and involved a uniform protocol, standardized methodology, and staff training program. We collected demographic data and self-reported height and weight. Chronic cough was defined as cough that lasts >3 weeks. Constipation was defined as having to strain too hard to have a bowel movement for 1 year. Women were considered to have diabetes, hypertension, or depression if they reported having been diagnosed with diabetes, hypertension, or depression by a health care provider within the past 3 years. Gynecological diseases included pelvic inflammatory disease, pelvic pain endometriosis, and fibroids. All the subjects were asked to complete a questionnaire consisting of eight symptoms. If anyone responded positively to any of the eight symptoms, she would undergo a physical examination in the dorsal lithotomy position. The symptom items on the questionnaire are listed in Table 1. All points, except for total vaginal length, were recorded while the subject performed maximal Valsalva effort. The methods, definitions, and descriptions conformed to the standards recommended by the International Continence Society. Subjects were excluded if they did not sign the informed consent, were younger than 20 years of age, or were pregnant. The study population was stratified into BMI categories based on the Chinese criteria (Table 2).

Diagnostic criteria and data analysis

Symptomatic POP was defined as having a positive response to any of the eight questions and having stage II or higher POP. All statistical analyses were performed using SAS software. Descriptive statistics were used to present data in tables and graphs. We investigated the associations between outcome variables and potential risk factors using univariate

Table 1 The eight symptom items related with pelvic organ prolapse in questionnaire

Symptom 1	Usually experience heaviness or dullness in the pelvic area?
Symptom 2	Usually have a bulge or something falling out that you can see or feel in your vaginal area?
Symptom 3	Ever have to push on the vagina or around the rectum to have or complete a bowel movement?
Symptom 4	Usually experience a feeling of incomplete bladder emptying?
Symptom 5	Ever have to push up on a bulge in the vaginal area with your fingers to start or complete urination?
Symptom 6	Usually feel any vaginal friction when you walk?
Symptom 7	Usually experience urine leakage related to coughing, sneezing, or laughing?
Symptom 8	Usually experience urine leakage associated with a feeling of urgency?

Table 2 WHO standard and Chinese standard for BMI categories

	Overweight (kg/m ²)	Obesity (kg/m ²)	Overweight or obesity (kg/m ²)
WHO standard	25≤BMI<30	BMI≥30	BMI≥25
Chinese standard	24≤BMI<28	BMI≥28	BMI≥24

Abbreviation: BMI, body mass index.

analysis and multivariable logistic regression. Variables were included in multivariable analysis if they had either been associated in univariate analysis ($P<0.05$) or identified in previous studies as being associated. Adjusted and unadjusted ORs, and their 95% CIs, were calculated. All statistical tests were two-sided, and a P -value <0.05 was considered statistically significant. However, job and smoking were not included in the model, as they were not statistically significant in univariate analysis. Finally, residence, age, parity, delivery pattern, cough, constipation, gynecological diseases, and physical disease were included in the multivariable logistic regression.

Results

Participant characteristics

This study is a subanalysis of a previous study. The data were from a national cross-sectional survey on POP in 54,993 adult women aged 20 years in People's Republic of China. There were 3,105 obese women out of 54,993 subjects. The mean age of the women included in the final analysis was 51.78 ± 15.51 years, and their BMI was 29.95 ± 2.00 kg/m². The demographic characteristics of the study population are presented in Table 3.

Prevalence of symptomatic POP

The prevalence of symptomatic POP was 15.85% in obese women. The prevalence of symptomatic POP increased with age: 4.78% for women aged 20–29 years, 13.17% for women aged 40–49 years, 19.37% for women aged 60–69 years, and 28.21% for women aged >70 years. As shown in Table 3, women in rural areas had a lower incidence of symptomatic POP than those in urban areas (13.06% of women with POP symptoms were from rural areas compared to 19.04% of women from urban areas; $P<0.001$). Table 3 shows the prevalence of symptomatic POP in different age groups.

Potential risk factors with symptomatic POP

Several sociodemographic factors were significantly associated with symptomatic POP. Despite the fact that several factors were significantly associated with the symptoms of

POP in univariate analysis, multivariate logistic regression of these factors revealed that there were few independent risk factors. These risk factors included age, chronic cough (>3 weeks), and gynecological disease (Table 4). Compared with women aged 20–29 years, the adjusted OR for women aged 50–59 years was 2.621 (95% CI, 1.391–5.246). The adjusted OR increased with age, and the adjusted OR for women above 70 years of age was 4.588 (95% CI, 2.249–9.883). Gynecological diseases increased the risk of symptomatic POP by 2.647 times (95% CI, 2.118–3.308). As to delivery pattern, compared with vaginal spontaneous delivery, cesarean section was a protective factor against symptomatic prolapse (adjusted OR, 0.558; 95% CI, 0.433–0.709).

Discussion

The increasing prevalence of obesity is affecting a large proportion of individuals of all ages and races worldwide.^{4,5} In an analysis of 1,698 studies involving a total of 19.2 million people reported in Lancet, 200 national studies found that by 2025, the global obesity prevalence will reach 18% in men and will surpass 21% in women; severe obesity will surpass 6% in men and 9% in women.⁶ People's Republic of China has now joined the world epidemic of obesity with its rapid economic growth over the past three decades.^{7,8} Given that People's Republic of China is a large developing country, the prevalence of overweight and obesity increased in all gender and age groups and in all geographic areas between 1992 and 2002. National data showed that the prevalence of obesity increased from 3.6% in 1992 to 7.1% in 2002.⁹

Obesity has emerged as a risk factor for POP, with numerous epidemiological studies describing the impact of obesity on the prevalence of POP.^{10–13} Many epidemiological studies show that compared to non-obese women, obese women have a significantly higher prevalence of POP.^{13–16} A literature report indicated that compared with women in the normal-weight category, meta-analysis risk ratios for women in the obese category ranged from 1.47 to 1.61.¹³

In a sample of 1,590 Bangladeshi women, recruited using a multistage cluster sampling technique, the prevalence of

Table 3 General characteristics of and prevalence of symptomatic POP in the participants^a

Characteristics	n	Symptomatic POP, n (%)
Total	3,105	492 (15.85)
residence^b		
Urban	1,444	275 (19.04)
Rural	1,661	217 (13.06)
Race^c		
Han	2,986	481 (16.11)
Minority	93	9 (9.68)
Age^b		
20–29	293	14 (4.78)
30–39	501	38 (7.58)
40–49	630	83 (13.17)
50–59	622	115 (18.49)
60–69	568	110 (19.37)
≥70	468	132 (28.21)
Job		
Physical labor	2,738	444 (16.22)
Mental labor	367	48 (13.08)
Delivery pattern^{b,d}		
Nulliparous	192	6 (3.13)
Vaginal spontaneous delivery	2,347	431 (18.36)
Vaginal assistant delivery	40	17 (42.50)
Cesarean section	496	33 (6.65)
Parity^{b,e}		
Nulliparous	192	6 (3.13)
Semelparous (=1)	1,069	132 (12.35)
Multiparous (=2)	943	152 (16.12)
Multiparous (≥3)	877	199 (22.69)
Physical disease^b	1,082	228 (21.07)
HT^{b,f}	923	198 (21.45)
DM^g	295	63 (21.36)
Stroke^h	37	13 (35.14)
Chronic bronchitis	99	29 (29.29)
Cancerⁱ	27	6 (22.22)
Depressionⁱ	13	3 (23.08)
Gynecological disease^b	871	206 (23.65)
Pelvic surgery	1,033	143 (13.84)
Spine surgery	23	4 (17.39)
Smoking^b	28	6 (21.43)
Alcohol consumption^b	94	20 (21.28)
Cough^b	163	55 (33.74)
Constipation^b	267	68 (25.47)

Notes: ^aData are given as n (%). ^bP<0.0001. ^cn=3,079 for race; ^dn=3,075 for delivery pattern; ^en=3,081 for parity; ^fn=3,099 for HT; ^gn=3,098 for DM; ^hn=3,097 for stroke; ⁱn=3,098 for chronic bronchitis; ^jn=3,097 for depression.

Abbreviations: DM, diabetes mellitus; HT, hypertension; POP, pelvic organ prolapse.

addition, the prevalence of symptomatic POP observed in our study was 15.85%. The main reason for these inconsistencies was the difference not only in the obesity standards but also in the definition of POP. The obesity standard adopted by the Bangladeshi study was similar to the Chinese standard (obese [≥28]; normal [17.5–23]; overweight [23–28], underweight [≤17.4]).

The obesity standard used in the Kaiser Permanente Continence-Associated Risk Epidemiology Study was the WHO standard, and the mean BMI was 35.4±5.3 kg/m². However, we adopted the Chinese obesity standard, and the mean BMI in our study was 29.95±2.00 kg/m². The definition of POP used in the Kaiser Permanente Continence-Associated Risk Epidemiology Study and in the Bangladeshi study was merely a positive response to the question, “Do you have the sensation of a bulge in your vagina or that something is falling out of your vagina?” We define symptomatic POP as having a positive response to any of the eight symptoms and having stage II or higher POP with a physical examination.

The prevalence of POP differed by the stages of obesity. The prevalence of POP was highest in the morbidly obese (BMI ≥40, 12.7%) and severely obese (BMI ≥35–39.9, 9.9%) women, compared to that in obese women (BMI ≥30–34.9, 7.0%), as reported in the literature.¹⁰ However, the greatest number of participants in our study had a BMI between 28 and 34.9. Obese women with a BMI greater than 35 comprised only 3% of the sample. Therefore, we did not analyze the different prevalence of POP in different stages of obesity.

Although several risk factors have been suggested for symptomatic POP, multiparity vaginal childbirth and advancing age are the most consistently reported. In our study, there was a consistent increasing trend in the prevalence of POP with increasing age, which was similar to the trend for the overall population reported in the literature. The multivariate analysis results indicated that gynecological disease significantly increased the risk of POP in obese women, and a cough, which may increase intra-abdominal pressure, can exacerbate POP. Increased parity has also been reported to play a significant role in the occurrence of POP in the literature for the overall population. Interestingly, multiparity was not associated with symptomatic POP in the adjusted models in our study, suggesting the primary importance of the modifiable risk factor of obesity.

Obesity has become a prevalent health problem due to not only its association with subsequent cardiovascular disease and all-cause mortality but also the high prevalence of symptomatic POP. These health problems will have significant effects on the quality of life and increase health-related

POP was 10.0 (95% CI, 6.4–13.6) in obese women.¹⁶ According to the Kaiser Permanente Continence-Associated Risk Epidemiology Study, the prevalence of POP in all women with a BMI ≥30 kg/m² was 9% (95% CI, 7%–10%).¹⁰ In

Table 4 Logistic regression for predictors of POP^a

Independent variables	Symptomatic POP (unadjusted)		Symptomatic POP (adjusted)	
	OR	95% CI	OR	95% CI
Residence				
Urban (ref.)				
Rural	0.636	0.552–0.774**	0.97	0.909–1.036
Age				
20–29 (ref.)				
30–39	1.582	0.853–3.708	0.991	0.552–1.980
40–49	2.857	1.639–5.347**	1.602	0.879–3.120
50–59	4.331	2.519–8.026**	2.621	1.391–5.246*
60–69	4.555	2.642–8.458**	2.974	1.497–6.232**
≥70	7.384	4.299–13.679**	4.588	2.249–9.833**
Parity				
Semelparous (=1) (ref.)				
Multiparous (=2)	1.354	1.050–1.708**	1.188	0.896–1.579
Multiparous (≥3)	2.071	1.625–2.646**	1.291	0.936–1.782
Delivery pattern				
Vaginal spontaneous delivery (ref.)				
Vaginal assistant delivery	1.324	1.120–1.532**	1.215	0.871–1.667
Cesarean section	0.324	0.257–0.624**	0.558	0.433–0.709*
Job				
Mental labor (ref.)				
Physical labor	0.76	0.544–1.039	–	–
Smoking				
No (ref.)				
Yes	1.845	0.663–4.466	–	–
Cough				
No (ref.)				
Yes	2.797	1.968–3.932**	2.011	1.376–2.910**
Constipation				
No (ref.)				
Yes	1.924	1.421–2.576**	1.375	0.991–1.888
Gynecological disease				
No (ref.)				
Yes	2.042	1.666–2.499**	2.647	2.118–3.308**
Physical disease				
No (ref.)				
Yes	1.724	1.417–2.012**	0.991	0.785–1.250

Notes: ^aData are given as OR (95% CI). * $P < 0.05$; ** $P < 0.01$.

Abbreviation: POP, pelvic organ prolapse.

and economic burden. Accordingly, more attention should be given to the epidemiological features of obesity, considering its substantial health burden.

The strengths of this study include the recruitment of a large representative population-based sample of obese women. In addition, the screening for symptomatic POP was based on both the presence of prolapse-related symptoms and physical examinations.

A limitation is that screening-based prolapse-related symptoms may not be apparent in women without symptoms. Another weakness of this study is that we relied on self-reports

for height and weight. In addition, our study excludes those who underwent treatment for pelvic floor disorders; thus, the prevalence of symptomatic POP may be underestimated.

Conclusion

The prevalence of symptomatic POP was nearly 16.0% among obese women in People's Republic of China. Age, cough, and gynecological abnormalities were associated with an increasing prevalence of symptomatic POP. Cesarean section was a protective factor against symptomatic prolapse. However, multiparity was not associated with symptomatic POP in obese women.

Given the increasing prevalence of obesity in the population and its significant negative effect on health, interventions targeting obesity are urgently needed.

Ethical approval

This study obtained ethics approval from clinicaltrials.gov, <http://www.chictr.org.cn>. Number: ChiCTR-OCH-14004675. Approval in the form of written consent was obtained from all eligible participants. All eligible patients were invited to participate in the study, and those who agreed were given a written informed consent form to sign. Ethical approval for the research was sought and obtained from the Research Ethical Committee at the Peking Union Medical College Hospital in 2014. The study was conducted in accordance with the latest version of the Declaration of Helsinki.

Data sharing statement

No individual deidentified participant data are available online. No additional unpublished data are available.

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Author contributions

At the time of this study, Lan Zhu had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of data analysis. Study concept and design: Lan Zhu. Acquisition of data: Lan Zhu, Zhaoai Li, Jian Gong, Qing Liu, Yulin Wang, Juntao Wang, Zhijun Xia, Zhiyi Li. Analysis and interpretation of data: Zhiyi Li, Tao Xu, Lan Zhu. Drafting of the manuscript: Zhiyi Li. Critical revision of the manuscript for important intellectual content: Lan Zhu. Statistical analysis: Zhiyi Li, Tao Xu. Obtaining funding: Lan Zhu. All authors contributed to data analysis, drafting and revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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