Research Article

Comparison of the Levator Hiatal Area

Perbandingan Area Hiatal Levator Ani

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Abstract

Objective: To determine the relationship of the levator hiatal area among nulliparous, primiparous, and multiparous women so that we can assess the prevalence of avulsion.

Method: A cross-sectional study design was used by evaluating the transperineal ultrasound results of all nulliparous, primiparous, and multiparous women in the Obstetrics and Gynecology Clinic of Dr. Cipto Mangunkusumo hospital from May to December 2015. We analyzed the data through SPSS using one way ANOVA to compare the levator hiatal dimension among the groups of women during Valsava maneuver and at rest.

Result: There were significant differences in levator hiatal area among nulliparous, primiparous, and multiparous women during Valsalva maneuver and at rest, which the mean (SD) was 22.26 (5.45) cm^2 (p=0.028) and 10.70 (2.26) cm^2 (p=0.012), respectively. Levator ani muscle avulsion was occurred in 1 out of 46 (2.2%) women from the primiparous and multiparous group.

Conclusion: There are significant differences in levator hiatal area during Valsalva and at rest among the groups.

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Keywords: avulsion, levator hiatal area, multiparous, nulliparous, primiparous

Abstrak

***Tujuan**: Untuk mengetahui hubungan area hiatal otot levator ani perempuan nulipara, primipara dan multipara saat istirahat/kontraksi dan manuver Valsalva serta mengetahui prevalensi kejadian avulsi.*

***Metode**: Penelitian ini menggunakan studi potong lintang dengan melihat hasil pemeriksaan USG transperineal yang dilakukan pada pasien perempuan nulipara, primipara dan multipara yang datang ke poli Obstetri dan Ginekologi RSUPN Dr. Cipto Mangunkusumo pada bulan Mei-Desember 2015. Kami melakukan analisis data dengan SPSS menggunakan one way ANOVA untuk membandingkan area levator hiatal antara kelompok pasien selama manuver Valsalva dan saat istirahat.*

***Hasil**: Terdapat perbedaan bermakna untuk area hiatal otot levator ani pada saat Valsalva maupun istirahat untuk ketiga kelompok penelitian dengan (p=0.028 dan p=0.012). Saat Valsalva, perbedaan area hiatal otot levator ani ditemukan pada kelompok nulipara dan multipara dengan perbedaan rerata (standar deviasi) yaitu 22,26 (5,45) cm^2. Saat istirahat, perbedaan area hiatal otot levator ani ditemukan pada kelompok nulipara dan multipara dengan perbedaan rerata (standar deviasi) yaitu 10,70 (2,26) cm^2. Avulsi otot levator ani terjadi pada 1 dari 46 (2,2%) pada perempuan primipara dan perempuan multipara.*

***Kesimpulan**: Terdapat perbedaan bermakna untuk area hiatal otot levator ani pada saat maneuver Valsalva maupun istirahat untuk ketiga kelompok penelitian.*

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***Kata kunci**: area hiatal levator ani, avulsi, multipara, nulipara, primipara*

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INTRODUCTION

Pelvic floor dysfunction becomes major public health problem, whereas, around 23% of women suffer from this condition worldwide. Pelvic floor dysfunction significantly decreases the quality of life due to many symptoms, such as constipation, urinary or anal incontinence, chronic pelvic pain, and urogenital prolapse.[1]

An important component of pelvic floor system is levator ani muscle; therefore, trauma to this muscle is related to pelvic floor disorders. Avulsion of the levator ani muscle is a common consequence of vaginal childbirth[2] affecting between 13% and 36% of women. In general, it happens after the first vaginal delivery.[2-9] In nulliparas, no avulsions were observed.[10]

A levator avulsion results from the detachment of inferior pubic rami on puborectalis muscle.[11] The striated muscles of levator ani form an essential component of structural support mechanism in the pelvic floor. Unlike other skeletal muscles, the levator ani muscle differs because it maintains constant tone, except during voiding, defecation, and the Valsalva maneuver. It has the capability to con-

tract rapidly during sudden increase of abdominal pressure, for example on a cough or sneeze or physical activity; thereby, it will reduce the risk of incontinence and pelvic organ prolapse (POP). Paradoxically, it has to stretch during parturition even beyond its limits in order to allow the passage of baby. However, it has to contract after delivery to preserve the normal function.[12] Levator anal muscle is very susceptible to the stretch-induced injury. During the stretch, the extent of injury is proportional to the work performed on the muscle.[13] Therefore, this study aims to determine the relationship of the levator hiatal area among nulliparous, primiparous, and multiparous women so that we can assess the prevalence of avulsion.

METHOD

A cross sectional study design was used by evaluating the patients' transperineal ultrasound results. This study used consecutive sampling method with a total of 69 patients. We recruited the women coming to Obstetrics and Gynecology Clinic Dr. Cipto Mangunskusumo hospital from May to December 2015. We exclude the pregnancy women, women with history of pelvic malignancy, history of pelvic reconstructive surgery, history of pelvic trauma, and inability to contract pelvic floor muscles correctly. We described the characteristics demography of women and analyzed using one way ANOVA to compare the levator hiatal dimension among the groups of women during Valsalva maneuver and at rest. We analyzed the data using SPSS.

RESULTS

Of the 69 patients assessed, there were 23 women in each group of nulliparous, primiparous, and multiparous. Demographic characteristics of the patients were presented in Table 1.

Levator hiatal dimension measured at Valsalva maneuver was presented in Table 2. The data distribution on levator hiatal area were normal among all groups. The ANOVA result showed the significant differences on levator hiatal area among nulliparous, primiparous, and multiparous women during Valsalva maneuver (p=0.012).

Table 2. Comparisons of Levator Hiatal Dimensions Measured at Valsalva Maneuver

	N	Mean (SD)	p value
Nulliparous group	23	17.72 (4.93)	0.012
Primiparous group	23	18.69 (5.37)	
Multiparous group	23	22.26 (5.45)	

Table 3 presented levator hiatal dimension measured at rest. Among all groups, levator hiatal measurement was normally distributed. The ANOVA results indicated that there were significant differences on levator hiatal area among nulliparous, primiparous, and multiparous women at rest (p=0.012).

Table 3. Comparisons of Levator Hiatal Dimensions Measured at Rest

	N	Mean (SD)	p value
Nulliparous group	23	10.00 (2.17)	0.028
Primiparous group	23	10.70 (2.26)	
Multiparous group	23	11.96 (2.86)	

Of 46 primiparous and multiparous women, there was 1 (2.2%) patient who developed into levator avulsions. No avulsions were observed in nulliparous women.

DISCUSSION

Levator ani muscle avulsion is common problem in women after vaginal delivery and it is likely to be an etiological factor in the development of female POP, especially cystocele and uterine prolapse.[1]

Table 1. Demographic Characteristics of the Patients

Characteristics	Nulliparous (mean (SD))	Primiparous (mean (SD))	Multiparous (mean (SD))
Age (years)	31.4 (3.2)	27.0 (21.0 - 42.0)*	46.3 (9.5)
Highest birth weight (kg)	-	2.9 (0.6)	3.1 (0.4)
Body mass index (kg/m^2)	23.2 (3.1)	22.8 (3.2)	26.1 (3.7)

Median (min-max)

Acute levator ani muscle injury can be diagnosed clinically through visualization and digital examination; whereas, levator avulsion is associated with large vaginal tear.[2] Chronic detachment of the levator ani muscle from the inferior ramus of pubic bone can be evaluated by palpation.[3]

The incidence of levator ani muscle avulsion following vaginal delivery in our study was around 2.2% and it could be found in primiparous or multiparous women. Previous studies had shown higher incidence rate of levator ani muscle avulsion, namely 36%[4] and 21%[5]. The very low incidence rate in our study might be occurred because we only reported major levator ani muscle avulsion; meanwhile, the minor levator ani muscle avulsion was not counted in.

It is estimated that levator ani muscle injury happens not only during delivery but also during the period of pregnancy. During gestation, the gravid uterus enlarges progressively, inducing its effect on the levator ani muscle, probably through three mechanisms. The mechanisms are an increment of the uterine weight, an elevation of the intraabdominal pressure, and a mechanical interference with its functional activity. Continuously, the uterine weight increases during gestation, reaching its maximum weight during several final weeks of gestation. The levator ani muscle has to bear this weight. At the expense of the levator plate size, the enlarging uterus widens the levator hiatal area progressively. The levator hiatus occupies the anterior part of the levator plate. The lowest part of the enlarging uterus engages through the levator hiatus, resulting progressive widening of the hiatus. Meanwhile, the uterus encroaches on the levator plate, reducing to the minimum its transverse diameter across the pelvic cavity. As a result, the levator plate sags down, leading to suspensory sling subluxation in addition to widening and lowering of the levator hiatus. Hence, most of the anal canal, urethra, and vagina lie above and they are exposed to the direct effect of the intraabdominal pressure. The lowered and widened levator hiatus exposes anal canal and urethra directly to the intra abdominal pressure on straining at defecation or urination. Then, it is transmitted through the abnormally wide levator hiatus to the anal canal and urethra leading to their obstruction. It is predicted that the high anal canal pressure recorded during levator ani muscle contraction on straining in multiparous women coming from the increased intra abdominal pressure directly to the anal canal.[6] The second factor affecting the levator ani muscle during gestation is the constantly increasing intraabdominal pressure induced by the enlarging gravid uterus.[7] Previous studies had stated that the main brunt of the increased intraabdominal pressure fell on the levator plate, particularly on the rectococcygeal raphe, which is the most dependent and durable part of the levator plate.[8-10] Being tendinous, the rectococcygeal raphe and hiatal ligament become overstretched and subluxated. The third factor concerning the effect of the gravid uterus on the functional activity of the levator ani muscle is the mechanical factor. During last month of pregnancy, the gravid uterus mechanically blocks contraction power of the levator ani muscle, leading to interfered contraction process.[6]

According to previous study conducted by Garcia-Mejido[11], the most important risk factor associated with avulsion during vaginal delivery is fetal weight. Some studies had shown that birth weight is a risk factor for pelvic floor damage[12] and urogenital prolapse.[13] However, some studies concluded contrasting results.[14-17] Avulsion leads to an enlargement of the levator hiatus, particularly in its anterior part, which is clearly associated with POP.[20] It has been considered that older age is a risk factor for avulsion.[18-22]

Avulsion occurs more frequently in multiparous compared with nulliparous women due to greater contractibility. Zanetti, et al.[23] found greater distensibility in the multiparous than in the nulliparous women (20.07 (SD 0.46) cm vs 19.3 (SD 2.8) cm; $p<0.001$) during delivery. In addition, previous study conducted by Petricelli, et al.[24] suggested that nulliparous women had higher electrical activity compared to multiparous women. The mechanical and hormonal effects of pregnancy may induce biomechanical, neurological or neuromuscular changes to the pelvic floor and pelvic organ supports[25,26] and they may contribute to pelvic floor dysfunction, independently of delivery mode. Weidner, et al.[27] had demonstrated that pregnancy had negative effect on the electromyographic activity of the urethral rhabdo sphincter.

The limitation of this study included small sample size. The prevalence of avulsion in this study was very low (2.2%); while, the differences between nulliparous and multiparous group could not be observed any further.

CONCLUSION

It is essential to perform the measurement of the levator hiatus in pregnant women. By measuring the levator hiatus, the incidence of POP could be predicted; therefore, preventive management can be held earlier during the process of delivery.

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