Original Article

Incidence and Risk Factors of Obstetric Anal Sphincter Injuries after Various Modes of Vaginal Deliveries in Chinese Women

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Abstract

Background: Obstetric anal sphincter injuries (OASIS) can cause an adverse impact on women's physical and mental health. There was lack of published data in Chinese population particularly on studying the risk of OASIS for nonrotational outlet forceps. This study was to determine the incidence and risk factors of OASIS.

Methods: This is a retrospective cohort study carried out in a tertiary referral hospital in Hong Kong. The control group was selected randomly. Univariate and multivariate logistic regression analysis was performed to evaluate the influence of potential risk factors on OASIS. This study reviewed the obstetric records of OASIS women and random control from January 2011 to June 2014. Univariate and multivariate logistic regression analysis was performed to evaluate the influence of potential risk factors on OASIS.

Results: Of 15,446 women delivered, 49 had OASIS. The percentage of OASIS increased from 0.3% (2011) to 0.38% (2014). There was an increasing trend of OASIS in attempted spontaneous vaginal delivery without episiotomy ($P < 0.01$), but it did not increase the OASIS risk ($P = 0.46$). Univariate analysis of 49 cases and 438 control subjects showed that forceps delivery (odds ratio [*OR*] =8.73, $P < 0.01$), prolong second stage of labor ($OR = 1.43$, $P < 0.01$) increased the risk for OASIS. In multivariate regression models, only forceps delivery ($OR = 6.28$, $P < 0.01$) proved to be independent risk factor.

Conclusions: The incidence of OASIS in Chinese women was increased after 2012, but still lower than the reported figures in the literature. Outlet forceps delivery could be a possible associated risk factor.

Key words: Anal Incontinence; Operative Vaginal Delivery; Postnatal Care

Introduction

Obstetric anal sphincter injuries (OASIS) after vaginal delivery can affect a woman's physical and mental health, as well as future pregnancies. Up to 57% of women with OASIS may have fecal and flatal incontinence persisting at long-term follow-up,[1] and further worsens after subsequent delivery in around 20% of cases.[2,3] The risk of a severe perineal tear is increased five-fold in her subsequent delivery.[4] The reported incidence of OASIS varied among various countries from <1% to 11%,[5-7] and increased over time in Wales, England, and Denmark to around 6%.[8-10] The latest report from United States in 2015 suggestive of 4.4% (309, 109/7, 096, 056) had an OASIS after vaginal delivery.[11]

Among the various risk factors of OASIS, use of forceps delivery is the most significant one, with an odds ratio (*OR*) of 5.6[12] even if routinely combined with mediolateral episiotomy,[12] and it has been found to associate with a higher risk then ventouse.[13]

Another interest literature report from United Kingdom in 2015 suggested Kielland's forceps has a similar rate of 3rd- and 4th-degree perineal tear compared with low forceps delivery. In this report, there are 279/1492 women (19%)

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having OASIS after forceps delivery.[14] While ventouse delivery without episiotomy was a significant risk factor with an *OR* of 3[15] that with routine episiotomy was not. Although the use of median episiotomy increased the risk of OASIS,[13] the results of the various studies on the effect of mediolateral episiotomy causing OASIS were conflicting.[10,16,17] Stedenfeldt *et al*. reported higher risk of OASIS in primiparous than multiparous women with an *OR* of 3.84.[18]

There was lack of published data in Chinese population; the reported figure was increased from 0.03% to 0.08% in period of the year 2004 to the year 2009 in Hong Kong territory-wide audit conducted by Hong Kong College of Obstetricians and Gynecologists. However, the reported figure is very low when compared with other worldwide literature. Besides, there was no report on studying the risk of OASIS specifically for nonrotational outlet forceps. Whether the latter is associated with a less severe perineal trauma than mid-level, and rotational forceps is not known.

Our hospital is one of the tertiary referral and major Obstetrics Departments in Hong Kong with around 5500–6000 annual delivery, mostly belonged to Chinese ethnicity. Outlet forceps is the only practicing type of forceps delivery in our department. The aim of the present study is to determine the incidence and risk factors of OASIS in Chinese women. It may help to determine the possible avoidable risk factors, and hence reduce the incidence of OASIS in future.

Methods

This study was designed as a retrospective cohort study. All women delivered vaginally in a Hong Kong tertiary referral Obstetrics and Gynaecology Centre by spontaneous vaginal delivery/ventouse delivery/forceps delivery whom has been suffered from OASIS between January 1, 2011 and June 30, 2014 were reviewed. All vaginal twin deliveries were excluded from this study. Women were excluded when their deliveries were conducted by cesarean section. Additionally, women whom had antenatal care in our center but delivered in another Obstetric Unit because of whatever reasons were excluded from this study.

In our center, all pregnant women were encouraged to attempt vaginal delivery except there is recognized indication for elective cesarean section such as breech presentation, multiple previous cesarean section, placenta previa. Before vaginal delivery, women are allowed to express their choice of not having routine episiotomy at onset of labor except clinical necessity such as instrumental delivery. Their choice would be followed by labor room midwives or Obstetricians as far as clinically safe for patient. In our unit, all midwives are registered under The Midwives Council of Hong Kong and able to perform delivery independently. For qualification of doctors, all the doctors can perform vaginal delivery or instrumental delivery independently after certified training certified by The Hong Kong College of Obstetricians and Gynecologists. If the patient has no contrary intention to routine episiotomy, a mediolateral episiotomy would be made upon delivery. Instrumental delivery including ventouse or forceps delivery would be performed for clinical indication such as prolonged second stage of labor, fetal bradycardia, and persistent occipito-posterior position. Forceps delivery will be used for obstetric emergency condition such as fetal distress and cord prolapse, or when ventouse delivery is contraindicated such as suspected fetal hemorrhagic disorder or prematurity. For other nonspecific indications of instrumental delivery, choice of forceps or ventouse delivery would depend on the preference of the medical staff. When forceps delivery is chosen, only outlet nonrotational forceps delivery with fetal head in direct occipito-anterior position was performed as in traditional belief of Chinese women having relatively small body built and hence their pelvis may not be large enough for rotational forceps. In case of fetal head in occipito-posterior or occipito-transverse position, we usually use rotational ventouse delivery. During instrumental delivery, a routine mediolateral episiotomy would be performed by medical staff that is usually defined as postdelivery angles of <30° and >60°.[19] After delivery, all women would be examined by midwife or medical staff for any perineal injury including OASIS. If OASIS injury is suspected by midwife, all these women would be further examined by medical staff to confirm the diagnosis and prepare for repair in operation theatre under anesthesia.

We adopted the classification of OASIS into 3rd- and 4th-degree perineal tears as described by Sultan, and endorsed by the International Consultation on Incontinence and the Royal College of Obstetricians and Gynaecologists.[5,20] A 3rd-degree perineal tear is defined as a partial or complete disruption of the anal sphincter muscles, which may involve either or both the external anal sphincter (EAS) and internal anal sphincter (IAS) muscles. For 3a degree tear, it was defined as <50% EAS involvement and 3b degree tear represents >50% EAS involvement. Whenever disruption of IAS is involved, it is defined as 3c degree tear. A 4th-degree tear is defined as a disruption of the anal sphincter muscles with a breach of the rectal mucosa.

A data collection form was designed to collect the required information in this study. Overall, we have retrospectively reviewed the obstetric delivery record of 15,446 women from 2011 to June 2014, and there were 49 women having OASIS after the various mode of vaginal delivery. Control subjects were drawn from all vaginal deliveries of >24 weeks gestation in the same department randomly. Collected demographic information includes age, parity, maternal height and body weight hence body mass index (BMI), maturity at delivery, duration of 2nd stage of labor, newborn birth weight, Apgar score at 1 min and 5 min, and total blood loss. Besides, further information was retrieved on current delivery record which including mode of delivery, any episiotomy made at delivery, details on degree of perineal tear. Other variables including prolong second stage of labor, forceps delivery, nulliparity, induction

of labor and baby birth weight >4 kg were reviewed as risk factors for suffering from OASIS after vaginal deliveries. At around 6 months postdelivery, women were assessed again for any residual complication including fecal and flatal incontinence, perineal pain, and coital problem at out-patient setting. Physical examination was also performed to review any wound complication.

All the retrieved data will be entered in the data collection form. Distribution of maternal and obstetrical predictor variables was compared with the use of Mann–Whitney *U*-test (continuous predictors) and Fisher exact test (categorical predictors). A $P < 0.05$ was considered as statistically significant. Univariate and multivariate logistic regression analysis was performed to evaluate the influence of potential risk factors on OASIS. *ORs* and 95% confidence intervals (*CIs*) were estimated to describe the prognostic strengths of variables potentially influencing the occurrence of OASIS considered in the logistic regression model. Statistical analyses were performed using Statistical Package for the Social Sciences (Windows version 15.0; SPSS Inc., Chicago, IL, USA).

This study has been approved by Kowloon Central Cluster/Kowloon East Cluster Research Ethics Committee of Hospital Authority of Hong Kong (Reference Number: KC/KE-14-0133/ER-1).

Results

There were a total of 49 women suffering from OASIS after vaginal delivery from the year 2011 to June 2014. The overall incidence is 0.32%. Of these 49 cases, 3 (6.1%), 27 (55.1%), 9 (18.4%) and 10 (20.4%) had 3a, 3b, 3c, and 4th-degree OASIS, respectively. All women were delivered at term (>37^{+0} weeks of gestation). Comparing the maternal characteristics between the OASIS and control group, there were no significant difference among mean age (31 vs. 31, $P = 0.39$), parity (0 vs. 0, $P = 0.06$), maturity at delivery (39 weeks vs. 39 weeks, $P = 0.23$), maternal BMI (kg/m^2) (20.74 vs. 20.90, $P = 0.44$), duration of 2nd stage of labor (minutes) (19 vs. 15, $P = 0.61$) except there is significantly more blood loss in the OASIS group compared with the control group (300 ml vs. 200 ml, $P < 0.01$). Comparing the baby characteristics and outcome, there were no statistical significant difference on baby birth weight (3.2 kg vs. 3.2 kg, $P = 0.11$), Apgar score at 1 min (8 vs. 8, $P = 0.28$) and 5 min (9 vs. 9, $P = 0.35$).

There was overall increasing trend of OASIS after vaginal deliveries from the year 2011 to June 2014 (0.30–0.38%). There was statistical significant increase in the incidence of OASIS in nulliparous women having vaginal delivery without episiotomy ($P < 0.01$) but not in multiparous women ($P = 0.11$) [Table 1]. In addition, there was no statistical difference in the incidence of OASIS in nulliparous ($P = 0.81$) and multiparous ($P = 0.58$) women having vaginal delivery with episiotomy. On the other hand, the background rate of 1st- and 2nd-degree perineal tear was similar from the year 2011 to June 2014 (25.6–29.4%). From the year 2011 to June 2014, there was no significant difference in the incidence of OASIS in both nulliparous and multiparous women having forceps delivery and ventouse delivery. For the overall incidence of OASIS in forceps delivery, it was ranged from 2.4% to 4.44% ($P = 0.38$) without statistical significant difference. For ventouse delivery, the overall incidence was ranged from 0% to 0.74% ($P = 0.56$) and again shows no statistical significant difference.

When comparing the incidences of OASIS among different modes of deliveries [Table 2], the incidence in women having vaginal delivery without episiotomy is similar to the group with episiotomy (0.25% vs. 0.28%, $P = 0.72$). On the other hand, there was significantly higher incidence of OASIS in instrumental delivery group (including both forceps and ventouse delivery) compared with normal vaginal delivery group (0.84% vs. 0.26%, $P < 0.01$). In addition, when comparing the incidence of OASIS in forceps group against ventouse group, there was statistically significant higher incidence in the OASIS group (2.86% vs. 0.39%, $P < 0.01$).

An univariate analysis of these 49 cases and 438 randomly selected control subjects showed that forceps delivery (*OR* = 8.73, $P < 0.01$), prolonged second stage of labor (*OR* = 1.43, $P < 0.01$) increased the risk of OASIS. However, Ventouse ($P = 0.73$), nulliparity ($P = 0.24$), induction of labor ($P = 0.77$) or birth weight >4 kg ($P = 0.43$) did not increase the risk [Table 2]. In multivariate regression models, only forceps delivery (*OR* = 6.28 (95% *CI* = 2.32–17.04), $P < 0.01$) proved to be independent risk factor.

Among the 49 women having OASIS after delivery, there was no reported case of fecal incontinence or flatal

Table 1: Incidence of OASIS in various mode of vaginal delivery

Parity	Mode of delivery	2011	2012	2013	2014	*P*
Nulliparity	Vaginal delivery without episiotomy (%)	1/475 (0.21)	1/560 (0.18)	2/442 (0.45)	4/174 (2.30)	<0.01
Multiparity	Vaginal delivery without episiotomy (%)	1/1472 (0.07)	0/1159 (0.00)	5/1432 (0.35)	2/749 (0.27)	0.11
Nulliparity	Vaginal delivery with episiotomy (%)	6/1325 (0.45)	4/1217 (0.33)	4/1058 (0.38)	1/598 (0.17)	0.81
Multiparity	Vaginal delivery with episiotomy (%)	3/973 (0.31)	1/845 (0.11)	1/774 (0.13)	0/386 (0.00)	0.58
Nulliparity	Forceps delivery (%)	2/38 (5.26)	1/61 (1.64)	2/106 (1.89)	1/35 (2.86)	0.67
Multiparity	Forceps delivery (%)	0/7 (0.00)	1/8 (12.5)	1/19 (5.26)	0/6 (0.00)	0.65
Nulliparity	Ventouse delivery (%)	1/302 (0.33)	1/295 (0.34)	3/357 (0.84)	0/144 (0.00)	0.57
Multiparity	Ventouse delivery (%)	0/64 (0.00)	0/39 (0.00)	0/51 (0.00)	0/21 (0.00)	–

OASIS: Obstetric anal sphincter injuries.

incontinence at 6 months after delivery despite there were two women (4.08%) complaining subjective sensation of fecal and flatal urgency but not affecting their usual daily activities. There was one woman (2.04%) complained of mild wound pain and discomfort without coital difficulty, but on physical examination, there was no local lesion or wound complication identified.

Discussion

The overall incidence of OASIS after vaginal deliveries among Chinese women in Hong Kong (0.42%) in 2013 was lower than the reported incidence (0.6–11%)[5,6,21] of OASIS in Caucasians. However, this rate is higher than that reported incidence mentioned previously in our Hong Kong territory-wide audits results (0.03–0.08%). There might be a possibility of under reporting. According to a local paper, the reported rate of levator ani injury diagnosed by ultrasound scan in primiparous women was as high as 15.4%, 33.3%, and 71.4% following spontaneous vaginal delivery, ventouse extraction, and forceps delivery, respectively.[22] In fact, detection of OASIS after vaginal delivery demands certain level of clinical skills, and it may be easily missed if the perineum is not examined carefully after delivery.

Consistent with previous studies,[1,9,12,23] our study also showed outlet forceps delivery was associated with increased risk of OASIS. When comparing forceps delivery against ventouse delivery, the incidence of OASIS was significantly higher (2.86% vs. 0.39%, $P < 0.01$). On literature search, there was no report to specifically evaluate the OASIS rate after outlet forceps alone. In fact, there may be perception that outlet forceps may cause less perineal trauma than mid-level forceps delivery. When operator performs outlet forceps delivery, the cephalic curve of the forceps distended the perineum widely when lifting fetal head during crowning. An interesting report from Memon and Handa[24] showed that there is four times higher chance to have levator ani avulsion when comparing forceps against ventouse delivery. It could be proposed from this evidence that the forceps overall diameter in both anterior-posterior and lateral are much bigger than fetal head alone contributing to this phenomenon of pelvic floor injury. For the same analogy, this provides one of the possible explanations for the significant increase in risk for OASIS in women having outlet forceps delivery. The second possible explanation is the potential relative shorter perineum in Asian then Caucasians thus the overall OASIS rate in forceps delivery is higher than worldwide literature. The maternal BMI median from our case samples were ranged from 20.4 to 21.5, which are within the normal range, and this range is much lower when compared with another report in Caucasian countries. These overall smaller body built in Chinese population may proportionally predict their perineum is shorter than Caucasians.

We have showed that on logistic regression, ventouse delivery with routine episiotomy was not a risk factor for OASIS. This finding is compatible with previous reports.[8,10] This could be explained anatomically as vacuum cup placement occupies much less vaginal space than the rigid cephalic curve of forceps.

Consistent with previous studies[8-10] on other countries, we found there was an increasing trend of OASIS over time. There are numbers of considerations. First, there was increasing trend of spontaneous vaginal delivery without episiotomy in our unit for multiparous but not for nulliparous women. However, consistent with other studies,[25] not making routine episiotomy has not been found to be an independent risk factor in univariate or multivariate analysis [Table 3]. Second, although increasing number of forceps, a risk factor of OASIS, the number of the later after forceps was not increased over time. Third, like the explanation in another study,[10] we postulated that there was an improvement in competence of diagnosing

Table 2: Comparison on incidence of OASIS among different mode of vaginal deliveries from 2011 to June 2014

Mode of deliveries	Incidence (%)	*P*
Vaginal delivery without episiotomy	16/6463 (0.25)	0.72
Vaginal delivery with episiotomy	20/7176 (0.28)	
Vaginal delivery with or without episiotomy	36/13639 (0.26)	<0.01
Instrumental delivery (includes forceps and ventouse)	13/1553 (0.84)	
Forceps	8/280 (2.86)	<0.01
Ventouse	5/1273 (0.39)	

OASIS: Obstetric anal sphincter injuries

Table 3: Univariate and multivariate logistic regression analysis of individual risk factor for OASIS among women with various modes of vaginal delivery

Risk factors	Univariate analysis		Multivariate analysis	
	OR (95% *CI**)	*P*	*OR* (95% *CI**)	*P*
Vaginal delivery without episiotomy	0.92 (0.45–1.85)	0.81	1.36 (0.59–3.15)	0.46
Forceps delivery	8.73 (3.42–22.33)	<0.01	6.28 (2.32–17.04)	<0.01
Ventouse delivery	1.40 (0.52–3.76)	0.51	1.21 (0.41–3.56)	0.73
Prolong second stage of labor	1.43 (1.42–5.76)	<0.01	1.90 (0.88–4.14)	0.11
Nulliparity	1.88 (0.98–3.60)	0.06	1.52 (0.76–3.03)	0.24
Induction of labor	1.00 (0.55–1.82)	0.99	0.91 (0.49–1.71)	0.77
Birth weight >4 kg	1.50 (0.18–12.72)	0.71	2.40 (0.27–21.10)	0.43

**CI*: Confidence interval; *OR*: Odds ratio; OASIS: Obstetric anal sphincter injuries.

OASIS after the introduction of obstetric anal sphincter repair workshop with lectures and hands on sessions in our department in 2012. Since the year 2012, most of the obstetrics and gynecology trainee and labor ward midwives in this department have attended the workshop. According to the literature report from Andrews *et al*.,[26] their sonographic evidence persistent anal sphincter defect reduced from 92% to 10% postoperatively after the introduction of OASIS workshop. Siddighi *et al*.[27] (United States) showed the trainees had significant improvement of scores on OASIS repair after the usage of objective structured assessment of technical skills (OSATA) assessment. Fourth, we did not study the techniques of protecting the perineum that can reduce the occurrence of OASIS.[22,28,29]

The results of this study have an implication on the choice of instrumental deliveries. Although it has been shown that forceps delivery had higher successful rate of instrumental delivery than ventouse delivery,[30] this benefit have to balance against the increase risk of maternal OASIS and subsequent morbidities. In fact, a report from Bulgaria[31] did show that the usage rate of forceps delivery was dropped from >2% to <1% in a decade. This indicates that obstetricians nowadays prefer ventouse rather than forceps in nonspecific indications of instrumental delivery. Although forceps delivery still has irreplaceable role in cases such as cord prolapse, suspected fetal hemorrhagic disorders or prematurity, its role in another situation is questionable when taken into the account of maternal OASIS and its consequence. Besides, with increasing incidence of OASIS, emphasis on techniques to protect perineum irrespective of whether episiotomy is made or not may be an important factor to reduce the risk of OASIS. Interventions including the classical method of protecting perineum, good communication between the operator and the delivering woman, a delivering position that allows visualization of the perineum, and restrictive of midline resulted in a decrease in OASIS from 4–5% to 1–2% over a period of 6 years.[22,29] Education and training are required[4] to reduce the risk.

Another interesting issue identified in the study is the significant increase in the incidence of OASIS in women having vaginal delivery without episiotomy ($P < 0.01$). In fact, the incidence in this group has been increased from the year 2011 (0.20%) to the year 2014 (2.30%). Consistent with previous literature reports, it suggested that Asian ethnicity and vaginal or instrumental delivery without episiotomy is associated with high-risk of OASIS.[9] Although there was no statistically significant difference in incidence of OASIS in women having delivery with or without episiotomy ($P = 0.72$), the increasing trend of OASIS in nulliparous group did alert us on the possibility of high-risk association in this women group. Further evaluation of this aspect of a well-designed prospective cohort study is recommended.

One of the limitations of this study is the retrospective cohort design in a single department with a small sample size. The second limitation is the possibility of under reporting in number of actual OASIS. This can be improved by usage of endoanal ultrasound to enhance the detection rate of OASIS,[32] or trained medical/nursing staff on clinical diagnosis. Thirdly, we did not study the effects of epidural analgesia, techniques of protecting the perineum, and the direction of episiotomy. Further larger studies involving multicenter are required.

In conclusion, the incidence of OASIS in Hong Kong Chinese women was increased after 2012 particularly in nulliparous women having vaginal delivery without episiotomy, but still lower than the reported figures in the literature. Outlet forceps delivery is a possible associated risk factor for OASIS.

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Conflicts of interest

There are no conflicts of interest.

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