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Original Article

Obstetrics and Gynaecology Section

Predictive Factors for Pelvic Organ Prolapse (POP) in Iranian Women's: An Ordinal Logistic Approch

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ABSTRACT

Introduction: To investigate the predictors factors of Pelvic Organ Prolapse (POP) in Iranian women by using ordinal logistic regression.

Materials and Methods: The role of risk factors of POP was evaluated among 365 patients attending in two public centres in Ilam province, Iran. Exclusion criteria were of single, pregnant and lactate women receiving hormone replacement therapy. Both the unvaried and multi-variate ordinal logistic regression were used to find the predictive factors of POP and computing sensitivity and specificity of models.

Results: In multi-variate ordinal logistic regression the variables of Body Mass Index (BMI) Maximum Birth Weight (MBW) and delivery mode were the most important factors for prediction of prolapse stage. The sensitivity and specificity of multi-variate ordinal logistic, as a screening test, were 95.7% and 48.7% respectively.

Conclusion: BMI, MBW and delivery mode can use for prediction of POP stage. Stage of prolapse is an ordinal variable, therefore to show relationship between stage of prolapse and other variables ordinal logistic regression is an appropriate model.

Keywords: Ordinal Logistic Regression, Pelvic Organ Prolapse, Dorsal Lithotomy position

INTRODUCTION

Pelvic Organ Prolapse (POP) is defined as the descent of intra-pelvic organs due to deficiencies in the pelvic support system. It is a common condition among women [1,2]. POP can affect the women of all ages and is associated with functional problems of the pelvic floor [3].

The worldwide prevalence of genital prolapse is estimated to be 2–20% in women under the age of 45 years [4]. However, it is common among elderly woman and the frequency has been reported as high as 39.8% [5]. The lifetime risk of women undergoing surgery for incontinence or prolapse is estimated to be 11% in the USA [6]. Based on previous studies conducted in Iran, the prevalence of POP is higher than the global situation, so that about half of the Iranian women, who experience some degree of POP [7].

POP is an important public health issue and it has side effects on quality of life and impact on the health care system [8]. On the other hand, the results of the studies indicate that 135, 000 women undergo surgery for UI and 225,000 have POP repair each year in the United States [9,10].

There are many techniques of classifying POP. The Baden-Walker (grades 0 through 4) and Pelvic Organ Prolapse–quantification POPQ (stages 0 through IV) are the two main systems for staging the degree of POP [4]. However, no unique system is generally agreed upon, the system approved by the International Continence Society (ICS), called the POPQ system, is considered as one standard. This POPQ system contributed significantly to the development in studying prolapse because it allows researchers to report findings by a standardized style [11].

There are common risk factors for POP, including aging, pregnancy, vaginal birth, birth trauma, chronic increases intra-abdominal pressure (obesity, chronic constipation, chronic coughing, repetitive heavy lifting), menopause, estrogen deficiency, genetic factor, prior surgery, myopathy, collagen abnormalities, smoking and lifestyle [3,12,13]. In prior, studies have used of X2, t-test, liner and logistic regression to find relationship between prolapse stage and risk factors. Since the stage of prolapse is an ordinal variable, the aim of present study is investigated the predictive factors for POP by using of Ordinal Logistic Regression in Iranian women's.

MATERIALS AND METHODS

This is a cross-sectional study carried out to examine the role of demographic, anthropometric and clinical variables on POP. In the first, we evaluated 1,000 available Health Information documents in two primary health care centers in Ilam province, Iran. In the second, extracted address and phone number of eligible women for the study. Then invited the eligible women to participate in the study according to a schedule. All the women participated in the study except for single, pregnant and lactate women receiving hormone replacement therapy. Overall, in this research 365 women participated.

Data collection and examinations was carried out in face to face interviews by researcher.

1. **Demographic information:** This included data on age, education, and occupation.
2. **Anthropometrics data:** This included information on weight and height. Trained research personnel measured height and weight by a Seca 220 (made by Germany) while the subjects were minimally clothed and not wearing shoes. The BMI was calculated based on heights and weights [BMI = weight (kg)/(height (m)2]. Based on the BMI, women were grouped into different categories as recommended by the National Centre for Education in Maternal and Child Health.
3. **Clinical measures:** The summary of the patient's obstetrical included data on pregnancy, delivery mode, delivery operative, delivery position, MBW, medical and surgical histories and POP type and stage collected with observation, interview, and examination.

All the subjects evaluated in Dorsal lithotomy position after emptying their bladders according to the POPQ technique recommended by ICS. In this system measurements are made at different vaginal sites, providing quantification of prolapse affecting different vaginal

	Severity stage 0	Severity stage 1	Severity stage 2	p-value
Age (Mean ± SD)	32.19 ±7.16	34.88 ±9.22	38.02 ±8.99	0.000
Body mass index (Mean±SD)	26.29 ± 4.78	27.67 ± 4.84	29.02 ± 4.91	0.000
Maximum birth weight (Mean ±SD)	3443.75 ±548.09	3340 ±781.56	3787 ± 663.25	0.000
Pregnancy number(Mean±SD)	3.17 ± 2.78	3.81 ± 2.99	5.37± 2.99	0.000
Constipation N(%)				0.103
Yes	5 (8.9)	12 (21.4)	39 (69.6)	
No	65 (21)	61 (19.7)	183 (59.2)	
Pelvic Surgical N(%)				0.005
Yes	19 (28.4)	19 (28.4)	29 (43.3)	
No	51 (17.1)	54 (18.1)	193 (64.8)	
Occupation N(%)				0.002
Light work	58 (24.1)	50 (20.7)	133 (55.2)	
Heavy work	12 (9.7)	23 (18.5)	89 (71.8)	
Delivery operative N(%)				0.000
Mix	16 (28.6)	8 (14.3)	32 (57.1)	
Traditional Midwife	7 (6.4)	17 (15.6)	85 (78)	
Physician	24 (54.5)	12 (27.3)	8 (18.2)	
Obestetrician	16 (12)	26 (19.5)	91 (68.4)	
None	7 (30.4)	10 (43.5)	6 (26.1)	
Delivery position N(%)				0.000
Mix	5 (9.8)	9 (17.6)	37 (72.5)	
Home	7 (6.4)	17 (15.6)	85 (78)	
Hospital	51 (28)	37 (20.3)	94 (51.6)	
None	7 (30.4)	10 (43.5)	6 (26.1)	
Delivery Mode N(%)				0.000
Normal Vaginal Delivery and other	39 (13)	53 (17.7)	208 (69.3)	
CS + Nulli gravid	30 (46.9)	20 (31.2)	14 (21.9)	

[Table/Fig-1]: Severity stages population according to selected independent variables

segments (anterior and posterior vagina, vaginal apex or cervix) as well as an overall stage of prolapse. Measurements are made in centimeters relative to the hymen as the reference point. In this system, negative numbers represent positions above the hymen, and positive numbers represent points beyond or past the hymen. A rigid marked hysterometer, calibrated in centimeters was used for measurements. Also, the small vaginal dilator was used to measure Aa, Ba, Ap, Bp. The apical points of C, D and the Total Vaginal Length (TVL) points were measured relative the hymen. All points except for TVL were recorded in maximal valsalva effort. The external measurements of GH and PB made at the time of rest and with strain. Then, bimanual examination for determine abdominal and pelvic mass were performed.

Patients were divided into two groups for comparison: (1) with prolapse (2) without prolapse. Both univariate and multiple logistic regression analyses were used to indicate the association between dependent (with prolapse vs. without prolapse) and independent variables. Independent variables tested for an association were age, education, occupation, BMI, pregnancy, delivery mode, delivery operative, delivery position, and MBW. Significant level was considered to p=0.05.

The Ethics Committee of Ilam University of Medical Sciences approved the study design. Written informed consent was obtained from the participants after comprehensive explanation of the procedure involved.

	B	SE	Wald	p-value
Age	0.05	0.01	22.65	0.000
Body mass index	0.08	0.02	17.11	0.000
Maximum birth weight	0.001	0.00	10.48	0.001
Pregnancy number	0.182	0.031	33.5	0.000
Constipation				
Yes	0.408	0.26	2.43	0.12
No	1.0 (ref.)			
Pelvic Surgical				
Yes	-0.64	0.19	11.35	0.001
No	1.0 (ref.)			
Occupation				
Light work	-0.61	0.19	9.86	0.002
Heavy work	1.0 (ref.)			
Delivery operative				
Mix	0.73	0.32	5.11	0.02
Traditional Midwife	1.61	0.33	24.56	0.000
Physician	-0.39	0.30	1.66	0.2
Obestetrician	1.19	0.3	16.03	0.000
None	1.0 (ref.)			
Delivery position				
Mix	1.34	0.37	13.2	0.000
Home	1.60	0.33	24.05	0.000
Hospital	0.58	0.27	4.43	0.03
None	1.0 (ref.)			
Delivery Mode				
NVD and other	1.44	0.18	64.3	0.000
CS + Nulli gravid	1.0 (ref.)			

[Table/Fig-2]: Association prolapse stage with other factors using univariate ordinal logistic regression analysis (link function complementary log-log)

RESULTS

Of the 365 women examined in this study, 285(80.8%) women were put in the POP group. The overall distribution of POP-Q system stages were as follows: stage 0, 19.2%, stage I, 20% (73/365) and stage II, 60.8% (222/365) .The prevalence of POP per stage in relation with independent variables in our general population is presented in [Table/Fig-1].

The present study participants had a relatively higher rate of anterior vaginal prolapse (sub stage AA, Be: 72.3%) than other sub stages (Ape, Bp: 49.9%, C: 47.1% and all points 28.77%). There is significant association between increasing age with increasing stage of POP (38.72 ± 8.94 in prolapse group vs 32.76 ± 7.29 in the without prolapse group, p= 0.000). Of all participants 82 % (300/365) had experienced at least one vaginal delivery. Association prolapse stages with other factors using univariate ordinal logistic regression analysis are presented in [Table/Fig-2].

The coefficient of ordinal logistic regression for age shows that the increasing of age is associated with increasing stage of Pelvic Organ Prolapse. The wald statistic in [Table/Fig-2] show that the importance of prolapse of variable in prediction os stage of prolapse. Fore example, variables of pregnancy number and delivery mode are more important than others variables in predication of prolapse stage.

In multi-variate ordinal logistic regression the variables of BMI, MBW and delivery mode were the most important variables for prediction of prolapse stage. The wald statistic in [Table/Fig-3] show that

	Estimate	Std. Error	Wald	p
Threshold				
Stage0	3.856	1.072	12.937	0.000
Stage1	4.652	1.086	18.360	0.000
Location				
Body mass index	0.093	0.031	8.810	0.003
Maximum birth weight	0.000	0.000	4.006	0.045
Delivery mode: NVD	1.518	0.268	32.119	0.000
Delivery mode: CS	1.0 (ref.)			

[Table/Fig-3]: Association prolapse stage with the covariates using multi-variate ordinal logistic regression analysis (link function complementary log-log)

Predicted Response				
	Stage 0	Stage 2	Total	p
Obseved Response	Stage 0	19 (48.7)	20 (51.3)	39 (100)
	Stage 1	9 (36)	16 (64)	25 (100)
	Stage 2	4 (4.3)	88 (95.7)	92 (100)
	Total	32 (20.5)	124 (79.5)	156 (100)

[Table/Fig-4]: Sensivity and spesifity of the ordinal logistic model

delivery mode, BMI, and MBW are the most important variables in prediction of prolapse stage respectively.

If we consider multi-variate ordinal logistic, as a screening test, the sensitivity of test is high (95.7%) but the specificity of test is low (48.7%) [Table/Fig-4].

DISCUSSION

In this cross-sectional study, according to the POPQ system the majority (80.8%) of our study population met criteria for pelvic organ prolapse. Several studies have shown a wide range of POP ranging from 2-2.6% in the general population [13], 4-12.2% in Sweden [14], 11.4% amoung women aged 45-85 years [15], 19.7% among women in 16 low-income and lower middle-income countries [16] and 39.8% in women who enrolled in the Women's Health Initiative Hormone Replacement Therapy (HRT) Clinical Trial [5]. The prevalence of POP was higher in our study (80.8%) as compared to other study conducted in Iran (53%) [7]. Regarding the effect of age, lifestyle, number and type of delivery and other risk factors [17,18], differences between the research participants can be attributed to the difference in the reported prevalence.

We found that stage 2 is most common severity of prolaps. In Other Iranian study most participants have stage 1 or 2 of POP [7]. Trowbridge et al., confirm our results and reported the stage 2 in 67.7% of all participants [19].

In present study, we investigated a model for predication of POP. The univariate ordinal logistic regression showed significant statistical association between age, BMI, MBW, pregnancy number, pelvic surgical, occupation, delivery operative, and delivery mode with stage of POP. There was any association between constipation and stage of pelvic organ prolapse. In a case-control study evaluated the risk factors for the development of genital prolapse in the Brazilian population. The age, BMI, parturition, number of vaginal, caesarean section or forceps deliveries, newborn weight and positive family history factors in patients were factors associated with POP. After Logistic Regression presence of at least one vaginal delivery, fetal macrosomia and positive family history for dystocia have reported as independent risk factors in POP [20]. Although several studies have confirmed the effect of increasing age on the incidence and severity of POP [9,21-24], in a case study reported the third-degree uterine prolapse in 11-month-old infant [25].

Based on best knowledge, it is the first study that use ordinal logistic regression to analysis data. In previous research to find association between prolapse stage and other variables used X2 and t-test and liner regression and logistic regression [7,26-27]. Stage of prolapse is an ordinal variable so that to show relationship between it and other variables the appropriate model is ordinal logistic regression. In Ordinal Logistic Regression finding appropriate link function is very important.

CONCLUSION

In present research, we choose much link function such as Cauchit, Complementary log-log, Logit, Negative log-log and Probit. Likelihood function shows that complementary log-log is the best link function for this data. In Ordinal Logistic Regression we can compute specificity and sensitivity of model that can have medical application and help to midwife and Gynaecologist to diagnosis of stage of prolapse.

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