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ORIGINAL ARTICLE

Prospective comparison of obstetric anal sphincter injury incidence between an Asian and Western hospital

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Abstract

Introduction and hypothesis Obstetric anal sphincter injury (OASIS) rates are reported to be higher in Asian women living in Western countries than in those living in Asia, but the reasons for the differences remain unclear. The objectives of this study were for a single examiner to prospectively compare OASIS rates in primiparous Asian women in an Asian and Western birth unit and determine potential birth factors that may influence the possible difference in OASIS incidence.

Methods This was a prospective observational study based in Hong Kong, China, and Sydney, Australia, involving primiparous women > 36 weeks gestation of Asian descent undergoing vaginal delivery. A single examiner recorded basic patient demographics, observed all the deliveries at both sites, noting birthing techniques, and then examined the women, including a rectal examination, to determine OASIS incidence.

Results Seventy births in Hong Kong and 66 in Sydney were studied. The incidence of OASIS was 34% in Sydney and 10% in Hong Kong ($p = 0.001$). Birthweight, epidural rate, body mass index, and instrumental delivery were higher in Sydney. Episiotomy rates were higher in Hong Kong (59.2% vs. 82.9%; $p = 0.007$). When comparing OASIS with no-OASIS, perineal length (OR = 0.36, 95% CI 0.17 to 0.76, $p = 0.004$) and birthweight (OR = 1.14, 95% CI 1.00 to 1.30, $p = 0.039$) were independent risk factors for OASIS.

Conclusions The incidence of OASIS in Asian women is significantly higher in a Western than in an Asian setting. In Asian women, perineal length and birthweight can affect the risk of OASIS at the time of vaginal delivery.

Keywords Birthweight · Episiotomy · OASIS · Perineal length · Primiparous

Abbreviations

BMI	Body mass index
EDB	Epidural block
GDM	Gestational diabetes mellitus
MLE	Mediolateral episiotomy
OASIS	Obstetric anal sphincter injuries

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Introduction

The incidence of obstetric anal sphincter injury (OASIS) in Australia is higher than the reported average compared with other similar countries [1]. The reported incidence in the literature is up to 25% of primiparous women [2–4], but misdiagnosis at the time of delivery may render untreated women at risk of faecal incontinence [5–7]. Studies based in Western countries suggest that Asian women are at greater risk than most other races [3, 8–10]. In a recent study of Vietnamese women in Australia, the rate of OASIS in primiparae was up to 9% [3]. However in two studies available from Hong Kong, the incidence of OASIS was lower, with reported rates in Hong Kong of 0.3–0.9% [4, 11]. Whether a rectal examination was performed to aid diagnosis in these studies was not

reported; therefore, we cannot ascertain if this regional variation is due to underdetection in Hong Kong or increased susceptibility in Asian women living in Western countries. If OASIS rates for Asian women in Australia are higher than in Asia, aetiological factors associated with this difference need to be established.

Previously published risks factors for OASIS include nulliparity, instrumental delivery (especially forceps), increased birthweight, occipito-posterior position of the baby at delivery, midline or narrow mediolateral episiotomy (MLE) angle, short perineum, increased duration of second stage, and ethnicity [4, 8, 12–16]. Addressing these issues may help reduce the rate of OASIS at a vaginal delivery. A hands-on approach (guarding of the perineum, controlling the head, appropriate use of MLE, and slowing the delivery) reduces rates of OASIS [14, 17–19]. Variations in practice may influence differences in OASIS rates. Genetic variation may also be a factor as Cheung et al. showed that pregnant women of East Asian descent have a smaller genital hiatus and thicker pubovisceral muscles [20] compared with Caucasian women, which may also account for the higher rates of OASIS.

Andrews et al. showed that a single experienced examiner performing a rectal examination increased the detection rate of OASIS and found a 25% incidence in primiparous women [2]. Ultrasound at the time of birth did not dramatically increase the level of detection. While recommended [21], a rectal examination is not always performed. The primary objective of this study was to obtain an accurate comparison of OASIS rates in Asian primiparous women in an Asian and a Western location by employing the same experienced examiner at both sites to assess women immediately postpartum via a rectal examination. A hospital in Hong Kong, China, was chosen as the Asian site and one in Sydney, Australia, as the Western location. A secondary aim was to study birth factors that may influence rates of OASIS at both units.

Methods

Ethics approval was obtained at each hospital through the district ethics committees [Australia: Human Research Ethics Committee 15/212 (LNR/15/POWH/382) granted 17/11/15; Joint Chinese University of Hong Kong-New Territories East Cluster Clinical Research Committee CREC record number 2015.660, granted 19/1/16)].

The Sydney hospital was a tertiary teaching hospital. In 2015, 11% of 2552 deliveries were Asian primiparous women. The Hong Kong hospital was a university teaching hospital, with approximately 6500 deliveries per year. Caesarean delivery rates at each hospital were approximately 26% and 21%, respectively. Recruitment was as for the Australian hospital using the same examiner who travelled to Hong Kong. The study was conducted in Sydney from December 2015–October 2016 and in Hong Kong over 2 weeks in June 2016, based on sample size requirements (discussed below). Owing to the small percentage of Asian women birthing in Sydney, it was necessary to conduct a longer recruitment period. As the primary researcher was an Urogynaecology fellow not employed as an accoucheur, preliminary recruitment efforts were by labour ward staff, with numerous other duties. Therefore, it was anticipated not all eligible women would be recruited; hence, background data of all Asian primiparous deliveries were collected from the birth register at each hospital to ensure that those recruited did not differ from the background population.

Consecutive primiparous women of East and Southeast Asian descent (China, Hong Kong, Indonesia, Japan, Taiwan, Vietnam, Korea, Chinese Malaysian, Philippines), > 36 weeks gestation, were invited to participate in the first stage of labour by the midwives involved in their care. Informed written consent was then obtained. Where English was not spoken, Chinese-speaking midwives at each location translated. In both centres, the single examiner (author LB) was called to attend the delivery once full dilatation of an enrolled woman had been reached.

Demographic data [age, height, booking body mass index (BMI), place of birth, gestational age, gestational diabetes mellitus (GDM), when available the partner's ethnicity, and height] were obtained from the women's hospital records. Gestational age was based on the last menstrual period and/or an early first trimester ultrasound.

Birth variables recorded included infant birthweight, baby position in labour and birth, maternal position at delivery, duration of first and second stages, duration of active pushing, use of warm perineal compresses, MLE, rates of ventouse or forceps, and use of epidural block (EDB) at the time of delivery. Preliminary discussions with our Asian co-investigators suggested that there would be substantial variation in delivery techniques between sites that could affect the study outcomes. Therefore, all such variations were prospectively recorded as shown in Table 1 (for example indications for induction of labour and rationale for episiotomy use). Perineal length was measured from the posterior fourchette to the mid-anal canal [22] using a disposable ruler in the first stage of labour or very early in the second stage of labour prior to the foetal head distending the perineum. If an episiotomy was cut, the angle and length were best approximated at crowning using a disposable protractor, standing behind the accoucheur.

At both sites after the accoucheur examined the woman for obstetric trauma, the single examiner repeated the examination, including a rectal examination. The Sultan classification was used to classify the degree of perineal trauma [23]. Ultrasound was not used.

Table 1 Comparison of policy and prospectively observed practice between the two sites

	Sydney	Hong Kong
Weight gain in pregnancy	Not routinely measured	Routinely measured on electronic scales at each visit
Elective caesarean section	Occurred at 39+ weeks. Indications for elective caesarean section were 7 for breech, 2 for placenta previa, 2 for suspected macrosomia, 1 for maternal requests, 1 for medical reason	Occurred at 38+ weeks. Indications for elective caesarean section were 4 for breech, 4 for placenta previa, 3 for twins, 1 large fibroids, 1 for macrosomia, 1 for medical reason
Indication for induction of labour	Spontaneous ruptured membranes with meconium liquor (7 cases) or group B Streptococcus were induced at the earliest possible time, if GBS negative (13 women), women were sent home to await events and induced at 24–48 h post rupture of membranes. Four were induced for postdates, 3 for small for gestational age or suspected intrauterine growth restriction, 9 for GDM; 2 cases each for decreased foetal movements, cholestasis of pregnancy, preeclampsia, macrosomia	Women with ruptured membranes were induced at the next appropriate time, 23 induced for ruptured membranes, 7 further had induction for meconium-stained liquor, for GBS-positive and ruptured membranes, 10 induced for postdates, 6 induced for an abnormal foetal heart rate, 5 for oligohydramnious diagnosed as an amniotic fluid index < 7 at term, 3 for gestational hypertension or pre-eclampsia
Postdates defined as	10 days past due date	7 days past due date
Episiotomy	There was no protocol for the use of episiotomy. Restrictive episiotomy use—encouraged for all instrumental deliveries. All episiotomies were mediolateral, mostly on the right, aimed at 60 degrees with at least 3 cm, cut mostly for foetal distress, then for non-stretcing of the perineum. Reluctance of midwifery staff to cut episiotomies due to lack of training or implications of cutting one	More liberal use of episiotomy, 4 indications: Poor maternal effort, short/tight perineum, foetal compromise, or "others", which included all instrumental deliveries. All were mediolateral, mostly to the left, aimed at 60 degrees and a length of at least 3 cm. All midwives trained as students to cut episiotomy. No midline episiotomies
Gestational diabetes mellitus (GDM)	Routine testing of all women at 24–26 weeks, or at 16 weeks if they have risk factors. Based on the WHO 2013 criteria, included 0, 1, 2 h blood glucose levels. Treatment initially diet and exercise, low threshold to start oral glycaemic agents, then insulin. If well controlled with diet, allowed to labour spontaneously or induced at 41 + 3, if on insulin induced at 38–39 weeks depending on glycaemic control	Women tested only if they have risk factors for GDM. Test only 0, 2 h blood glucose levels. If not well controlled with diet, then progressed to insulin
Operative vaginal delivery	There are no guidelines as to the instrument of choice and is dependent on the doctor's preference. As this is a teaching hospital, there was a tendency to using forceps, especially with an epidural. Rotational forceps were almost obselete. Manual rotation was not routinely attempted	Instrument of choice was the Bird's cup ventouse. The use of forceps was only for strict teaching purposes, when at station ≥ + 1 in the direct occipito-anterior position.Manual rotation was often attempted
Epidural	Women driven, available 24 h, an hour for passive descent and time for epidural to wear off was allowed if no foetal distress	Women driven, but not actively encouraged, available 24 h. An hour for passive descent and time for epidural to wear off was allowed if no foetal distress
Delivery technique	Woman driven with multiple positions tried while pushing. Techniques varied considerably depending on experience of midwife, reluctance for episiotomy, (mostly due to lack of experience)	All women delivered in a lithotomy position, with feet on footplates or in stirrups. Midwives and doctors all used the same techniques, even with an instrumental delivery
"Hands on"	This varied from gently applying a warm compress (34.8%) to firm pressure (15.1%) or a distinct squeezing together of the perineum 30.3%). This depended on the level of experience of the midwife. The more recent graduates were less likely to adopt a pinching technique. Department policy is to use warm compresses applied to the perineum in second stage in all vaginal deliveries where there is not an epidural in situ	Either firm pressure or pressure with squeezing of the perineum, also known as the modified Ritgen manoeuvre, was used by all midwives and doctors. Warm compreses were not used
Slowing of head, telling women to stop pushing	All women told push slowly. Hands were not always on the foetal head	All women told to stop pushing, and hands were always on the foetal head with flexion of the head

Statistical analysis

The study was designed to have a sample size of 63 women at each site to ensure at least 80% power to detect a difference of 20% in the proportion with OASIS, assuming a rate of 30% in Australia and 10% in Hong Kong using a 5% significance level. Based on the number of deliveries in each hospital, recruitment took place over 2 weeks in Hong Kong and 10 months in Sydney.

The demographic data and birth variables of enrolled women were compared with routinely collected data for all eligible women to assess representativeness of the samples. The two sites were compared using means, standard deviations for continuous variables (as data were normally distributed), and independent samples t-tests; percent for categorical variables and significance were assessed using the chi-squared test.

Primary statistical analysis of the difference in the proportion of women with OASIS between Hong Kong and Sydney was conducted. The total number of women with OASIS was then compared with those without OASIS for the multivariable analysis. Logistic regression models were used to model the association of factors, decided a priori, with the outcome (OASIS), between the two sites. The factors were: birthweight, instrumental delivery, perineal length, study site (Sydney/Hong Kong), episiotomy (yes/no), length of episiotomy, hands on (yes/no), duration of second stage, duration of active pushing, GDM, BMI, and epidural use (no/yes). Odds ratios and 95% confidence intervals were estimated from the model and a likelihood ratio p value used to assess statistical significance. Univariable models were estimated first and then a multivariable model was developed using stepwise backwards elimination. Confounding on study site was assessed at each step. Fractional polynomials were used to assess linearity. The final model was used to estimate the probability of OASIS by perineal length, site, and birthweight and plotted by perineal length.

Missing observations were excluded for the purposes of the logistic regression model. Sensitivity analysis was undertaken by fitting the model to spontaneous deliveries.

Analyses were conducted in SPSS (versions 23 and 24) and Stata SE 14.2 [24].

Results

During the recruitment period, there were 160 primiparous Asian births in Sydney, of which 14 were excluded because of elective caesarean delivery and 17 because of emergency caesarean delivery prior to full dilatation. Eleven women were excluded because of caesarean at full dilatation; three had a failed ventouse delivery, and six had unsuccessful forceps attempts. As expected, 53 women either were not recruited or did not consent, leaving a total of 66 observed vaginal deliveries for analysis.

In Hong Kong, there were 128 primiparous Asian births during the recruitment period, of which 13 were elective caesarean sections, and 14 women had an emergency caesarean delivery prior to full dilatation. There were no caesarean sections at full dilatation. Of the vaginal deliveries, 31 women either were not observed or did not consent, leaving 70 observed vaginal deliveries for analysis.

Table 1 outlines the observed differences in practice and policy, especially the "hands-on" perineum technique, induction of labour indications, and epidural rates between the two sites. A 'hands-on' technique was used in 80% of cases in Sydney, but 100% of deliveries in Hong Kong ($p = < 0.001$). There was wide variation in the delivery techniques observed in Sydney: 30% of accoucheurs used firm pressure and squeezing of the perineum, 15% applying firm pressure only, and 34.8% applied warm compresses (not used in Hong Kong). In Hong Kong, all accoucheurs uniformly used firm pressure on the head and perineum, +/− fingers laterally squeezing towards the midline.

Table 2 compares the demographic data collected for all observed vaginal delivery patients at both sites in relation to the routine data for all non-observed vaginal deliveries and then the total overall deliveries. At each level, the baseline demographics of the populations were largely similar. All women at both sites, except one woman from Hong Kong, were born in Asia. At both sites, more observed women underwent induction of labour (having more time to consider the study) compared with the non-observed groups. Induction rates in Sydney were almost half those of Hong Kong, but with no difference in gestational age (Table 2); 2.6 times more women had an instrumental delivery in Sydney ($p < 0.001$). The rate of ventouse deliveries was not significantly different between sites but forceps delivery was significantly higher in Sydney (26% vs. 4%; $p = 0.001$). One hunderd per cent of women at both sites suffered some degree of perineal trauma.

The overall incidence of OASIS in observed vaginal deliveries was 34.8% in Sydney and 10% in Hong Kong ($p = 0.001$) (Table 3). For spontaneous deliveries, the rate of OASIS in Sydney was three times greater than in Hong Kong (26% vs. 9%, Table 3). There was a three-fold higher prevalence of 3a tears in Sydney. No 3c tears occurred in Hong Kong (Table 3). There were no fourth degree tears at either location.

The duration of second stage and active pushing was two-fold higher in Sydney (Table 2). One relevant factor may be that the EDB rate was 50% in Sydney vs. 7% in Hong Kong. Nevertheless, mean duration of active pushing in Sydney appeared to be unaffected by the high EDB rate (71.5 min with an epidural; 61.9 min without an epidural, 95% CI -7.2 to 26.4: $p = 0.2$).

The overall episiotomy rate (all MLE) was substantially lower in Sydney (59%) compared with Hong Kong (83%, Table 2). For spontaneous births, episiotomy was three-fold higher in Hong Kong (Table 2). The majority of instrumental deliveries included an episiotomy. The angle of episiotomy in Sydney was closer to 60° (57.4 vs. 51.71, $p < 0.001$). There was no association of OASIS with the length or angle of the episiotomy (Table 3), but the number of cases was small.

Table 2 Baseline characteristics and results comparing the two sites and the observed and non-observed samples

	Sydney study sample observed deliveries $N = 66$ (SD or %)	Sydney routinely collected vaginal deliveries $N = 52$, (SD or %)	Sydney overall births including caesarean delivery $N = 160$ (SD or %)	Hong Kong study sample observed deliveries $N = 70$ (SD or %)	Hong Kong routinely collected vaginal deliveries $N = 31$ (SD or %)	Hong Kong overall births including caesarean deliveries $N = 128$ (SD or %)	P value comparing Sydney sample to Hong Kong sample
Age (years)	29.8 (4.2)	31.33 (4.4)	30.6 (4.4)	30.8 (4.3)	31.43 (4.0)	31.1 (4.2)	0.140
Region of birth-Asia	66/66 (100%)			69/70 (98.6%)			0.330
BMI at booking (kg/m2)	21.3 (3.0)	21.4 (3.5)	21.3 (3.3)	20.3 (2.7)	22.2 (3.6)	21.2 (3.2)	0.047
Gestation (days)	276.8 (7.6)	279.6 (27.9)	278 (21)	274.0 (8.6)	274.4 (7.8)	274 (8.2)	0.430
Perineal length (cm)	3.56 (0.77)			3.35 (0.66)			0.107
Birthweight (g)	3323 (403)	3187 (455)	3246 (437)	3113 (362)	3046 (418)	3083 (387)	0.003
Induction of labour	17/66 (25.8%)	10/52 (19.2%)	37/160 (23.1%)	29/70 (41.4%)	8/31 (25.8%)	45/128 (35.2%)	0.050
Epidural rate	33/66 (50%)	21/52 (40.4%)	76/160 (47.5%)	5/70 (7.1%)	0%	6/101 (5.94%)	< 0.001
Duration of first stage (hours)	6.67 (3.8)	5.35 (3.15)		6.93 (3.76)	8.56 (4.84)		0.408
Duration of second stage (min)	89.8 (50.2)	59.3 (42.8)		42.8 (36.1)	27.58 (28.2)		< 0.001
Time of active pushing (min)	68.52 (35.17)	n/a		37.4 (28.3)	n/a		< 0.001
Non-occipitoanterior presentation	9/66 (13.6%)			5/70 (7.1%)			0.183
Hands-on technique	53/66 (80.3%)			70/70 (100%)			< 0.001
Semirecumbent/ lithotomy rate	62/66 (94.0%)			70/70 (100%)			0.025
Spontaneous vaginal delivery	35/66 (53.0%)	36/52 (69.2%)	71/160 (44.4%)	57/70 (81.4%)	23/31 (74.2%)	80/128 (62.5%)	0.001
Epsiotomy at spontaneous delivery	14/35 (40%)	9/36 (25.0%)	23/71 (35.5%)	45/57 (78.9%)	22/23 (95.7%)	67/80 (82.7%)	< 0.001
Ventouse delivery	14/66 (21.2%)	9/52 (17.3%)	23/160 (14.3%)	10/70 (14.3%)	8/31 (25.8%)	18/101 (17.8%)	0.502
Episitomy rate at vaccum	10/14 (71.3%)			10/10 (100%)			0.114
Forceps delivery	17/66 (25.8%)	7/52 (13.5%)	24/160 (15%)	3/70 (4.2%)	0	3/101 (2.98%)	0.001
Episiotomy rate at forceps	17/17 (100%)	7/7 (100%)	24/24 (100%)	3/3 (100%)	0	3/3100%	1.00
Episiotomy-overall rate	41/66 (59.2%)	25/52 (48.1%)	67/118 (56.8%)	58/70 (82.9%)	30/31 (96.8%)	88/101 (87.1%)	0.007
Overall instrumental delivery rate*	31/66 (47%)	16/52 (30.8%)	47/118 (39.8%)	13/70 (18.6%)	8/31 (25.8%)	21/101 (20.8%)	< 0.001
Angle of episitomy at crowning (degrees)	57.64 (9.3)			51.71 (6.53)			< 0.001
Angle of episiotomy after suturing (degrees)	35.44 (11.7)			27.74 (8.56)			< 0.001
Overall LSCS rate			42/160 (26.3%)			28/128 (21.9%)	0.333
Elective LSCS			14/160 (8.75%)			14/128 (10.9%)	0.312
Emergency LSCS			28/160 (17.5%)			14/128 (10.9%)	0.312
LSCS at full dilatation			11/160 (6.8%)			0/128	0.058

n/a = not available as not recorded in birth register; *per vaginal deliveries

Table 3 Rates of OASIS detected

	Sydney study sample observed deliveries N = 66 (%)	Hong Kong study sample observed deliveries N = 70 (%)	P value comparing Sydney sample to Hong Kong sample
OASIS in all deliveries	23/66 (34.8%)	7/70 (10%)	0.001
Episiotomy + OASIS	14/41 (34.1%)	6/58 (10.3%)	0.004
OASIS in spontaneous deliveries	9/35 (25.7%)	5/57 (8.8%)	0.038
3a	5/35 (14.3%)	3/57 (5.2%)	
3b	2/35 (5.7%)	2/57 (3.5%)	
3c	2/35 (5.7%)	0/57 (0%)	
OASIS in forceps delivery	8/17 (47.1%)	0/3 (0%)	0.242
3a	4/17 (23.5%)	0/3 (0%)	
3b	3/17 (17.6%)	0/3 (0%)	
3c	1/17 (5.9%)	0/3 (0%)	
Ventouse delivery	6/14 (42.9%)	2/10 (20%)	0.388
3a	4/14 (28.6%)	2/10 (20%)	
3b	2/14 (14.3%)	0/10 (0%)	
3c	0/14	0/10 (0%)	
OASIS in all instrumental deliveries	14/31 (45.9%)	2/13 (15.4%)	0.089

Infant birthweight was significantly higher in Sydney (Table 2). The proportion of women with an infant birthweight of > 3.5 kg was 21/66 (31.8%) in Sydney and 12/70 (17.1%) in Hong Kong. No baby in Hong Kong was > 4 kg compared with 2/66 (3%) in Sydney. While the incidence of GDM was higher in Sydney [16.9% (12/66)] compared with Hong Kong [5.7% (4/70) ($p = 0.032$)], there was no difference in birthweight between women with or without GDM.

Characteristics of those with OASIS, those without OASIS, and the logistic regression model results are shown in Table 4. The multivariable model for all deliveries showed that birthweight and perineal length were significantly associated with OASIS (Table 4). The mean birthweight of women who sustained OASIS in both samples was on average 200 g higher than those who had no OASIS (Table 4). Those with OASIS had a shorter perineum length (Table 4). Regarding location, there was a significant difference in the unadjusted rate between Sydney and Hong Kong [OR = 4.98 (95 CI% 1.86 to 13.35)]; this was no longer significant ($p = 0.056$) in the multivariable model [OR = 3.19 (95% CI 0.93 to 10.97)]. Instrumental delivery rates in those with OASIS were twice as high ($p = 0.011$), but again not significant in the multivariable model ($p = 0.192$). These differences were in part explained by inclusion of birthweight, delivery type, perineal length, episiotomy, and duration of second stage. As per Table 1, the large variation of hands-on techniques made comparison difficult. Using a binary "yes" hands on or "no" not on, there was no significant difference [OR = 0.98 (95% CI 0.22, 4.48) $p = 0.98$] in OASIS rates.

When restricted to spontaneous deliveries only, perineal length alone remained significantly associated with OASIS ($p = 0.004$). Most effect sizes remained similar but there was less power with this smaller group.

Using the multivariable model for all deliveries, the estimated proportion with OASIS was plotted by perineal length for varying birthweights with all other variables in the model held constant (see Fig. 1). The association shows that the shorter the perineum is, the higher the risk of OASIS. For a 3500 g baby born in Sydney with a spontaneous delivery, no episiotomy, duration of second stage set to 65 min, and a perineal length of 2.5 cm, there is an estimated 60% probability of having an OASIS compared with 30% in Hong Kong for the same characteristics.

Discussion

In Sydney, we noted a higher rate of OASIS in Asian women compared with other ethnicities, leading us to question if this was the same in Asia. To our knowledge, this is the first study to eliminate observer bias between two locations by using a single independent examiner to ensure meticulous prospective assessment and collection of specialised data, such as the duration of active pushing, length of the perineum, or episiotomy angles. This study uniquely proves that the increased risk only applies to Asian women in a Western setting and that Asian women in an Asian setting have a lower risk.

The incidence of OASIS in Asian women, 34% in Sydney and 10% in Hong Kong, was much higher at both locations than have been previously published [3, 4]. At first glance, a 34% rate is alarmingly high. However, in the only other study where a single examiner assessed all patients, a higher rate (25%) was seen in a population of mixed ethnicities [2]. As our study was only in primiparous Asian women, a slightly higher rate was plausible. Laine et al. showed initial OASIS rates of 6.1% overall in primiparous Scandinavian women and up to 19.2% with a foetal weight > 4.5 kg [17]. Based on Andrews' paper that showed midwives and junior doctors do not detect OASIS in 87% and 24% [2] of women, respectively, we can extrapolate that the 6.1% incidence of OASIS in the Laine paper could actually be between 16 and 20%. As this study investigated only Asian women, the rates in Sydney may have been higher because of factors associated with the Western location, as the anatomical variances found in Asian women [20] should have been the same for each group.

Table 4 Logistic regression models showing factors associated with OASIS in all deliveries and then spontaneous deliveries only

	OASIS ($n = 30$)	No OASIS ($n = 106$)	All (excluding ceasarean deliveries) ($N = 127$)				Spontaneous only ($N = 85$)			
			Univariable results		Multivariable results		Univariable results		Multivariable results	
			OR (95% CI)	LR p value*	OR (95% CI)	LR p value*	OR (95% CI)	LR p value*	OR (95% CI)	LR p value*
Babyweight (g) (OR is per 100 g)	3385 (363)	3160 (392)	1.19 (1.06, 1.34)	0.003	1.14 (1.00, 1.30)	0.039	1.15 (0.98, 1.35)	0.088	1.12 (0.94, 1.34)	0.199
Instrumental delivery	16/30 (53.3%)	28/106 (26.4%)	3.08 (1.30, 7.30)	0.011	2.25 (0.66, 7.67)	0.192	N/A			
Perineal length prior to pushing (OR is per 1 cm)	3.22 (0.8)	3.53 (0.7)	0.55 (0.30, 1.01)	0.049	0.36 (0.17, 0.76)	0.004	0.28 (0.11, 0.74)	0.006	0.23 (0.08, 0.68)	0.004
Location = Sydney, Australia	23/30 (76.7%)	43/106 (40.6%)	4.98 (1.86, 13.35)	0.001	3.19 (0.93, 10.97)	0.056	3.01 (0.89, 10.17)	0.072	3.77 (0.69, 20.73)	0.109
Duration of second stage (OR is per minute)	89.7 (54.1)	57.8 (44.0)	1.01 (1.00, 1.02)	0.003	1.01 (0.99, 1.02)	0.365	1.00 (0.99, 1.02)	0.190	1.00 (0.97, 1.02)	0.774
Episiotomy = yes	20/30 (66.7%)	79/106 (74.5%)	0.71 (0.29, 1.78)	0.473	0.52 (0.15, 1.83)	0.307	0.40 (0.12, 1.33)	0.136	0.59 (0.12, 2.93)	0.521
Angle at crowning (°)	53.61	54.09	0.92 (0.83, 1.03)	0.13						
Length at crowning (mm)	43.6	40.6	0.98 (0.92, 1.03)	0.43						
Duration of active pushing (OR is per minute)	66.82 (40.4)	49.3 (32.0)	1.01 (1.00, 1.03)	0.020			1.00 (0.98, 1.02)	0.940		
Hands on (yes vs. no)	24/30 (80%)	99/106 (93.4%)	0.98 (0.22, 4.48)	0.980						
GDM (yes vs. no)	25/30 (83.3%)	22/105 (21%)	1.21 (0.36, 4.09)	0.764			0.77 (0.09, 6.87)	0.813		
Prepregnancy BMI	20.8 (2.1)	20.7 (3.0)	0.99 (0.85, 1.15)	0.907			0.78 (0.58, 1.07)	0.095		
No epidural (for model: no vs. yes)	14/30 (46.7%)	84/106 (79.2%)	0.29 (0.12, 0.69)	0.005			0.30 (0.07, 1.41)	0.149		

*Likelihood ratios: p values have been used

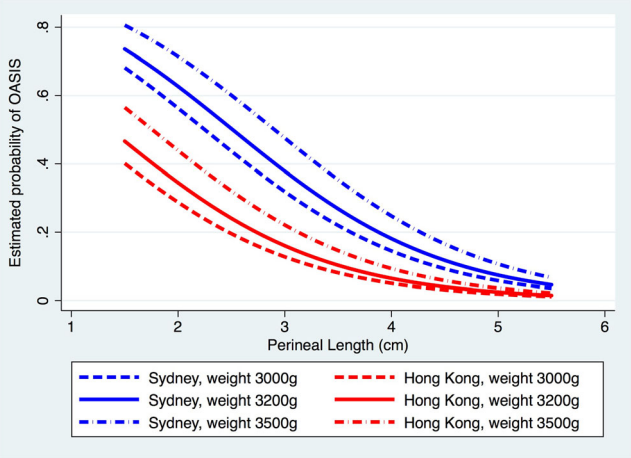

Fig. 1 OASIS risk figure: Estimated proportion with OASIS by perineal length, site, and birth weight based on the final multivariable logistic regression. For the purposes of estimating proportions, all other variables were held constant with delivery type set to be spontaneous, with no episiotomy, and duration of second stage set to 65 min

While the incidence in Hong Kong was higher than expected, the majority of OASIS in Hong Kong were small 3a tears, which may not result in long-term consequences [25].

One important finding of this study is that Asian women in Australia are giving birth to larger babies than their counterparts in Asia, which appears to be associated with greater birth injuries. The average birthweight difference was 200 g between both sites and those with OASIS versus no OASIS. This may appear a small variation, but is clinically significant with a steep rise in OASIS risk, reaching 50% with a birthweight of 3500 g (Fig. 1). Perhaps for an Asian population, a birthweight of > 3500 g equates to a > 4000 g Caucasian infant. It is notable that 11 women in the Sydney group had an emergency caesarean delivery at full dilatation (half of the babies were > 3.5 kg) compared with none in Hong Kong during the study period. The higher birthweight may account for the longer duration of active pushing, greater EDB rate, and doubling of the instrumental rate that was seen in women in Sydney. Larger sample sizes were needed to show significance in the multivariable analysis.

The difference in birthweight between Sydney and Hong Kong could not be explained by differences in gestational age at birth, as this was similar at both centres. Larger birthweight in a Western setting could not be explained by a non-Asian partner as this occurred in just eight women in Sydney and one woman in Hong Kong.

As the majority of women enrolled at both sites were born in Asia, thus having similar dietary origins, there appeared to be a migration effect. The baseline BMI of Asian women in the Sydney sample was significantly higher, suggesting adoption of a higher calorie Western diet. The higher incidence of GDM in Sydney may also support this hypothesis. Differences in screening systems for GDM between countries inhibited further conclusions. However, birthweights in both countries were similar for women with or without GDM, reflecting stricter dietary control with GDM and thus smaller babies. Unfortunately, we could not compare weight gain in pregnancy, as these data were not routinely collected in Sydney and could only be obtained by recall, thus introducing bias.

Short perineal length was also a predictor of OASIS. In agreement with Lai et al. [26], we found the mean perineal length was not shorter than in other ethnicities: 3.35 cm in Hong Kong and 3.56 cm in Sydney ($p = 0.1$). However, in women with OASIS, the perineum was significantly shorter (Table 4). Figure 1 shows that in a Sydney sample, an Asian woman with a 2.5-cm perineal length and a 3.2-kg baby had a 50% chance of OASIS, without an MLE. The findings of this study suggest that routine measurement of perineal length in labour should be adopted and MLE should be considered when < 3 cm; however, this would require a randomised controlled trial. Figure 1 of this study could be used to inform the accoucheur of the degree of impending risk of OASIS.

Even though birthweight and perineal length are important, these factors alone could not account for the discrepancy in OASIS rates between the two locations. Figure 1 shows that even with a 3-kg baby and 3-cm perineal length, the OASIS rate is lower in Hong Kong. Factors that may have contributed to this include the 'hands-on' approach used in Hong Kong (Table 1). In the multivariable analysis, the difference in the risk of OASIS between the two sites decreased when adjusting for episiotomy, suggesting that MLE may become significantly protective for OASIS with a larger sample size. Further studies are required.

The strength of this study is the employment of a single independent and experienced examiner at both sites, which enabled accurate collection of data at the time of delivery and non-judgmental grading of obstetric trauma. New insights into the low rate of OASIS in Asia have resulted. This study was adequately powered to detect an overall difference in the rate of OASIS but was underpowered to detect aetiological factors associated with higher birthweight.

The finding of our study regarding the association of increased birthweight in Asian neonates and the higher risk of OASIS needs to be disseminated to antenatal care providers. Interventions influencing birthweight, such as stricter dietary control, need to be further investigated. In addition, this study confirms that women with shorter perinea are at greater risk of OASIS [16]. The ideal management of women with a short perineal length is unknown. The use of our OASIS risk diagram (Fig. 1) can help inform accoucheurs of the risk of OASIS based on perineal length. A lower threshold for MLE and greater use of the hands-on technique may decrease the rate of OASIS in such women. These hypotheses need to be tested in a randomised controlled trial. When to perform an episiotomy is still poorly understood and evidence-based guidelines are needed.

Conclusion

By conducting a standardised rectal examination, an accurate rate of OASIS in primiparous vaginal births was determined in Asian women: 34% in Sydney and 10% in Hong Kong. High birthweight and short perineal length are independent risk factors. Furthermore, our data suggest that greater attention to delivery techniques such as hands-on control of the perineum and judicious use of MLE may help to reduce OASIS rates in Asian women.

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Compliance with ethical standards

Conflicts of interest None.

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