Comparison Of Levator Ani Muscle Avultion Between Forceps Extraction And Vacuum Extraction Based On Ultrasonographic Examination

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Abstract

Introduction Avulsion of the levator ani muscle is a major issue that can arise as a result of childbirth. The risk of avulsion of the levator ani muscles increased when operative vaginal delivery was performed. Operative vaginal deliveries are forceps extraction or vacuum extraction. Delivery by vacuum extraction considered to have a higher risk for levator ani avulsion compared to forceps extraction delivery. Two-dimensional ultrasonography is a tool that can diagnose the presence of avulsion of the levator ani muscle.

Method This study was a cross-sectional analytical study. The samples were 17 patients who delivered with forceps extraction and 17 patients gave birth with vacuum extraction, in the period from August to November of 2013, and then compared the incidence of levator ani avulsion.

Result There were significant differences in the incidence of levator ani avulsion between forceps and vacuum extraction deliveries (p<0,05). Avulsion of the levator ani muscles occurred in 8 patients (47,1%) with forceps extraction, and 2 patients (11,8%) in the vacuum extraction. There were a total of 10 levator ani muscles avulsions. On repeat ultrasound examination 42 days after delivery, all of levator ani may still be found.

Conclusion There are differences in the incidence of avulsion of the levator ani between forceps and vacuum extraction. The incidence of avulsion of the levator ani muscle is higher in forceps compared to delivery by vacuum extraction.

INTRODUCTION

The pelvic floor consists of connective tissue and muscles that support the pelvic organs. One of the muscles that make up the pelvic floor is the levator ani muscle. The levator ani muscle consists of 3 muscles namely pubococcygeus, puborectalis, and iliococcygeus muscle.[1]

Trauma to the levator ani muscle is associated with labour, especially operative vaginal delivery. Operative vaginal delivery is a term used when the head is born with the help of vacuum or forceps extraction[2]. The prevalence of operative vaginal delivery in Australia and Canada is around 15%, Thailand 8%[3], and in the United States 5%[2]. In Indonesia there is no accurate data regarding the prevalence of operative vaginal delivery.

Previous studies have noted 2 cases of levator ani avulsion from 9 forceps deliveries (22%) and others recorded 4 out of 10 cases of deliveries (40%)[4,5]. Therefore it can be seen that the vacuum extraction rate of the avulsion levator ani is greater than the extraction of forceps. Levator ani muscle injury may cause pelvic floor muscle dysfunction which will cause pelvic organ prolapse[6]. Uterine prolapse is one of the problems that affect the quality of life of a woman due to its effects on the urinary tract, digestion, and sexual function[7].

Avulsion of the levator ani muscle can be detected by Magnetic Resonance Imaging (MRI), two / three / four dimensional ultrasound (2D / 3D / 4D ultrasound)[5,8,9]. However, not all health facilities in the world, especially developing countries have these tools, whereas 2D ultrasound is almost owned by all obstetricians around the

world. Given the lack of reliable data on levator ani avulsion in Indonesia, this research is still necessary to be performed.

METHOD

This research was a cross-sectional study conducted at Hasan Sadikin General Hospital in Bandung, Bandung, West Java, Indonesia from August-November 2013.

The population in this study were patients who underwent operative vaginal delivery. Sampling was carried out by consecutive sampling (the order of patients coming) who met the inclusion criteria (women giving birth with operative vaginal delivery procedures on the indication of prolonged 2nd stage of labour, age between 18-35 years, birth weight of newborn 2,500-3,325 grams). Exclusion criteria were mothers with signs of puerperal infection, undergoing immunosuppressive treatment, patients with malignant diseases, as well as patients with inclusion criteria but could not have an ultrasound examination.

Determination of sample size was based on statistical calculations by setting 95% of confidence level and 80% of power test. The formula used to determine the sample site to test the difference in two proportions is as follows:

Notes:

- p1 = proportion of respondents in group 1 (labour with forceps extraction) who got an avulsion of levator ani muscle = 71.4%
- p2 = proportion of respondents in group 2 (labour with vacuum extraction) who got an avulsion of levator ani muscle = 25%
- P = (p1+p2)/2
- z = z score for 95 % Confidence Interval = 1,96
- z = z score for 80 % power = 0,84

Based on the above calculation, the number of samples obtained was 17 samples for each study group. Selected research subjects will be examined using 2D ultrasound 24-48 hours after delivery. This examination was carried out by a Urogynecology consultant. Inspection results were then recorded and collected for statistical analysis.

STATISTICAL ANALYSIS

The data that has been collected will be tested for homogeneity using Kolomogorov-Smirnov test and Shapiro-Wilk to determine whether the data is normally distributed or not. Chi-square tests used to compare the means of categorical data if data were normally distributed and Exact Fisher's test if it were not normally distributed. Numerical data was tested by t-test or Mann-Whitney test as appropriate. The significance of the statistical test results is determined based on the value of p <0.05. The data obtained is recorded in a special form and then processed with SPSS version 18.0 for Windows.

ETHICAL APPROVAL

Ethical approval of this study was obtained from Hasan Sadikin General Hospital Bandung, West Java, Indonesia in 2013 No. 306 / UN6.C2.1.2 / KEPK / PN / 2013.

RESULTS

This research was conducted from August to November 2013. During this period, there were 34 research subjects that met the inclusion criteria consisting of 17 subjects for each study group, these were patients who were subjected to forceps extraction and vacuum extraction. The subjects of the study were patients who gave birth at Hasan Sadikin General Hospital, and network hospitals such as Soreang Regional Hospital, Cibabat Regional Hospital, Astana Anyar Regional Hospital, and Majalaya Regional Hospital, during the study period and fulfilled the inclusion criteria. Ultrasound examination was performed on the subject of study at the beginning of postpartum.

Characteristics

Table 1 shows the characteristics of the research subjects which included the age, weight of newborn, and body mass index.

Table 1

Subject Characteristics of the Two Research Groups

Characteristics	Forceps Extraction (n=17	Vacuum Extraction (n= 17)	P value
Age (Years)			
Mean (SD)	23,4 (4,9)	22,1 (3,9)	0,540
Median	22	21	
Range	18-34	18-30	
Weight of Newborn	2881,8 (246,5)	2968,2 (279,3)	0,375
Mean (SD)	2900	3000	
Median	2500-3300	2500-3300	
Range			
Body Mass Index(BMI)	27,2 (1,63)	28,3 (2,08)	0,082
Mean (SD)	26,6	28,5	
Median	24,7-30,8	24,6-32,0	
Range			

Note: *) calculated based on the Mann-Whitney test; except for BMI was tested based on t test. The test was considered significant if p<0,05.

Table 1: As many as 34 study subjects were grouped based

on patient age, weight of newborn, and Body Mass Index (BMI). Comparison of infant age and body weight characteristics between the two study groups used the Mann-Whitney test because the data were not normally distributed for numerical data, whereas the BMI characteristics was tested by t test because the data were normally distributed. In the table above, two characteristics (maternal age and baby weight) did not differ significantly ($p>0,05$). This shows that these variables groups are homogeneous, so the groups can be compared.

The Incidence of Levator Ani Avulsion in Operative Vaginal Delivery

Table 2 presents data comparing the incidence of levator ani avulsion between forceps extraction and vacuum extraction.

Table 2

The Incidence of Levator Ani Avulsion in Forceps Extraction and Vacuum Extraction

Avulsion	Type Of Deliveries		P value
	Forceps Extraction (n=17	Vacuum Extraction (n= 17)	
Avulsion (+)	8	2	p = 0,024
Avulsion (-)	9	15	

Note: Calculated based on Chi-Square test. The test was considered significant if p<0,05.

Table 2 shows the incidence of levator ani avulsion in labour with forceps extraction was more frequent than in vacuum extraction. Chi-square was used to analyse the data ($p<0,05$) or significant results.

The Incidence of Levator Ani Avulsion in Forceps Extraction and Vacuum Extraction at Early Postpartum Period and 42 Days After Delivery

Subjects with positive avulsions in both forceps extraction and vacuum extraction labour was ultrasound re-examination using ultrasound within 42 days postpartum.

Table 3

Incidence of Levator Ani Avulsion in Operative Vaginal Delivery at Early Postpartum Period and 42 Days After Delivery

Levator Ani Avulsion	Type Of Deliveries		Percentage
	Forceps Extraction (n=17	Vacuum Extraction (n= 17)	
Early Postpartum	8	2	100%
42 Days After Deliveries	8	2	100%

Table 3 presents data which comparing the incidence of levator ani avulsion between vacuum extraction and forceps extraction.

Table 3. The incidence of levator ani avulsion at early postpartum period that remained after the puerperium. There were 2 positive avulsions in the vacuum extraction group and 8 positive avulsions in the forceps extraction group.

DISCUSSION

In this study, we recorded maternal age, weight of newborn, and body mass index (BMI) (Table 1). These characteristics were chosen because they act as risk factors for the occurrence of levator ani avulsion, and have the potential to be a confounding variable that can affect the validity of the study.

Baseline age range between the group was not significant different. 18-30 years in the vacuum extraction group and 18-34 years in forceps extraction group. The median value in each group was the same (21), and therefore, bias caused by age can be minimized. The lowest age of each subject was 18 years, while the highest age was 30 years for the vacuum extraction group and 34 years in the forceps extraction group.

Weight of newborn also contributed to the incidence of levator ani muscle avulsion. In a study conducted by Budi (2012), it was found that birth weight higher than 3325 grams are at risk for the occurrence of levator ani avulsion.[12] The mean baby weight in the vacuum extraction group was 2968.2 grams, whereas in the forceps extraction group had a mean weight 2881.8 grams. The group with vacuum extraction had a higher birth weight than the forceps extraction group, but the incidence of levator ani avulsion was higher in the forceps extraction group. The median

value between the two groups was also almost the same, that is 3000 grams in vacuum extraction and 2900 grams in forceps extraction, the range of birth weight was the same in both groups, that is 2500-3000 grams. This also reduces the bias that might occur in this study.

Obesity is estimated to increase the risk of levator ani avulsion[13], however our study found that it was not significant different between groups (p<0,05) (table 1). The mean of body mass index (BMI) for the vacuum extraction group was 28.3 and the forceps extraction group mean was 27.2. Obesity is thought to make it difficult to put obstetrical forceps or vacuum cap so that it can increase the risk of levator ani avulsion, but in this study there was no significant relationship between obesity and the incidence of levator ani avulsion (p>0,05) (table 1).

The Incidence of Levator Ani Avulsion in Vacuum Extraction and Forceps Extraction

Based on the results above (Table 2), the incidence of levator ani avulsion was more common in the group with forceps compared to the vacuum extraction group (p<0,05). This study implies that the forceps extraction poses a greater risk for levator ani avulsion.

Levator ani avulsion is associated with labour due to excessive stretching of the levator ani muscle, laceration of the birth canal, and widespread episiotomy. Basically, all of operative vaginal deliveries increased the risk of defects in the levator ani and laceration of the birth canal[12,14,15]. Forceps extraction uses a spoon-shaped instrument to hold the baby's head, thereby increasing the volume in the birth canal. This is thought to cause excessive stretching of the levator ani muscle which ultimately results in avulsion, whereas vacuum extraction does not have the effect of increasing the volume of the birth canal. Forceps extraction also has a greater risk of birth canal trauma compared to vacuum extraction, the morbidity of forceps extraction is higher when compared to vacuum extraction. Forceps extraction is relatively more difficult than vacuum extraction. There is a risk for misalignment of obstetrical forceps which can harm both mother and baby. The presence of squeezed tissue during the insertion of obstetrical forceps increases the risk of birth canal trauma. All these factors may lead to avulsion of the levator ani.

The Incidence of Levator Ani Avulsion in Forceps Extraction and Vacuum Extraction at Early Postpartum Period and After the Puerperium

Based on the above results (Table 3), there were 2 cases of levator ani muscle avulsion in the labour group with vacuum extraction and 8 cases of levator ani muscle avulsion in the labour group with forceps extraction, with a total of 10 cases. In the re-examination after the puerperium obtained all cases of levator ani avulsion could be diagnosed, so the percentage of avulsion obtained by re-examination is 100%.

After muscle trauma the healing process will go through several phases, that is:

1. Degeneration and inflammation.

2. Muscle regeneration.

3. Fibrosis.[10]

Severity level and type of muscle injury also affect the healing process, increased muscle regeneration and prevention of fibrosis will increase the wound healing process. The healing process of a trauma can last for many years[11]. The possibility of levator ani avulsion may still be found in the postpartum period. A good wound healing process requires a good approximation of the wound.[16] In cases avulsion of the levator ani there is no approximation, the avulsion tissue regenerates by itself. Causing tissue fibrosis.[11] In this study, there were no repairment in levator ani avulsion, so in the examination after the puerperium, levator ani may still be found in all cases. Ultrasound examination after delivery and 42 days postpartum provided an image of avulsion. There were differences in the two ultrasound results. Avulsion at 42 days postpartum was more clearly seen, which may occur due to the loss of factors that can affect the results of ultrasound, such as edematous tissue or blood clots.

RESEARCH LIMITATIONS

This research was conducted by cross sectional method due to limited time and funding. Cohort will provide better data and better results as well. We were also limited by the lose of patients who were lost to follow up.

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