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ORIGINAL ARTICLE

An epidemiologic study of pelvic organ prolapse in rural Chinese women: a population-based sample in China

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Abstract

Introduction and hypothesis We aimed to investigate the prevalence and risk factors of symptomatic pelvic organ prolapse (POP) in rural China.

Methods A cross-sectional study of POP was conducted in rural China from February 2014 to March 2016. In total, 25,864 rural women were recruited. All were asked to complete a questionnaire that included questions about their age, job, parity, diseases, and so on. Symptomatic POP was assessed using Pelvic Organ Prolapse Quantification (POP-Q) system staging and validation questionnaires. Multivariate logistic regression was used to assess the factors associated with symptomatic POP.

Results The prevalence of symptomatic POP was 9.10%. There was a consistent trend toward an increasing prevalence of POP with increasing age, ranging from 2.53 to 13.40% ($P < 0.0001$). Women aged 50–59 years [adjusted odds ratio (AOR) 1.86, 95% confidence interval (CI) 1.46–2.37] were more likely to have POP than women aged 20–29 years. POP was positively associated with giving birth to more than three children (AOR 2.18, 95% CI 1.88–2.43). Cesarean section was a significant protective factor (AOR = 0.34, 95% CI 0.33-0.49) compared with vaginal delivery. Multivariate logistic regression analysis showed that obesity, constipation, smoking, coughing, gynecological diseases, and other physical diseases were also associated with POP.

Conclusions Symptomatic POP affects a substantial proportion of women in rural China. Older age, multiparity, vaginal delivery, obesity, and many chronic conditions significantly increased the odds of developing symptomatic POP. Additional healthcare campaigns are needed to educate women in rural areas about POP.

Keywords Epidemiology · Pelvic organ prolapse · Prevalence · Risk factors · Rural

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Abbreviations

POP	Pelvic organ prolapse
POP-Q	Pelvic Organ Prolapse Quantification
AOR	Adjusted odds ratio
CIs	Confidence intervals
BMI	Body mass index

Introduction

Pelvic organ prolapse (POP) is defined as the descent into or out of the vagina of the pelvic organs, including the uterus and the anterior and posterior vaginal walls. POP mainly results from dysfunction of pelvic floor support. POP is a common condition, and the prevalence has been increasing in recent decades. The prevalence reported in the literature varies greatly [1–5]. In addition, many women with stage 2 prolapse do

not experience symptoms related to the prolapse. The exact state of prolapse can be defined by combining prolapse symptoms and the Pelvic Organ Prolapse Quantification (POP-Q) stage. Although the prevalence of POP varies among different studies depending on the definition of POP and research methodology used, it is the most prevalent in low- and middle-income countries. In China, where the rural population constitutes nearly 50% of the total, representing ~605,990,000 people, urban–rural health disparities are expected to be even more pronounced, since the central and local governments implement policies that favor urban areas [6]. In addition, in rural areas, high fertility rates and more engagement in physical labor are common. However, there are no epidemiological studies regarding the incidence or prevalence of POP in rural areas in China. Therefore, it is essential to conduct a study to investigate its prevalence and identify the potential sociodemographic risk factors. The aim of this study was to evaluate the prevalence and risk factors of POP based on symptoms and POP-Q stage among women in rural China.

Methods

Study setting

This was part of a nationwide, population-based, multistage, stratified study of female pelvic organ disorders in rural Chinese women. The study represents an analysis of a subset of data from that cross-sectional study. Detailed descriptions of the recruitment process, sampling technique, and data collection protocols have been described previously [7]. The sampling framework was constructed with six provinces randomly selected by computer-generated random numbers from the six major geographic regions of mainland China. The following six regions were included: northwest China, southwest China, north China, east China, northeast China, and south China. According to the predetermined sample size, which was stratified by levels of economic development, three counties were randomly selected from each province. Our target population consisted of all eligible residents aged 20–99 years according to the updated census lists from the community registry offices. In addition, the included participants must have lived in the area in which they were registered for at least 10 years prior to the study. Pregnant women and women who had undergone treatment for pelvic floor disorders were excluded from our study. The eligibility participants were women aged 20-99 years and were recruited from February 2014 to March 2016. Eligible women in these counties were contacted and invited to participate in the survey. Approval was obtained from the Research Ethical Committee of the Peking Union Medical College Hospital. Written consent was obtained from all eligible participants. This survey was conducted under the guidance of the subcommittee for quality control, with a uniform protocol, standardized methodology, and staff training program. The gynecologist who performed the physical examination and survey workers who collected and recorded data were not allowed to participate in the study until they had undergone training and passed an examination.

Study instrument and data collection

Patients answered sociodemographic questions and self-reported their height and weight; the medical staff asked participants questions about their previous health history data, obstetric history, occupation, and presence or absence of constipation, chronic cough, smoking, alcohol consumption, and reproductive and other health-related risk factors. A chronic cough was defined as one lasting >3 weeks. Constipation was defined as having to strain to have a bowel movement for at least 1 year [8]. Smoking was defined as those who smoked at least once per month. In addition, current alcohol consumption was defined as the consumption of one or more alcoholic drink per month. The diseases included on the questionnaire were diabetes, hypertension, and depression, which women were considered to if they reported having been diagnosed by a healthcare provider within the past 3 years. The gynecological diseases included on the questionnaire were myoma, pelvic inflammatory disease, chronic pelvic pain, and endometriosis. Regarding the different delivery methods: If the same participant had undergone cesarean section (CS) and spontaneous vaginal delivery, we defined the delivery method as spontaneous vaginal delivery. If a patient experienced spontaneous vaginal delivery and assisted vaginal delivery in successive pregnancies, we defined the delivery method as assisted vaginal delivery.

All participants were asked to complete a questionnaire that consisted of eight symptoms, which was the short form of the Pelvic Floor Distress Inventory-20 (PFDI-20). The Chinese version was already validated in a Chinese population [9]. Each question had yes/no answers listed. If any participant responded positively to any of the eight questions, she received a physical examination in the dorsal lithotomy position. The symptom questionnaire items are listed in Table 1. All points except total vaginal length (TVL) were recorded while the participant exerted maximum Valsalva effort. Methods, definitions, and descriptions used conformed to the standards recommended by the International Continence Society (ICS). For each participant, we defined prolapse stage using the most advanced prolapse site.

The dependent variable used in this study was the presence of symptomatic POP. The definition of symptomatic POP was an affirmative response to any of the eight questions and presence of stage ≥2 POP upon a physical examination in the dorsal lithotomy position. Descriptive statistics were used to present data in tables and graphs.

Table 1 Eight prolapse symptoms

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

Statistical analysis

All analyses were performed using SAS. Univariate and multivariate analyses were performed using chi-square tests and binary logistic regression. Only variables that were significant in univariate analyses and had been identified in previous studies as being either associated with POP or a potential confounder of an association were included in the multivariate logistic regression model. All statistical tests were two sided, and a P value <0.05 was considered statistically significant. In addition, odds ratios (ORs) and 95% confidence intervals (CI) of the variables that were considered possible risk factors were calculated in relation to the prolapse stages.

Results

Characteristics of the sample population

Of the 54,993 participants, 25,864 were from rural areas. As shown in Fig. 1, 24,848 were included in our data analysis. The mean age of the women included in the final analysis was 45.40 ± 15.77 (standard deviation, SD) years, and the mean body mass index (BMI) was 23.02 ± 3.12 kg/m^2. The sociodemographic characteristics are presented in Table 2. Overall, 747 participants (3.01%) were minorities. The percentages of participants that engaged in physical or mental labor were 85.34 and 14.66%, respectively; 88.50% were parous, and 22.40% had three or more children. Regarding the type of delivery, 73.85% had experienced vaginal spontaneous delivery, 13.86% had undergone a CS, and 0.79% had experienced vaginal-assisted deliveries. Prior pelvic surgery was reported by 7420 (29.86%) women; 3820 (15.37%) had a coexisting disease, and 6998 (28.16%) had a gynecological disease. Smoking was reported by 142 participants (0.57%), and alcohol consumption by 869 (3.50%).

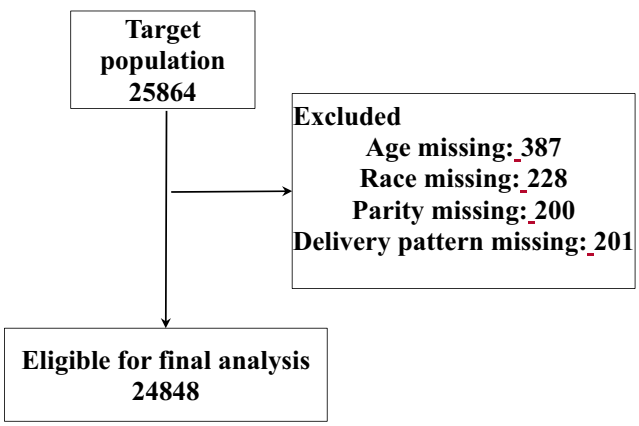

Fig. 1 Study flowchart

Prevalence of symptomatic POP

The overall prevalence of POP in rural China was 9.23% (Table 3). Prolapse stage 2 accounted for 7.55%, stage 3 for 1.52%, and stage 4 0.16%. The incidence of POP increased with increasing age. The prevalence of each potential risk factor are depicted in Table 4. Women aged 50-59 years had the highest incidence of POP (13.40%). Table 4 depicts the prevalence of symptomatic POP in all participants. POP was significantly more common in women who underwent vaginal-assisted delivery (17.26%) than those who experienced spontaneous vaginal delivery (11.70%) and CS (2.90%). The type of job also affected the prevalence of POP symptoms, which were more prevalent among women who performed physical labor (9.98%) than among those who performed mental labor (4.86%). Symptomatic POP was more prevalent in women who had a chronic cough for at least 3 weeks (24.84%), were smokers (19.72%), had gynecological disease (14.52%), and had suffered constipation for at least 1 year (20.84%) compared with their counterparts with the corresponding negative traits. Multiparous, obese, and women with a history of gynecological disease were more likely to have symptomatic POP (14.73%, 13.31%, and 14.52%, respectively) than their counterparts with the opposite traits.

Table 2 General characteristics of participants. Data are given as mean ± standard deviation (SD) and number (%)

Characteristics	Data
Age (years), mean (SD)	45.40 ± 15.77
20–29	4902 (19.73)
30–39	5385 (21.67)
40–49	5524 (22.23)
50–59	3918 (15.77)
60–69	2595 (10.44)
≥ 70	2524 (10.16)
Body mass index (kg/m^2), mean (SD)	23.02 ± 3.12
Underweight (<18.5)	1386 (5.58)
Normal (18.5–23.9)	14,821 (59.65)
Overweight (24–27.9)	7033 (28.30)
Obese (≥28)	1608 (6.47)
Race	
Han	24,101 (96.99)
Minority	747 (3.01)
Job	
Mental labor	3642 (14.66)
Physical labor	21,206 (85.34)
Parity	
Nulliparous	2857 (11.50)
Primiparous (=1)	9173 (36.92)
Multiparous (=2)	725 (129.01)
Multiparous (≥3)	5567 (22.40)
Delivery pattern	
Nulliparous	2857 (11.50)
Vaginal spontaneous delivery	18,351 (73.85)
Vaginal assisted delivery	197 (0.79)
Cesarean section	3443 (13.86)
Gynecological disease	6998 (28.16)
Other disease	3820 (15.37)
Smoking	142 (0.57)
Alcohol consumption	869 (3.50)
Cough (>3 weeks)	851 (3.42)
Constipation (>1 year)	1876 (7.55)
Pelvic surgery	7420 (28.86)
Spinal surgery	80 (0.32)

Other diseases included diabetes, hypertension, and depression; gynecological diseases included myoma, pelvic inflammatory disease, chronic pelvic pain, and endometriosis

SD standard deviation

Factors associated with symptomatic POP

Variables that had *P* values <0.05 in univariate analysis were included in the multivariate regression model. The results showed that age, BMI, parity, constipation, smoking, cough, gynecological diseases, and other diseases were independent risk factors of POP (Table 4). Women aged 60-69 years (AOR 2.19, 95% CI 1.72–2.79) were more likely to have POP than women aged 20-29 years. Compared with women of normal weight, overweight and obese women were more likely to have POP (AOR = 1.2, 95% CI 1.09–1.33; AOR = 1.30, 95% CI 1.11–1.53).

Women who had gynecological or other diseases were more likely to have POP (AOR = 1.324, 95% CI 1.173–1.492, AOR = 2.08 95% CI 1.890-2.289, respectively) than women who did not have concomitant illnesses. Smoking, coughing, and constipation were all risk factors for symptomatic POP (AOR = 1.88, 95% CI 1.57-2.24; AOR = 1.64,95% CI 1.04-2.51; AOR = 2.12,95% CI 1.86-2.41, respectively).

Multivariate logistic regression analysis showed that nulliparity was a protective factor against symptomatic POP (AOR = 0.119 95% CI 0.06-0.22). Regarding delivery pattern, CS was also a significant protective factor (AOR = 0.335 95% CI 0.33-0.49) compared with vaginal delivery.

Discussion

Epidemiological studies of symptomatic POP are rare in China, especially in rural areas. This is one of the few village-based studies using symptoms and physical examinations to determine the prevalence of and risk factors for symptomatic POP. POP was identified in 30-70% of women presenting for routine gynecologic examinations, but only 3–6% of those had descent beyond the hymen [10–12]. In the United States National Health and Nutrition Examination Survey (NHANES), overall, 2.9% of women experienced symptomatic POP [13]. The prevalence of POP was 15.6% in a rural Bangladeshi study [14]. The different prevalences in those studies may be the result of the different definitions of POP adopted. The definition used in the NHANES and Bangladeshi study was a positive response to the question: "Do you experience bulging or an object falling out that you can see or feel in the vaginal area?" There was no physical examination performed to confirm the prolapse. This is

Table 3 Prevalence of each prolapse stage. Data are given as number (%)

No symptomatic POP or POP stage 1	Symptomatic POP		
	POP stage 2	POP stage 3	POP stage 4
22,555 (90.77%)	1875 (7.55)	378 (1.52%)	40 (0.16%)

POP pelvic organ prolapse

Table 4 Weighted logistic regression for predictors of pelvic organ prolapse (POP). Data are given as number (%) and odds ratios (OR) [95% confidence intervals (CI)]

Independent variables	Symptomatic POP	Symptomatic POP (unadjusted)			Symptomatic POP (adjusted)		
	N (%)	OR	95% CI	*P* value	OR	95% CI	*P* value
Age							
20–29 (ref)	124 (2.53)						
30–39	341 (6.33)	2.61	2.12–3.22	<0.001	1.18	0.95–1.48	0.06
40–49	707 (12.80)	5.66	4.67–6.90	<0.001	1.75	1.42–2.17	<0.001
50–59	525 (13.40)	5.96	4.90–7.32	<0.001	1.86	1.46–2.37	<0.001
60–69	320 (12.33)	5.42	4.32–6.73	<0.001	1.59	1.21–2.10	<0.001
≥ 70	276 (10.94)	4.73	3.82–5.90	<0.001	1.27	0.94–1.69	0.0676
BMI (kg/m^2)							
Normal (18.5–23.9) (ref)	1187 (8.01)						
Underweight (<18.5)	73 (5.27)	0.64	0.50-0.82	<0.001	0.80	0.62–1.03	
Overweight (24–27.9)	819 (11.65)	1.51	1.38–1.66	<0.001	1.21	1.09–1.33	<0.001
Obese (≥28)	214 (13.31)	1.76	1.51-2.06	<0.001	1.37	1.16–1.61	<0.001
Parity							<0.001
Primiparous (=1) (ref)	607 (6.62)						
Nulliparous	12 (0.42)	0.06	0.03–0.10	<0.001	0.12	0.06–0.22	<0.001
Multiparous (=2)	854 (11.78)	1.88	1.69–2.10	<0.001	1.60	1.42–1.80	<0.001
Multiparous (≥3)	820 (14.73)	2.44	2.83–2.72	<0.001	2.18	1.88–2.43	<0.001
Delivery pattern							
Vaginal spontaneous delivery (ref)	2147 (11.70)						
Vaginal assisted delivery	34 (17.26)	1.55	1.07–2.25	<0.001	1.66	1.54–2.62	<0.001
Cesarean section	100 (2.90)	0.23	0.18–0.28	<0.001	0.34	0.33-0.49	<0.001
Job				<0.001			0.10
Physical labor (ref)	2116 (9.98)						
Mental labor	177 (4.86)	0.46	0.39–0.54		0.96	0.81–1.15	0.08
Race				0.068			–
Han	2237 (9.28)						
Minority	56 (7.50)	0.79	0.60–1.03		–	–	–
Smoking				<0.001			<0.001
No (ref)	2265 (9.17)						
Yes	28 (19.72)	2.43	1.58–3.63		1.88	1.57–2.24	
Alcohol consumption				<0.001			<0.001
No (ref)	2187 (9.12)						
Yes	106 (12.20)	1.35	1.13–1.62		1.09	1.01–1.14	
Cough (>3 weeks)				<0.001			<0.001
No (ref)	2083 (8.68)						
Yes	210 (24.68)	3.45	2.93–4.05		1.64	1.04–2.51	
Constipation (>1 year)				<0.001			<0.001
No (ref)	1902 (8.28)						
Yes	391 (20.84)	2.92	2.58–3.29		2.12	1.86–2.41	
Gynecological disease				<0.001			<0.001
No (ref)	1277 (7.15)						
Yes	1016 (14.52)	2.20	2.012–2.41		2.08	1.89–2.29	
Other disease				<0.001			<0.001
No (ref)	1685 (8.01)						
Yes	608 (15.92)	2.17	1.97–2.40		1.32	1.17–1.49	
Pelvic surgery				0.12			–

Table 4 (continued)

Independent variables	Symptomatic POP	Symptomatic POP (unadjusted)			Symptomatic POP (adjusted)		
	N (%)	OR	95% CI	*P* value	OR	95% CI	*P* value
No (ref)	1647 (9.45)						
Yes	646 (8.71)	0.99	0.86–1.012		–	–	
Spine surgery				0.15			–
No (ref)	2290 (9.25)						
Yes	3 (3.75)	0.49	0.20–1.33		–	–	

Other diseases included diabetes, hypertension, and depression; Gynecological disease included myoma, pelvic inflammatory disease, chronic pelvic pain, and endometriosis. Variables were included in the multivariate analysis if they exhibited a significant association in the univariate analysis ($P < 0.05$) or were identified in previous studies as being associated with POP. Race, pelvic surgery, and spinal surgery were not included in the model, as these factors were not statistically significant in the univariate logistic regression analyses

BMI body mass index

different from our definition, which was based on both symptoms and POP-Q stage. Apart from this, differences in the prevalence may have also resulted from the population involved in studies and the socioeconomic growth. There is more expenditure on public health in developed countries than in developing and undeveloped countries. Therefore, the prevalence of POP in developed countries such as the USA is much lower than in developing and undeveloped countries.

According to the same study conducted in urban China (manuscript being prepared), prevalence in the rural area was lower than that in the urban area. We found that most patients with symptomatic POP in our study had stage 2 prolapses. Urban women pay more attention to their quality of life and are more sensitive to illness and discomfort, leading to a higher rate of self-perceived illness among urban women than among rural women [6, 15, 16]; rural women may neglect symptoms that do not seriously affect their daily lives. Similarly, incidence rates of hypertension, diabetes, and other chronic diseases were higher among urban than rural residents, indicating that people in rural areas are reluctant to seek healthcare unless they are impaired by the health problems [15]. In addition, limited by their lower economic status, the demand for healthcare among rural residents is not as high as among those living in urban areas. Therefore, the different degree of attention to health in rural and urban areas may cause the difference in the prevalence of POP. Considering the reduced attention to health in rural areas, we should strengthen health-related information and education in rural areas.

Several factors in our study were also associated with POP in previous studies, including multiparity, advanced age, and increased BMI [2, 17–21]. With increasing age, the prevalence of symptomatic POP increases. Obese women had a greater risk of POP than nonobese women in our study, which was similar to results reported in a previous study [22]. Consistent with prior studies, being multiparous (parity ≥3) significantly increased the risk of symptomatic POP compared with those who were not multiparous [18, 23]. Given the large rural population and increased number of deliveries by rural Chinese women, interventions targeting these risk factors to prevent POP are needed.

Multivariate results indicated that smoking and coughing can also exacerbate POP, as they increase intra-abdominal pressure, risk of POP 1.63-fold (95% CI 1.04–2.50), and 1.86-fold (95% CI 1.55–2.22), respectively. Constipation was also found to be associated with POP, which is consistent with the results of a recent study conducted in the United Arab Emirates [17]. Although constipation could be generated by POP, some studies have shown that straining to produce stool as a young adult prior to the onset of POP was more common in women who subsequently developed POP than in women who did not (61 vs 4%, $P < 0.001$) [24]. More longitudinal studies are required to explore the relationship between constipation and POP. However, all these characteristics have the potential to be modified. Therefore, efforts should be strengthened to improve access to family planning. Controlling weight and avoiding a chronic cough and constipation can reduce the likelihood of developing symptomatic POP. Data are conflicting regarding whether the risk of prolapse is increased in women with certain occupations [25]. One study of >1000 women reported that women who engage in manual labor have significantly more severe POP than women engaged in other jobs, likely as a result of increased intra-abdominal pressure related to more heavy lifting and standing for long periods [26]. In our analysis, there was no significant association between symptomatic POP and physical labor. More studies in the general population correlating jobs with the incidence of POP are needed.

Strengths of this study include screening for symptomatic POP based on both the presence of prolapse-related symptoms and POP-Q stage. Furthermore, our study includes a large representative population-based sample of rural women and had a high response rate. This was the largest population-based epidemiologic study of POP in rural China. Our study

had some limitations: The prevalence of POP may be underestimated, because screening based on prolapse-related symptoms may miss women without symptoms. In addition, the low level of attention to health in rural areas may result in an underestimated prevalence of POP. Another weakness is that our study excluded who underwent treatment for pelvic floor disorders.

This was the largest population-based epidemiological study to date to examine symptomatic POP in rural China. More than 9% of adult women in rural China experience symptomatic POP. The prevalence of POP increased with age. Obesity and multiple deliveries increased the odds of experiencing symptomatic POP. Many chronic conditions, such as constipation, smoking, coughing, gynecological diseases, and other diseases, also increased the risk of POP. However, all these characteristics have the potential to be modified. Therefore, additional healthcare programs and campaigns are required to educate the public regarding those risk factors to decrease the prevalence of this potentially negative condition. Complete epidemiological data are essential for further assessment of medical need and the reasonable allocation of healthcare resources, as well as improvements in the diagnosis and treatment of POP.

Acknowledgments This study obtained ethical approval from clinical trials.gov and http://www.chictr.org.cn (number: ChiCTR-OCH-14004675). Written consent was obtained from all eligible participants. All eligible patients were invited to participate in the study, and those who agreed were provided with 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.

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Compliance with ethical standards

Conflicts of interest None.

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