

A Retrospective Cross-Sectional Study on the association between Newborn's Head Circumference at Birth and Obstetric Anal Sphincter Injuries among Primigravidae

Ng Jun Jiet¹, Chan Yan Ling¹, Ahmad Amir Ismail², Aruku Naidu a/l Apana¹, Thuvina a/p Aruku Naidu²

1 Department of Obstetrics and Gynaecology, Hospital Raja Permaisuri Bainun, Ipoh, Perak, Malaysia

2 Department of Obstetrics and Gynaecology, Hospital Universiti Sains Malaysia, Kota Bharu, Kelantan, Malaysia

3 Newcastle University Medicine Malaysia, Kota Ilmu Educity@Iskandar, Iskandar Puteri, Johor, Malaysia

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Corresponding author:

Ng Jun Jiet MD MRCOG,

Department of Obstetrics and
Gynaecology,

Hospital Raja Permaisuri Bainun,

Jalan Raja Ashman Shah,

30450 Ipoh, Perak,

Malaysia.

Email: njjgbb@gmail.com

ABSTRACT

Introduction: Obstetric anal sphincter injuries (OASIS) is a term used to describe third- and fourth- degree perineal trauma during childbirth. There are a lot of risk factors associated with OASIS, however newborn's head circumference (HC) at birth as a risk factor is understudied. The aim of this study was to determine the incidence of OASIS and establish the association between newborn's HC at birth and OASIS among primigravidae who delivered in Hospital Raja Permaisuri Bainun (HRPB) from 2016 to 2018. Other OASIS risk factors were also analysed. **Methods:** This was a retrospective cross-sectional study among primigravidae who delivered in HRPB from 2016 till 2018. Systematic sampling method was used, and the total sample recruited was 538. Women who sustained OASIS were compared to women without OASIS. Simple and multiple logistic regression analysis were used to look for the association between associated risk factors and OASIS. **Results:** The incidence of OASIS in HRPB during the study period was 2.0%. Newborn's HC at birth ($p=0.588$) was not significantly associated with OASIS, whereas birth weight (OR 1.002 95%CI 1.001-1.004 $p=0.06$) and instrumental delivery (OR 8.13 95%CI 1.91-34.59 $p=0.05$) were significant risk factors for OASIS. **Conclusion:** Overall incidence of OASIS in HRPB was 2.0%, which is within the normal range. Newborn's HC was not significantly associated with the occurrence of OASIS. Birth weight and instrumental delivery were significant risk factor for OASIS. This information can be used for patient counselling and shared decision making.

KEYWORDS: anal incontinence, newborn's head circumference, obstetric anal sphincter injury, perineal trauma, risk factor

INTRODUCTION

Perineal trauma may occur spontaneously or iatrogenically from childbirth. More than 85% of women suffer perineal trauma following vaginal delivery, out of which 0.6-7% sustained third- or fourth-degree tear [1]. In order to standardise the nomenclature of perineal trauma, Sultan classification should be used when describing OASIS [2] (Figure 1). Clinicians and midwives need to be aware of the risk factors of OASIS so that measures can be taken to prevent OASIS. There is abundance of literatures on different risk factors for OASIS e.g. birth weight more than 4kg, prolonged second stage of labour, instrumental delivery, Asian ethnicity and occipito-posterior position [3]. However,

newborn's HC at birth is not widely studied as a risk factor for OASIS.

Newborn's head is the first part that passes through the vaginal canal. It stretches and distends the vulva during childbirth which may cause perineal trauma. Large HC is associated with unplanned caesarean section, failed instrumental delivery and neonatal complications [4].

Most of the literatures used sonographic HC rather than the actual HC at birth. As there will be discrepancy between sonographic HC and the actual HC at birth, therefore we decided to measure the actual HC at birth to increase the accuracy of the study. The aim of this study was to determine the incidence of



OASIS, and to establish the association between newborn's HC at birth and OASIS among primigravidae who delivered in Hospital Raja Permaisuri Bainun (HRPB) from 2016 to 2018. Other OASIS risk factors were also analysed. Our hypothesis was that the larger the head circumference, the higher the chance of sustaining OASIS. By establishing the association between newborn's HC and OASIS, we might be able to come up with guideline recommending prophylactic caesarean section or routine episiotomy if the estimated newborn's HC based on the foetal HC

measured by ultrasound is beyond certain cut-off point to reduce the risk of OASIS. Such recommendation is already available using estimated foetal weight. For example, ACOG Practice Bulletin Number 216 on macrosomia had stated "Although the prediction of macrosomia is imprecise, scheduled caesarean birth may be beneficial for newborns with suspected macrosomia who have an estimated foetal weight of at least 5,000 g in women without diabetes and an estimated foetal weight of at least 4,500 g in women with diabetes [5]".

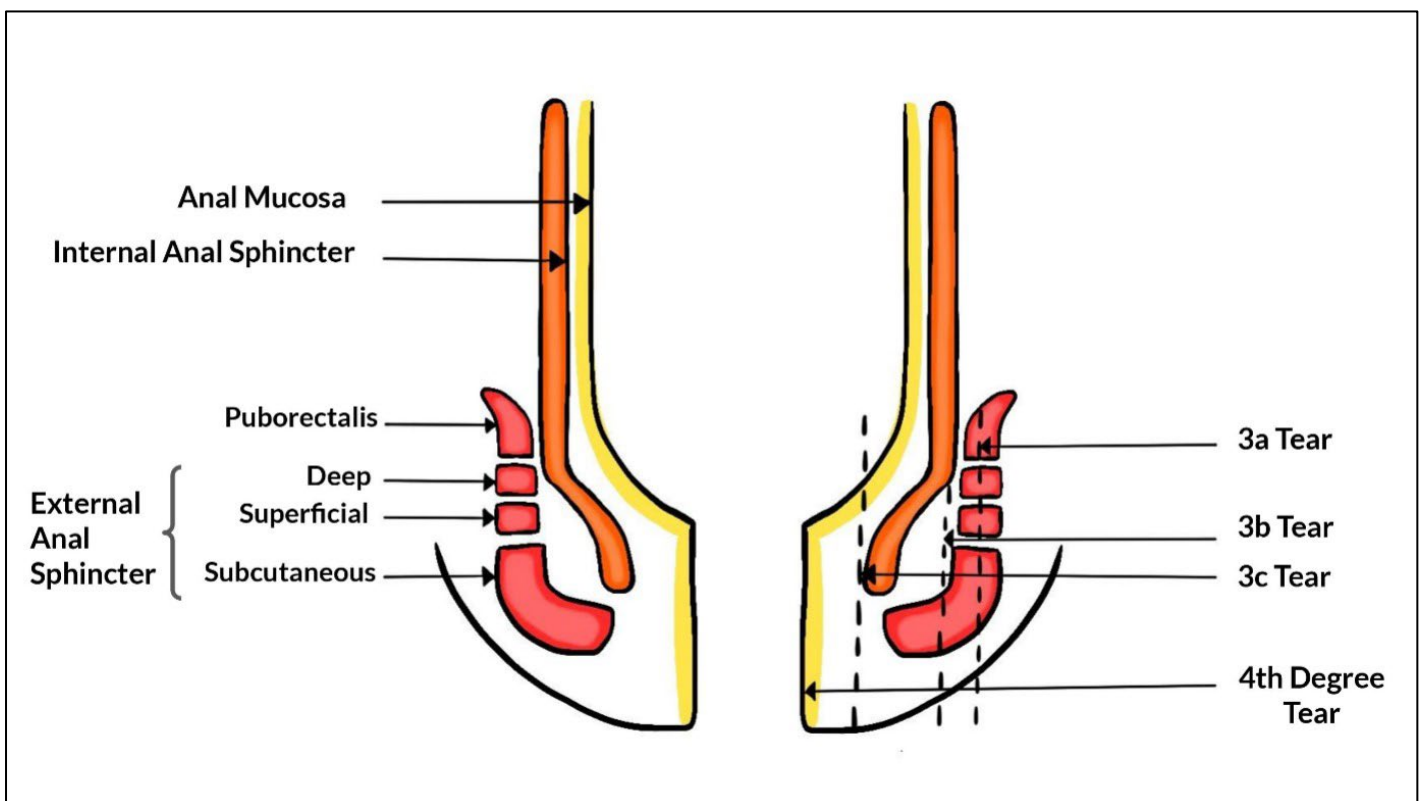


Figure 1 Sultan classification of perineal trauma [2]

First-degree tear	Injury to perineal skin and/or vaginal mucosa
Second-degree tear	Injury to perineum involving perineal muscles but not involving the anal sphincter
Third-degree tear	Injury to the perineum involving the anal sphincter complex
Grade 3a tear	Less than 50% of external anal sphincter (EAS) thickness torn
Grade 3b tear	More than 50% of EAS thickness torn
Grade 3c tear	Both EAS and internal anal sphincter (IAS) torn
Fourth-degree tear	Injury to perineum involving the anal sphincter complex and anorectal mucosa

MATERIALS AND METHODS

This is a retrospective cross-sectional study of the association of newborn HC at birth and OASIS among primigravidae delivered in HRPB from June 2016 till June 2018. The delivery rate per year ranges from 9 000 to 12 000 deliveries annually, with an average of 20 to 30 deliveries per day.

We calculated the sample size using sample size formula based on following assumptions: confidence interval at 95%, marginal error of 1.5%. This was based on the prevalence of OASIS among primigravidae of 3% reported by Smith et al [6]. The two arms of our study were: women who sustained OASIS and women without OASIS. This gives us a sample size of 617 participants. Data were traced and reviewed from labour room registry census and patients' folders from record office. The inclusion criteria for the study were singleton pregnancy with gestation of 37 weeks and above with vertex presentation and delivered vaginally. Foetus with gross structural abnormality and contraindicated for vaginal delivery were excluded. Newborn HC at birth were measured using measuring tape.

SPSS version 24 was used for data entry and analysis. Numerical data were presented as mean and median based on normality of distribution while categorical data were presented as percentage of frequency. Fisher's exact test and the Chi-squared test were used to compare differences between continuous and categorical demographic variables between the groups, respectively. Simple and multiple logistic regression tests were used to quantify the association of

risk factors and OASIS where Odd Ratio (OR) were presented with confident interval of 95%. P value of less than 0.05 was statistically significant.

RESULTS

i) Descriptive Analysis of the Study

The sociodemographic characteristics of primigravidae were analysed. There were 79 missing data (12.8% drop out rate), making the final sample recruited were 538 primigravidae with a mean age of 25.03 years. The majority of patients were Malay (68.2%), followed by Chinese (12.8%), Indian (11.3%) and others (6.9%). A total of 506 patients (94.1%) had second degree of the perineal tear, followed by 17 patients with first degree tear (3.2%) and 4 patients with no perineal tears (0.7%). There were 11 cases of OASIS out of 538 vaginal deliveries during the study period, giving an incidence of OASIS of 2.0%.

ii) OASIS Risk Factors in Univariate Analysis

Table 1 compared different risk factors with the occurrence of OASIS. Instrumental delivery had significant association with OASIS with p value of 0.013 ($p < 0.05$). A total of 3 patients (27.3%) had an instrumental delivery in the OASIS group, and 23 patients (4.4%) had an instrumental delivery in the non-OASIS group. On the contrary, there were no significant association between newborn's head circumference ($p = 0.46$), birth weight ($p = \text{NA}$), episiotomy ($p = 0.386$), maternal BMI ($p = 0.313$), prolonged second stage ($p > 0.95$) and shoulder dystocia ($p = 0.098$) with OASIS.

Table 1 Univariate analysis of risk factors for OASIS in primigravidae

Variables	OASIS		Total n (%)	P- value
	No n (%)	Yes n (%)		
Newborn's Head Circumference				
≤34cm	499(94.7)	10(90.9)	509(94.6)	0.46 ^b
>34cm	28(5.3)	1(9.1)	29(5.4)	
Birthweight				
<4kg	527(100.0)	11(100.0)	538(100.0)	NA
Episiotomy				
Yes	503.(95.8)	10(90.9)	513(95.7)	0.386 ^b
No	22(4.2)	1(9.1)	23(4.3)	



Maternal BMI				
<18.5	42(11.0)	3(37.5)	45(11.6)	0.313 ^b
18.4-24.9	135(35.4)	3(37.5)	138(35.5)	
25-29.9	114(29.9)	1(12.5)	115(29.6)	
30-34.9	76(19.9)	1(12.5)	77(19.8)	
35-39.9	10(2.6)	0(0.0)	10(2.6)	
>40	4(1.0)	0(0.0)	4(1.0)	
Prolonged second stage				
No	507(96.2)	11(100.0)	518(96.3)	>0.95 ^b
Yes	20(3.8)	0(0.0)	20(3.7)	
Shoulder dystocia				
No	523(99.2)	10(90.9)	533(99.1)	0.098 ^b
Yes	4(0.8)	1(9.1)	5(0.9)	
Instrument delivery				
No	504(95.6)	8(72.7)	512(95.2)	0.013 ^b
Yes	23(4.4)	3(27.3)	26(4.8)	

^bFisher-exact test; expected count>20%

iii) OASIS Risk Factors in Adjusted Logistic Regression Analysis

After data exploration and cleaning, simple logistic regression analysis identified three unadjusted significant factors with p-value <0.05 to be included in variable selection. The factors were birth weight (OR 1.002, 95%CI 1.002-1.004, p=0.05), shoulder dystocia (OR 13.08, 95%CI 1.34-127.67, p=0.027) and instrumental delivery (OR 8.22 95%CI 2.04-33.03 p=0.03) (Table 2). Using multiple logistic regression analysis, methods of variable selection were proceeded. Forward selection automatically entered the important variables into the model, while backward elimination automatically removed unimportant variables from the model. In this study, two variables were significant with p<0.05, which were birth weight (OR 1.002 95%CI 1.001-1.004 p=0.06) and instrument delivery (OR 8.13 95%CI 1.91-34.59 p=0.05) (Table 3).

Women who underwent instrumental delivery are 8 times more likely to sustain OASIS compared to spontaneous vaginal delivery. A birthweight less than 4 kg had a lower odd of OASIS.

iv) Goodness of Fit Tests

We assessed the goodness of fit by: The Hosmer-Lemeshow test, Classification table, receiver operating characteristic (ROC) curve. Based on Hosmer-Lemeshow test, the p-value was 0.212, indicating no significant difference between the observed probability and predicted probability. In this context, the overall correctly classified percentage was 98.0%. The area under the ROC curve was 0.76 (95% CI: 0.58, 0.94). The model can accurately discriminate 76.0% of the cases. Assumptions were met, and the final model is achieved.

Table 2 Risk factors for OASIS in primigravidae (Simple logistic regression)

Variable	β	Crude Odds Ratio (95%CI)	Wald statistics	P- value
Newborn's Head Circumference				
≤34cm	0	1		
>34cm	0.580	1.78(0.22,14.42)	0.29	0.588
Birth weight	0.002	1.002(1.001,1.004)	7.91	0.005*
Episiotomy				
No	0	1	0.60	0.440
Yes	0.83	2.29(0.28,18.66)		



Maternal BMI				
<18.5	0	1		
18.4-24.9	-1.17	0.31(0.06,1.60)	1.95	0.162
25-29.9	-2.10	0.12(0.01,1.21)	3.22	0.073
30-34.9	-1.70	0.18(0.02,1.83)	2.09	0.148
35-39.9	-18.56	0.00(0.00,0.00)	0.00	<0.95
>40	-18.56	0.00(0.00,0.00)	0.00	>0.95
Prolonged Second Stage				
No	0	1	0.00	>0.95
Yes	-17.37	0.00(0.00,0.00)		
Shoulder dystocia				
No	0	1	4.89	0.027*
Yes	2.57	13.08(1.34,127.67)		
Instrumental delivery				
No	0	1	8.81	0.003*
Yes	2.11	8.22(2.04,33.03)		

Table 3 Risk factors for OASIS in primigravidae (Multiple logistic regression)

Variable	β	Crude Odds Ratio (95%CI)	Wald statistics	P- value
Birth weight	0.002	1.002(1.001,1.004)	7.43	0.006*
Instrumental delivery				
No	0	1	8.04	0.005*
Yes	2.10	8.13 (1.91,34.59)		

DISCUSSION

OASIS is the commonest cause of anal incontinence in women of reproductive age [7]. It may affect women's physical, psychological, social, and sexual well-being if it is not diagnosed and managed appropriately. Short term complications of OASIS are perineal pain, wound breakdown, abscess formation and urinary retention. Anal incontinence, rectovaginal fistulae, dyspareunia, altered sexual function and defecation problems are examples of long-term complications [8]. Therefore, it is important to identify risk factors for OASIS in order to reduce the incidence of OASIS and to prevent OASIS recurrence.[9]

We analysed the relationship between variables and occurrence of OASIS using simple and multiple logistic regression analysis. We found that instrumental delivery, birthweight, and shoulder dystocia rather than newborn's HC increased the incidence of OASIS. Shoulder dystocia was found not significant in multiple logistic regression analysis due to the low incidence of shoulder dystocia among primigravidae in HRPB.

Our hypothesis on newborn's HC and OASIS was not proven correct might be due to maternal and foetal factors. Women undergo physiological changes during pregnancy and childbirth. The rise in oestrogen, progesterone and relaxin lead to laxity of the sacroiliac joint and pubic symphysis, opening up of the pelvis, increased elasticity and stretchability of the vulvovagina and perineum [10]. Fontanelles and sutures of foetal head enable foetal head moulding to accommodate the geometry of the birth canal [11]. Thus, sonographic HC and measuring of the HC at birth might not reflect the true HC. All these factors might contribute to our study findings which was there were no significant association between HC and OASIS. This finding is in accordance with the study conducted by Meyer R et al. using sonographic foetal HC [12].

In our study, the prevalence of OASIS was 2.0%, which was within the range of 0-8% quoted by Royal College of Obstetricians and Gynaecologists (RCOG) [2]. Instrumental delivery is a significant risk factor for OASIS in HPRB with an odd ratio of 8.13.



This means that women who underwent instrumental delivery are 8 times more likely to sustain OASIS compared to spontaneous vaginal delivery. Indication, types, operator, and techniques of instrumental delivery should be looked into and audited. Operators need to be equipped with knowledge, skills, and experience before is allowed to perform instrumental delivery independently. Selective mediolateral episiotomy and manual perineal protection are protective of OASIS during instrumental delivery and should be encouraged. Vacuum-assisted delivery should be preferred whenever possible as forceps carries a higher risk of OASIS [2].

HRPB as one of the tertiary hospitals with Urogynaecology services, is constantly monitoring the incidence of OASIS and upholding “OASIS Care Bundle” which is a collaborative effort to standardise maternal care related to OASIS prevention led by the RCOG and Royal College of Midwives (RCM). “OASIS Care Bundle” consists of four components: antenatal information, manual perineal protection for all vaginal births, episiotomy with a 60° mediolateral angle at crowning when clinically indicated and systemic perineal examination, including per rectum after vaginal birth for all women [13].

CONCLUSION

Prevention and management of OASIS is an important part of maternity services in Malaysia. Newborn's head circumference at birth was not significantly associated with OASIS. Hence, the estimated foetal head circumference measured by ultrasound should not be utilised as a tool for OASIS risk stratification. Two significant OASIS risk factors from this study were birth weight and instrumental delivery. This information can be used as a reminder for clinicians, for patient counselling and shared decision making. A deeper understanding of OASIS risk factors and awareness of them is one of the measures to prevent OASIS. Instrumental delivery should only be performed by trained experienced operator with strong indication, weighing the risk of OASIS. Implementation of “OASIS Care Bundle”, continuous audit and training programmes are among the interventions that can be

taken to ensure optimal care in prevention, identification and management of OASIS.

Conflict of interest

Authors declare none.

Ethical Considerations

This study has been approved by the Medical and Research Ethics Committee (MREC) NMRR-18-3776-45519(IIR) as well as from the Research Ethics Committee of the Universiti Sains Malaysia USM/JEPeM/19010004.

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None.

Authors' Contribution

All authors conducted the audit, wrote, edited, and approved the final version of the article.

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