Correlation of levator ani muscle strength measurement between Modified Oxford Grading Scale and perineometer on pelvic organ prolapse patient

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Abstract

Pelvic Organ Prolapse (POP) is a debilitating condition affecting about half of all women aged of more than 60 years globally. Reduced levator ani muscle strength in POP is associated with worse symptoms and prognosis. Measurement of levator ani muscle strength can be done with several tools such as perineometer and digital palpation. However, there is currently no study regarding conformity between tests. The aim of this study is to determine the correlation between tests in POP patients. An analytic observational study using cross sectional design was done to determine conformity between perineometer and digital examination using Modified Oxford Grading Scale (MOS) in Dr Cipto Mangunkusumo National General Hospital, Indonesia during the period of July, 2018 to June, 2020. Correlation between tests was determined using Spearman test. Cut-off of perineometer reading for each MOS score was also determined. A total of 110 subjects examined with both perineometer and digital palpation were recruited to the study. Positive correlation was observed between perineometer reading and Modified Oxford Grading Scale ($r = 0.790$, $p < 0.001$). According to the result, values between 0.01 – 9.64 cmH_2O correspond to very weak pressure (MOS 1); 9.65 – 22.49 cmH_2O represent weak pressure (MOS 2); 22.5 – 35.24 cmH_2O represent moderate pressure (MOS 3); ≥ 35.25 cmH_2O represent good pressure (MOS 4). There was a strong correlation between MOS and perineometer result for measuring levator ani strength in POP patients.

Introduction

Pelvic Organ Prolapse (POP) together with urinary incontinence and fecal incontinence are known collectively as pelvic floor disorders and are a common and important medical condition estimated to affect up to half of all female populations.[1] The annual incidence of POP surgery is stated to range from 1.5 to 1.8 cases per 1000 female-years, with the incidence peaking in women between 60 and 69 years.[2]

Although many risk factors have been identified, weakness of the endopelvic fascia and levator ani is the major factor in the etiology of POP and all known risk factors actually cause weakness and damage to the fascia and levator ani, leading to organ herniation and prolapse.[3,4] The levator ani muscle plays a very important role as a pelvic organ support system.[3,4] Therefore, measuring the function and strength of the levator ani will play a very important role in determining management and prognosis for POP patients.

Many techniques and methods have been developed to assess the function and integrity of the pelvic floor muscles in POP. Some examples are perineometry, ultrasonography, Magnetic Resonance Imaging (MRI), Electromyography (EMG), digital palpation, dynamometry, vaginal cones and others. These methods have advantages and disadvantages according to their clinical utility, aim, and cost.[5-7]

The choice of levator ani strength measurement primarily depends on the infrastructure available on the health service center. Unfortunately, most of the health facilities in Indonesia take place in suburban and rural areas, where such tools might not be readily available. Thus, digital palpation is currently the most widely used examination in order to determine levator ani muscle strength in POP patients.

To date, there is no study regarding correlation between perineometer result and digital examination using Modified Oxford Grading Scale (MOS) in POP patients in Indonesia, although it is important to ascertain that digital examination would prove to be sufficient. This study aimed to determine correlation between perineometer result and digital examination using Modified Oxford Grading Scale (MOS) in POP patients.

Materials and Methods

This study was an analytic observational study using cross sectional design was done to determine conformity between perineometer and digital examination using Modified Oxford Grading Scale (MOS) in Dr Cipto Mangunkusumo National General Hospital, Indonesia during the period of July, 2018 to June, 2020.

The inclusion criteria for this research were all pelvic organ prolapse patients examined with both perineometer and digital palpation. Subjects with secondary gynecologic problems such as anatomical deformity or gynecologic cancer and those unable to be examined using perineometer probe were excluded from the study. MOS was recorded during the examination with the interval limit being 0 and 5. Perineometer used in this study was Peritron™ hand-held clinical biofeedback Perineometer with range of pressure of 0 to 300 cmH_2O. A single obstetrician acted as the evaluator for all patients in this study. Subjects were evaluated using one of the tests during the first visit and the other during the second visit with one day interval. The first test performed on subjects was randomized using computer program.

This study used 5% error bound and 95% confidence interval limit, with power of the

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Key words: Levator ani muscle strength; Modified Oxford Grading Scale, pelvic organ prolapse; perineometer.

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Conflict of interest: The authors have no conflict of interest to declare.

Availability of data and materials: The data used in this study can be requested from corresponding author upon reasonable request.

Ethics approval and consent to participate: The present study had been approved by the Research Ethics Committee of Faculty of Medicine, University of Indonesia with ethical clearance letter numbered ND.340/UN2.F1.DEPT.25/PDP.01/2020. All patients who were included in this study had given the informed consent prior to the study.

Informed consent: Written informed consent was obtained from a Research Ethics Committee of Faculty of Medicine, University of Indonesia for anonymized patient information to be published in this article.

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test considered to be 90%.

This study followed the *Guidelines for Good Clinical Practice* and had been approved by the Research Ethics Committee of Faculty of Medicine, University of Indonesia with ethical clearance letter No. ND.340/UN2.F1.DEPT.25/PDP.01/ 2020. All patients who were included in this study had given the informed consent prior to the study.

Collected data were then analyzed using SPSS for Macintosh ver. 20. Characteristics of subjects and examination results were analyzed descriptively. Correlation between examination was calculated using Spearman test. Cut-off value for each MOS score was determined using Receiver Operating Characteristics (ROC) curve.

Results

On the course of this study, a total of 110 pelvic organ prolapse subjects had been examined using perineometer and digital palpation. Subject recruitment's flowchart can be found on Figure 1. Baseline characteristics of subjects were calculated and can be found on Table 1. Following the analysis of baseline characteristics, correlation of digital palpation and perineometer examination were observed. Scatterplot of examination results was obtained in order to determine the collinearity between tests (Figure 2). After ensuring that the results between test were rather linear, correlation between tests was calculated using Spearman test. It was found that both tests had strong correlation (r=0.790, p<0.001). Correlation result can be found on Table 2. Cut-off value for each Modified Oxford Grading Scale score can also be found on Table 3.

Table 1. Characteristics of subjects.

Characteristics	N = 110
Age in years, median (range)	56 (33-76)
<30	0
30-49	40
50-69	62
>69	8
Parity, median (range)	3(0-8)
0	1
1	18
2	20
3	37
>4	34
BMI (kg/m^2), median (range)	25.9 (18.3-34.4)
Underweight (<18.5)	2
Normal weight (18.5-24.9)	53
Overweight (25-29,9)	49
Obese (≥30)	6
Menopause status	
Postmenopausal	62
Premenopausal	48
Kind of POP	
Anterior prolapse	57
Uterine prolapse	29
Vaginal prolapse	13
Posterior wall prolapse	11
Grade	
I	20
II	45
III	33
IV	12

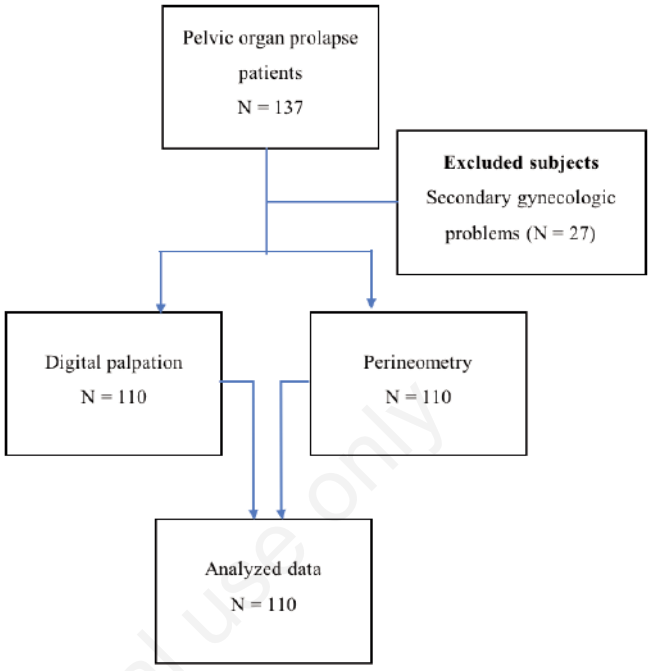

Figure 1. Subject recruitment.

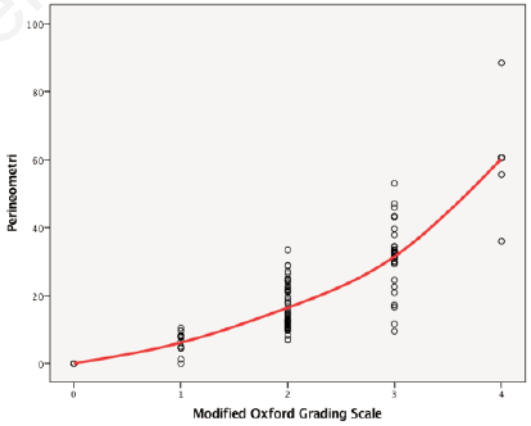

Figure 2. Scatterplot of examination results.

Table 2. Correlation of tests.

MOS	Perineometer result (cmH_2O), median (range)	r	p
0	0 (0 – 0)	-	-
1	7.15 (0 – 10.5)	Control	-
2	14.15 (6.9 – 33.4)	0.604	< 0.001
3	32.3 (9.5 – 53.0)	0.779	< 0.001
4	60.4 (36.0 – 88.4)	0.791	< 0.001
5	N/A	N/A	N/A

N/A = Not available, r = correlation degree, p = statistical significance.*Spearman test.

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Discussion

In this study, it was found digital examination using MOS and perineometer had strong correlation (r=0.790, p<0.001). In this study, it was known that the median age of patients with POP is 56 years, the majority of whom were multiparity patients, and had normal or overweight BMI. These results are consistent with the risk factors for patients with pelvic organ prolapse, namely old age, on postmenopausal period, having overweight risk factors and having given birth vaginally. [8] There are many tests in order to evaluate the function of the pelvic floor muscles, such as visual examination, digital palpation, EMG, ultrasonography, manometry (perineometry), and MRI.[9] However, on facilities with limited infrastructure, a simple examination is required to assess the strength of pelvic floor muscles, one of which is using digital examination using the MOS.

Correlation test between results of MOS and perineometry showed strong correlation (r=0.790, p<0.001). This result showed that the results of the MOS examination, which is a subjective examination based on operator experience, can provide performance that is consistent with objective perineometry examination. Similar value was obtained by a similar study by Volløyhaug *et al.*[10] in Norway (r = 0.740) and Angelo *et al.*[11] in Brazil (r = 0.722). However, both studies were conducted on healthy female population of varying ages and clinical characteristics.

The results obtained in this study at first glance appear to have a fairly low range of values when compared to the perineometer examination scale (1-100). With low range of values, it can be inferred that digital examination is quite sensitive to different pelvic floor muscle pressures. A similar study from Angelo *et al*. in Brazil in 2017 showed a higher classification of the perineometer measurement results for each MOS scale.[11]

Previous study by Dietz *et al.*[12] demonstrated that anatomically, there was an enlarged urogenital hiatus in patients with pelvic organ prolapse. This is also called *ballooning*, if the dilation is more than 25 cm^2. The phenomenon of ballooning has a strong correlation with a decrease in the strength of the contractions of the levator ani muscles, so that the mean muscle contraction strength is lower in patients with pelvic organ prolapse than studies in the general population.

In this study, there were no exclusions due to disturbances in the examination of the patient, such as pain at the time of introduction of the probe. Therefore, based on the results of digital MOS examination correlation with perineometry, it is feasible to do a digital examination with MOS to measure the strength of the pelvic floor muscles, especially in health care locations with limited facilities.

Conclusions

It is concluded in this study that there was a strong correlation between MOS and perineometer result for measuring levator ani strength in POP patients.

Table 2. Correlation of tests.

MOS	Perineometer result (cmH_2O), median (range)	r	p
0	0 (0 – 0)	-	-
1	7.15 (0 – 10.5)	Control	-
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5	N/A	N/A	N/A

N/A = Not available, r = correlation degree, p = statistical significance.*Spearman test

Table 3. Cut-off value of perineometer result for each MOS score.

MOS	n	Mean	SD	CI95% Lower	Upper	Cut-off Point
0	2	0	-	-	-	-
1	12	6.17	3.2	4.13	8.21	9.65
2	62	16.4	6.2	14.83	18.00	22.5
3	29	31.5	10.1	27.66	35.37	35.25
4	5	60.2	18.7	36.97	83.47	N/A
5	N/A	N/A	N/A	N/A	N/A	

*N/A = Not available.

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