Archives of Gynecology and Obstetrics (2019) 300:87–94
https://doi.org/10.1007/s00404-019-05174-0

MATERNAL-FETAL MEDICINE

Does the implementation of a restrictive episiotomy policy for operative deliveries increase the risk of obstetric anal sphincter injury?

Bertrand Gachon[1] · Carine Fradet Menard[1] · Fabrice Pierre[1] · Xavier Fritel[1,2,3]

Received: 12 December 2018 / Accepted: 24 April 2019 / Published online: 5 May 2019

Abstract

Purpose Our main objective was to investigate whether the implementation of a restrictive episiotomy policy in operative deliveries changes the incidence of obstetric anal sphincter injury (OASI).

Methods This is an observational study over an 11-year period in Poitiers University Maternity, France. We included women with vaginal operative deliveries after 34 gestational weeks for singleton births in cephalic presentation. We collected data on the mother and operative delivery characteristics: indication, instrument, epidural analgesia, labor length, episiotomy, OASI, and birthweight. We investigated the changes in the mediolateral episiotomy (MLE) and OASI rates and the association between MLE and OASI. The primary outcome was the evolution of the OASI and MLE rates. The secondary outcome was the occurrence of OASI during operative delivery with or without MLE.

Results In total, 2357 operative deliveries were assessed, including 847 vacuum-, 1350 forceps- and 160 spatula-assisted deliveries. Of these, 950 were performed with MLE and 1407 without; 37 OASIs (3.9%) occurred in the MLE group, and 137 (9.7%) in the no-MLE group. Between 2005 and 2015, MLE use decreased from 78.5 to 16.2% and OASI occurrence increased from 3.1 to 12.7%. The increase in OASI occurrence was significant for forceps deliveries, but not for vacuum or spatula deliveries. Operative delivery with MLE was associated with a three times lower OASI occurrence than that without MLE (adjusted OR = 0.29, 95% CI [0.20–0.43]).

Conclusions Implementation of a restrictive MLE policy for operative delivery seems to be associated with an increase in OASI incidence with forceps, but not with vacuum.

Keywords Obstetric anal sphincter injury · Episiotomy · Instrumental delivery · Perineal trauma · Childbirth

Introduction

Obstetric anal sphincter injuries (OASIs) occur in 0.4–5% of deliveries and can strongly affect women's health and quality of life [1–3]. OASIs are associated with a high prevalence of postnatal fecal incontinence, pain and sexual complaints [1–3]. Several risk factors are well described in the literature for OASI occurrence: nulliparity, short perineal body, prolonged second stage of labor, fetal macrosomia, posterior presentation, and operative delivery, particularly with forceps delivery [1, 4, 5]. The literature clearly reports that a routine use of episiotomy to prevent OASI in spontaneous vaginal delivery has no benefit and is even reported as a risk factor, particularly for midline episiotomy [6]. Nevertheless, the potential protective effect of mediolateral episiotomy (MLE) during operative vaginal delivery remains unclear. Operative delivery is a high-risk situation for OASI

This paper was accepted as a podium presentation at the 48th Annual Meeting of the International Continence Society in Philadelphia, United States of America, 29–31 August 2018.

✉ Bertrand Gachon
bertrand.gachon@gmail.com

[1] Department of Obstetrics and Gynecology, La Miletrie University Hospital, 2 rue de la Milétrie CS90577, 86021 Poitiers Cedex, France

[2] INSERM, Center for Research in Epidemiology and Population Health (CESP), U1018, Gender, Sexuality and Health Team, Univ Paris-Sud, UMRS 1018, Orsay, France

[3] INSERM CIC-P 1402, La Miletrie University Hospital, Poitiers, France

occurrence, particularly when other risk factors coexist [1, 4, 5]. The literature in this thematic is contradictory, but there are several studies reporting an increase in OASI occurrence when there is an operative delivery without MLE [7–13]. These studies are difficult to interpret since they often evaluate teams that routinely use MLE for operative deliveries, and OASI occurs in the few cases without MLE. Thus, it remains unclear whether a restrictive use of MLE during an operative delivery is associated with a higher risk of OASI.

Since 2005, according to the French guidelines [14], our institution introduced a restrictive use of MLE for all vaginal deliveries including operative deliveries. This considered, our local guidelines recommend since 2005, a restrictive use of MLE in case of operative delivery. It was requested to each obstetrician in our labor ward to reduce its use of episiotomy in case of operative delivery and to consider individually its use only for specific cases for which they think the intervention is beneficial for the woman and/or her baby. We hypothesize that this change in our practices may have affected our OASI incidence in operative deliveries, which is a high-risk situation for this outcome.

The primary endpoint was to investigate the effect of a restrictive policy of MLE during operative deliveries by measuring the evolution of OASI and MLE rates across an 11-year period. The secondary outcome was to assess the risk of OASI during an operative delivery with or without MLE.

Materials and methods

This is a retrospective observational study based on French university maternity data (Poitiers University Hospital, France). This study included all the operative deliveries at more than 34 weeks of gestation for singleton births in cephalic presentation between January 2005 and December 2015.

We systematically collected data from the patient's medical records, information about the women's characteristics (age, body mass index, parity) and the mode of delivery: epidural analgesia, term, second stage of labor length, expulsive phase length, MLE use, type of instrument used for the delivery, perineal tears occurrence and classification, and birthweight. The second stage of labor length was defined as the delay between full cervical dilatation and birth. The expulsive phase length was defined as the delay between the onset of pushing and birth. When using different instruments for the same delivery, the instrument used to finish the delivery was the instrument considered in the analysis. When an episiotomy was performed, it was always classified as MLE, in accordance with our institutional guidelines.

An OASI was defined as a stage 3 or 4 perineal tear according to the Royal College of Obstetricians and Gynaecologists (RCOG) guidelines [3]. During the first period (2005–2009), no distinction was made between stage 3 subtypes (3a, 3b and 3C) according the International Classification of Diseases. During the second period (2010–2015), our obstetrical teams (obstetricians, midwives, and students) were made aware of the diagnosis of OASI, and our local guidelines recommended a standardized report of OASI including all subtypes of stage 3. In our institution, all operative deliveries are performed by or under direct supervision of a senior obstetrician. Therefore, every perineal tear that occurred during an operative delivery was examined by a senior obstetrician and thus every diagnosis of OASI was made by a senior obstetrician.

We first described our population characteristics in terms of the mean [standard deviation (SD)] for continuous variables and effectives (percentage) for categorical variables. We then assessed the evolution of both MLE and OASI rates and our obstetrical practices (cesarean rate, operative delivery rate, type of instrument used) across the period of interest. We described the cross-evolution of OASI and MLE rates during the studied period according to the type of instrument. Finally, we investigated the effect of MLE during operative delivery on OASI incidence.

To investigate any increase/decrease in the rate of MLE and the rate of OASI across the period of interest, we used a non-parametric test for continuous data (Spearman test). This methodology has been previously used in previous works investigating changes in OASI occurrence and MLE rates across time [15]. The same type of analysis was used to investigate any change in our obstetrical practices during the period (operative delivery rate, cesarean section rate, forceps delivery rate, spatulas delivery rate, vacuum delivery rate, OASI and MLE rates according the type of instrument). We conducted a subgroup univariate analysis to investigate the effect of MLE for each instrument (a multivariate analysis was not performed because of the low number of cases expected in each group). Finally, we performed a multivariate analysis using a logistic regression to investigate the effect of MLE during an operative delivery (regardless of instrument type) for OASI occurrence. For this analysis, continuous data were converted into categorical data corresponding to the thresholds described in the literature as associated with OASI: age (< 25 years, 25–34 years, 35 years or more), maternal BMI (< 25 kg m^2, 25–30 kg m^2, 30 kg m^2 or more), second stage of labor length greater than 120 min, pushing phase length greater than 30 min, and birthweight (< 3500 g, 3500–4000 g, 4000 g or more) [1]. Outcomes with a level of significance greater than $p < 0.15$ in the univariate analysis were included in the multivariate analysis using logistic regression. Analyses were performed with Stata software (version V14IC; Stata Corporation, College Station, TX,

USA). For all analyses, significance was considered for $p < 0.05$, and we calculated odd ratios (OR) with 95% confidence intervals when appropriate.

Upon admission, each patient at our institution receives a document that specifically mentions the possibility that anonymized medical data collected during hospitalization could be utilized for medical research. Data have been collected in accordance with our typical practices, and the women underwent no supplementary procedures for this research. Considering French regulations (loi Jardé), ethical committee approval was not required for this non-interventional retrospective study.

Results

During the 11-year period, 22,023 singleton deliveries in cephalic presentation at 34 weeks or over occurred, among which 2357 were operative vaginal deliveries (10.7%) (Fig. 1). A total of 1350 operative deliveries were performed with forceps (57.3%), 160 with spatulas (6.8%) and 847 with a vacuum (35.9%). Additionally, 950 of the operative deliveries (40.3%) were performed with MLE (Fig. 1). OASI occurred less frequently (3.9%) in operative deliveries with MLE than without MLE (9.7%; $p < 0.005$) (Fig. 1).

The mean age of the women who delivered by operative vaginal delivery was 29 (SD = 5) years, and the mean BMI was 23 (SD = 4.6) Kg m^2. The mean term at birth was 40 (SD = 1.3) weeks, the mean second stage of labor length was 119 (SD = 68) min, the mean expulsive phase length was 23 (SD = 12) min and the mean birthweight was 3337 g (SD = 465).

The other characteristics of the mothers who delivered via operative delivery are reported in Table 1, as are the characteristics of the operative deliveries.

From 2005 to 2015, in all cephalic presentation deliveries above 34 weeks, our rate of operative delivery did not significantly change (10.1% in 2005 to 10.5% in 2015; $p = 0.47$). We significantly increased our cesarean section rate from 9.2% in 2005 to 12.6% in 2015 ($p < 0.005$). From 2005 to 2015, we decreased our forceps utilization rate from 66 to 45% ($p < 0.005$), we increased our vacuum-assisted delivery rate from 17.5 to 50% ($p < 0.005$) and our annual rate of spatula-assisted delivery remained stable (16–4.6%; $p = 0.12$).

We drastically decreased our rate of MLE during operative delivery from 78.5% in 2005 to 16.2% in 2015 ($p < 0.0005$). During the same period, we reported a very significant increase in the OASI rate in operative deliveries from 3.1 to 12.7% ($p < 0.0005$) (Fig. 2). If we focus on the first part of this study (2005–2009), we report a significant decrease in MLE use (78.5–43.5%; $p < 0.05$) without a statistically significant increase in OASI occurrence (3.1–9.3%; $p = 0.08$). However, during the second part of the study (2010–2015), the decrease of MLE use was no longer statistically significant (26.9–16.2%; $p = 0.35$), and we reported an increase in OASI occurrence from 6.1% to 12.7% ($p < 0.005$).

Considering the entire 11-year period, for each instrument, we significantly decreased our rate of MLE (Fig. 3). In the forceps group, the rate of OASI significantly increased (3.9–21%; $p < 0.005$) whereas it remained stable in the vacuum (0–6.1%; $p = 0.19$) and spatula (3.2–0%; $p = 0.87$) groups (Fig. 3).

In a subgroup univariate analysis, MLE was associated with a lower incidence of OASI with vacuum (1.1% for MLE versus 5.7% without, OR = 0.19 [0.02–0.74]) and forceps- (4.1% for MLE versus 13.6% without, OR = 0.28 [0.17–0.43]) assisted deliveries. Such an association was not significant for deliveries using spatulas (7% OASI rate for MLE versus 11.7% without, OR = 0.57 [0.16–2.02]).

The univariate analysis results evaluating the effect of several maternal characteristics and delivery characteristics on the risk of OASI occurrence in operative delivery are reported in Table 1. This multivariate analysis

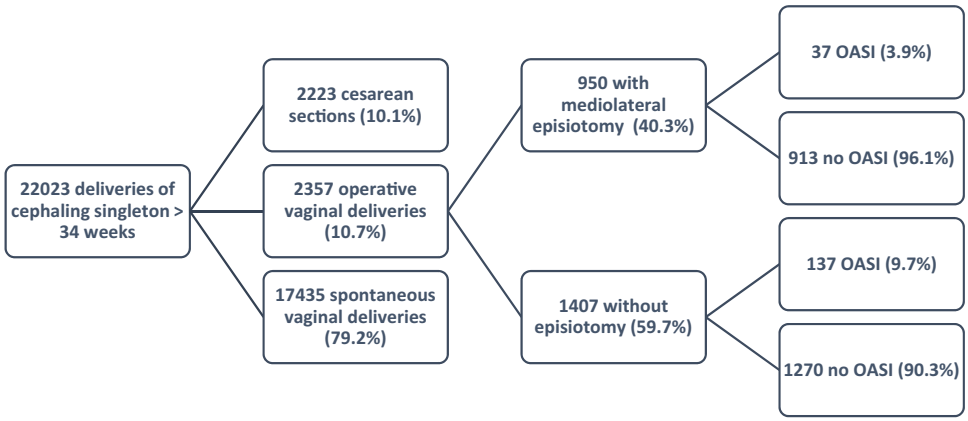

Fig. 1 Flow chart for deliveries of cephalic singleton above 34 weeks. *OASI* obstetric anal sphincter injury

Table 1 Univariate and multivariate analysis for OASIS occurrence according to maternal and delivery characteristics ($N=2357$ instrumental deliveries)

	Effective (% of total population)	OASI *n* (%)	Crude OR [95% CI]	Adjusted OR [95% CI]
Mediolateral episiotomy				
No episiotomy	1407 (59.7)	137 (9.7)	Ref.	
Episiotomy	950 (40.3	37 (3.9)	0.32 [0.22–0.47]	0.29 [0.20–0.43]
Parity[a]				
Parous women	472 (21.2)	27 (5.7)	Ref.	
Nulliparous women	1870 (79.8)	146 (7.8)	1.39 [0.91–2.22]	1.53 [0.99–2.38]
Maternal age (years)				
< 25	415 (17.6)	26 (6.3)	Ref.	
25–34	1565 (66.4)	121 (7.7)	1.25 [0.80–2.03]	–
35 or more	377 (16)	27 (7.2)	1.15 [0.63–2.10]	–
Maternal body mass index[b] (kg m^2)				
< 25	1678 (73)	117 (7)	Ref.	
25–29	430 (18.7)	33 (7.7)	1.11 [0.72–1.67]	–
30 or more	191 (8.3)	17 (8.9)	1.30 [0.72–2.24]	–
Epidural analgesia				
No epidural analgesia	309 (13.1)	23 (7.4)	Ref.	
Epidural analgesia	2048 (86.9)	151 (7.4)	1.72 [1.22–2.45]	1.10 [0.68–1.78]
Second stage of labor length[c] (min)				
< 120	1256 (62.6)	87 (6.9)	Ref.	
120 or more	751 (37.4)	55 (7.3)	1.06 [0.73–1.53]	–
Expulsive phase length[d] (min)				
< 30	1483 (64.5)	120 (8.1)	Ref.	
30 or more	817 (35.5)	50 (6.1)	0.74 [0.51–1.05]	0.71 [0.50–1.01]
Type of instrument				
Vacuum	847 (35.9)	40 (4.7)	Ref.	
Forceps	1350 (57.3)	120 (8.9)	1.97 [1.35–2.92]	2.48 [1.69–3.64]
Spatulas	160 (6.8)	14 (8.7)	1.94 [0.96–3.74]	2.97 [1.53–5.70]
Indication of operative delivery[e]				
Fetal distress	854 (37.6)	63 (7.4)	Ref.	
Other	1420 (62.4)	107 (7.5)	1.02 [0.73–1.44]	–
Birthweight[f] (g)				
< 3500	1521 (64.6)	97 (6.4)	Ref.	
3500–4000	651 (27.6)	52 (8)	1.27 [0.88–1.83]	–
4000 or more	184 (7.8)	25 (13.5)	2.31 [1.38–3.74]	2.19 [1.36–3.53]

OASI obstetric anal sphincter injury

[a]Data missing in 15 cases = 0.6%

[b]Data missing in 58 cases = 2.5%

[c]Data missing in 350 cases = 14.9%

[d]Data missing in 57 cases = 2.4%

[e]Data missing in 83 cases = 3.5%

[f]Data missing in 1 case = 0.4%

reported that the use of MLE during operative delivery was associated with a threefold decrease in OASI occurrence (adjusted OR = 0.29 [0.20–0.43]). The other outcomes associated with OASI were the use of forceps, the use of spatulas and a birthweight higher than 4 kg (Table 1).

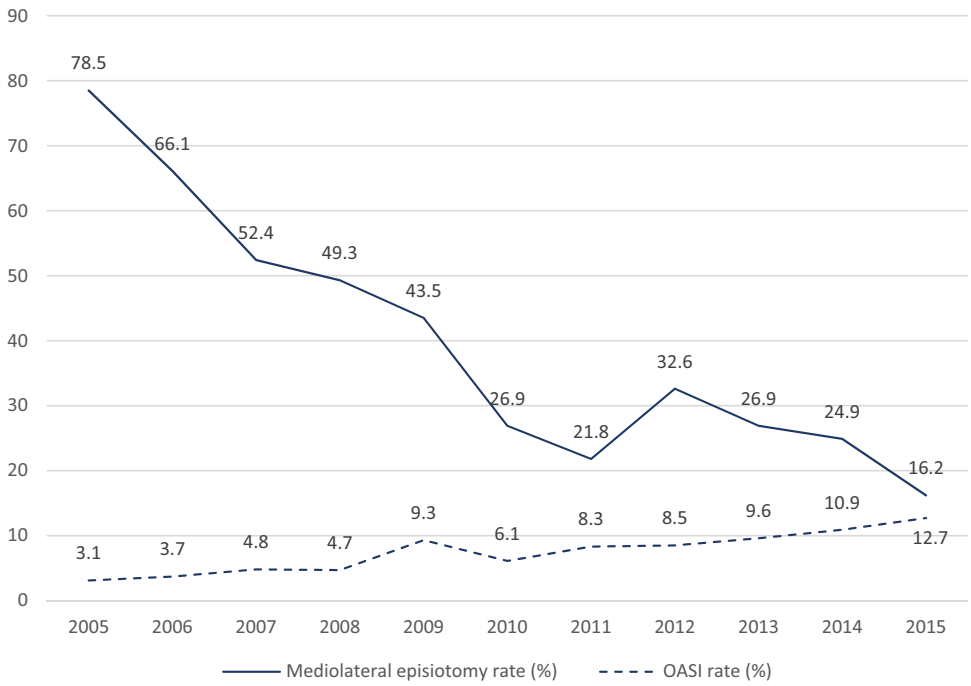

Fig. 2 Cross-evolution of mediolateral episiotomy annual and OASI annual rates in case of operative delivery from 2005 to 2015. *OASI* obstetric anal sphincter injury

Discussion

Main findings

During an 11-year observational period, among 2357 vaginal operative deliveries, we reported a fourfold decrease in MLE use and a fourfold increase in OASI occurrence. The utilization of MLE during operative delivery was associated with a threefold lower OASI occurrence (adjusted OR = 0.29, 95% CI [0.20–0.43]). A restrictive policy of MLE during an operative delivery appears to be associated with an increased risk of OASI whereas there was no increased risk with vacuum delivery.

Strengths and limitations

The main strength of this study is that it provides data about the experience of an obstetrical team implementing a restrictive use of MLE. Indeed, most of the papers available in the literature report the experience of obstetrical teams with a routine use of MLE [7–13]. In these studies, most of the operative deliveries were performed with MLE, and OASI occurred in the few cases without MLE.

The main limitation of this study is its historical design; thus, the association between the restrictive use of MLE and the increase of OASI occurrence should be cautiously interpreted. There might be other factors that could contribute to the increase of OASI. However, our rate of operative delivery did not significantly change during the 11 years considered. Even if we reported an increase in our cesarean section rate and a decrease in our forceps-assisted delivery rate associated with an increase in our vacuum utilization, the expected effect of these changes would be a decrease in our OASI rate and not an increase of OASI occurrence. It is possible that after 2010, the use of the RCOG classification, with a description of all subtypes of OASIs, particularly 3a, may have induced a more frequent diagnosis of OASI in the second part of the studied period compared to the first part in which these tears may have been considered stage 2. Even if it did not reach statistical significance, we reported an increase in OASI occurrence before 2010 (from 3.1% in 2005 to 9.3% in 2009), which seems clinically significant.

Another limitation is the low number of cases in the spatulas group, which should lead to a careful interpretation of our results in this group; therefore, most of our conclusions and our discussion are focused on vacuum and forceps use.

The last limitation is that some data are missing. In most cases, the proportion of missing data was low (less than 4%), so we do not believe that this limitation biased our analysis.

Interpretation

The decrease of MLE rate that we report for operative delivery (from 78.5 to 16.2%) is consistent with other work for a comparable period in France. Indeed, Goueslard et al. reported that in France from 2007 to 2014, the French rate of MLE in case of operative delivery decrease from 60 to 50% ($p < 0.05$) [16]. This decrease is more important in our experience than for the national rate. This might be explained by the fact that the national data contains rates of different

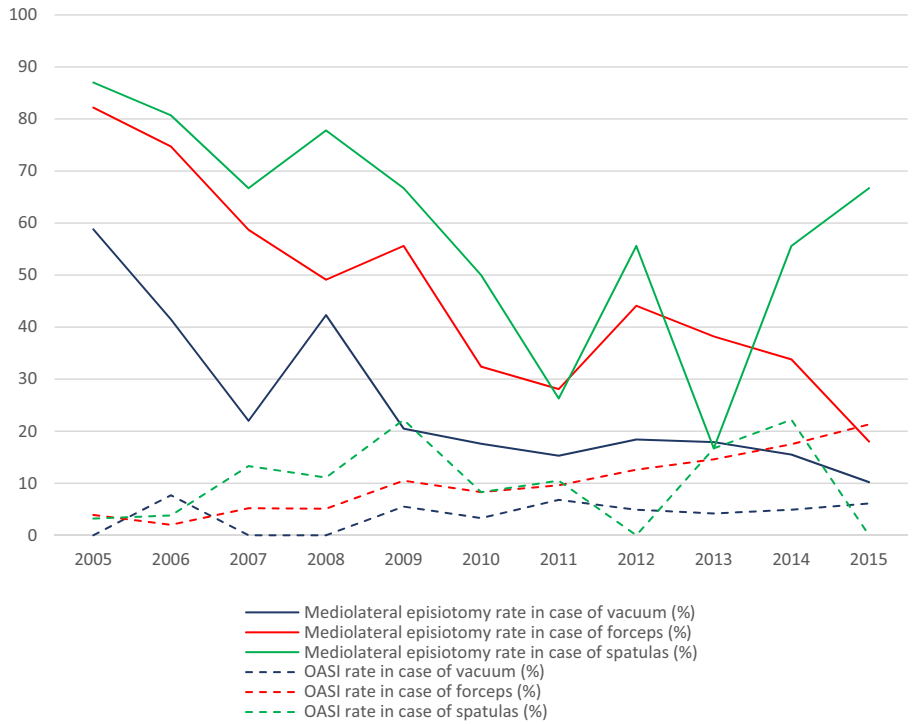

Fig. 3 Cross-evolution of mediolateral episiotomy and OASI annual rates according to the type of instrument from 2005 to 2015. *OASI* obstetric anal sphincter injury

The solid lines represent the decrease of the episiotomy annual rate in case of vacuum ($p<0.0005$), forceps ($p<0.0005$) and spatulas ($p<0.05$) assisted delivery.
The dashed lines represent the increase of OASI annual rate in case of forceps assisted delivery ($p<0.0005$) and the absence of change in case of vacuum ($p=0.19$) and spatulas ($p=0.87$) assisted delivery.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Episiotomy rate in case of vacuum (%)	58.8	41.5	22	42.3	20.5	17.6	15.3	18.4	17.9	15.5	10.2
Episiotomy rate in case of forceps (%)	82.2	74.7	58.7	49.1	55.6	32.4	28.1	44.1	38.2	33.8	18
Episiotomy rate in case of spatulas (%)	87	80.7	66.7	77.8	66.7	50	26.3	55.6	16.7	55.6	66.7
OASI rate in case of vacuum (%)	0	7.7	0	0	5.5	3.3	6.8	4.9	4.2	4.9	6.1
OASI rate in case of forceps (%)	3.9	2	5.2	5.1	10.5	8.3	9.6	12.6	14.6	17.5	21.3
OASI rate in case of spatulas (%)	3.2	3.8	13.3	11.1	22.2	8.3	10.5	0	16.7	22.2	0

teams with a variable application of the national guidelines (some with an important decrease of MLE, some other without any changes). In our experience, a restrictive use of MLE in case of operative delivery was clearly requested from all of our practitioners.

Our rate of OASI (3.9% with episiotomy, 9.7% without episiotomy) is comparable to rates reported in the literature. De Leeuw et al. reported an OASI rate of 3.5% during operative delivery with an episiotomy rate of 82.3% [9]. In their pilot study for a randomized trial about routine versus restrictive episiotomy, Murphy et al. reported an OASI rate of 8.1% in the routine group and 10.9% in the restrictive group [10]. De Vogel et al. reported an OASI rate of 5.7% (3.3% with episiotomy and 15.6% without episiotomy) in 2861 operative deliveries with an episiotomy rate of 81% [11]. Van Bavel et al. reported an OASI rate of 2.5% with episiotomy and 14% without episiotomy for 170,969 operative deliveries with an episiotomy rate of 84.5% [7].

The potential protective effect of MLE on OASI occurrence during operative delivery that we reported is consistent with the literature, even if our experience is related to a restrictive use of MLE whereas most of the literature addresses a routine use of MLE. De Leeuw et al. reported a protective effect of MLE with vacuum (OR = 0.11 [0.09–0.13]) and forceps-assisted delivery (OR = 0.08 [0.07–0.11]) with an episiotomy rate of 82% [9]. De Vogel et al. reported a protective effect of episiotomy with an OR of 0.17 [0.12–0.24] in a population of 2861 operative deliveries with an episiotomy rate of 81% [11]. The pilot randomized trial by Murphy et al. did not report any change for the OASI risk during operative delivery between a restrictive versus a routine use of episiotomy [10]. Nevertheless, these results must be interpreted carefully because in the group with a restrictive use of episiotomy, there was an episiotomy rate of 50% [10]. Van Bavel et al. reported a protective effect of MLE during instrumental delivery in

both primiparous (OR = 0.14 [0.13–0.15]) and multiparous (OR = 0.23 [0.21–0.27]) women [7].

Our results suggest that the implementation of a restrictive use of MLE is associated with an increased risk of OASI during operative deliveries. This result is significant for forceps-assisted deliveries, but not for vacuum-assisted deliveries, and is consistent with the results of our multivariate analysis, in which we reported twofold more OASIs with forceps delivery compared to vacuum delivery. This result is also consistent with the literature in which it is widely reported that the use of forceps for operative delivery is associated with an increased risk of OASI [17–19]. Finally, this result is consistent with the clinical conclusion that forceps (or spatulas) placed on the fetal head increase the fetal cephalic perimeter and particularly its transverse diameter, which induces more important stress to the perineum. In our team, obstetricians were free to use the instrument of their choice. There were no guidelines that recommend a type of instrument according to the indication of operative delivery. The proportion of vacuum-assisted deliveries increased from 2005 to 2015 which is consistent with the national French data which indicates that vacuum became the most commonly used instrument for operative delivery (50% of operative deliveries) [20]. Furthermore, the French 2018 guidelines recommend using preferentially a vacuum when an operative delivery is necessary and that several instrument can be used [21].

Due to its historical design, this study cannot conclude whether there is a protective effect of MLE for OASI occurrence during operative delivery and particularly for forceps- or spatula-assisted delivery. Nevertheless, considering that our rate of operative delivery remains stable whereas we reported an increase of cesarean section and vacuum-assisted deliveries (two outcomes expected to reduce the incidence of OASI) the hypothesis of the MLE's role is admissible. Only prospective studies and ideally a randomized trial (restrictive versus routine use of MLE during operative deliveries) could report such an association. The fact that most operative deliveries are performed within an emergency context leads to the necessity of including a very high number of women before the indication of procedure delivery to give information to women and obtain their free written consent [22]. Prenatal information about the possibility of an operative delivery, the risk of OASI and the question of the episiotomy delivered to a high number of women could be difficult to justify based on ethical considerations. Indeed, this information may be considered unnecessarily disturbing and inappropriate. In 2008, Murphy et al. published a pilot study for a randomized trial that reported these ethical difficulties and the fact that a complete randomized trial about this intervention would have to include a very high number of women [10]. Considering these difficulties of implementing a randomized trial to investigate the effect of MLE on the risk of OASI during operative delivery, one option leading to an analysis with a high level of evidence (level 2) may be a large prospective multicentric cohort analysis including practices of different centers with restrictive and liberal MLE use during operative delivery.

Conclusion

The implementation of a restrictive policy of MLE appears associated with an increase in OASI occurrence during operative delivery. The increase of OASI occurrence is significant in forceps-assisted delivery, but not vacuum- or spatula-assisted delivery. These results on a 11-year retrospective experience must be confirmed in prospective studies. The use of MLE to protect from OASI might be considered during instrumental delivery when other risk factors exist, particularly with forceps delivery.

Author contributions BG: wrote the main text of this manuscript, contribution to the study design, contribution to data analysis and interpretation, contribution to statistical analysis. He wrote the revised version of the manuscript. CFM: data collection, data analysis, statistical analysis, and review of each version of the manuscript. She reviewed the revised version of the manuscript. FP: contribution to the study design, contribution to data analysis and interpretation and review of each version of the manuscript. She reviewed the revised version of the manuscript. XF: contribution to the study design, contribution to data analysis and interpretation, contribution to statistical analysis, draft the work. She reviewed the revised version of the manuscript.

Funding There was no funding for this study.

Compliance with ethical standards

Conflict of interest The authors have no conflict of interest to disclose.

Ethical approval Ethical committee approval was not required for this study because we solely reported on anonymized data from patient's medical records. These data have been collected in accordance with our usual practices and patients underwent no supplementary procedures for this investigation. Upon admission, each patient at our institution receives an institutional chart that specifically mention the possibility that anonymized medical data collected during hospitalization could be used for medical research.

References

1. Fritel X, Gachon B, Desseauve D, Thubert T (2018) Anal incontinence and obstetrical anal sphincter injuries, epidemiology and prevention. Gynecol Obstet Fertil Senol 46:419–426
2. Mous M, Muller SA, de Leeuw JW (2008) Long-term effects of anal sphincter rupture during vaginal delivery: faecal incontinence and sexual complaints. BJOG 115:234–238

3. Royal College of Obstetricians and Gynaecologists. Green-top Guideline No. 29. The management of third- and fourth-degree perineal tears 2015. https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg29/. Accessed 7 July 2018
4. Baghestan E, Irgens LM, Bordahl PE, Rasmussen S (2010) Trends in risk factors for obstetric anal sphincter injuries in Norway. Obstet Gynecol 116:25–34
5. Ramm O, Woo VG, Hung YY, Chen HC, Ritterman Weintraub ML (2018) Risk factors for the development of obstetric anal sphincter injuries in modern obstetric practice. Obstet Gynecol 131:290–296
6. Jiang H, Qian X, Carroli G, Garner P (2017) Selective versus routine use of episiotomy for vaginal birth. Cochrane Database Syst Rev. https://doi.org/10.1002/14651858.CD000081.pub3
7. Van Bavel J, Hukkelhoven C, de Vries C, Papatsonis DNM, de Vogel J, Roovers JWR et al (2018) The effectiveness of mediolateral episiotomy in preventing obstetric anal sphincter injuries during operative vaginal delivery: a ten-year analysis of a national registry. Int Urogynecol J 29:407–413
8. Steiner N, Weintraub AY, Wiznitzer A, Sergienko R, Sheiner E (2012) Episiotomy: the final cut? Arch Gynecol Obstet 286:1369–1373
9. De Leeuw JW, de Wit C, Kuijken JP, Bruinse HW (2008) Mediolateral episiotomy reduces the risk for anal sphincter injury during operative vaginal delivery. BJOG 115:104–108
10. Murphy DJ, Macleod M, Bahl R, Goyder K, Howarth L, Strachan B (2008) A randomised controlled trial of routine versus restrictive use of episiotomy at operative vaginal delivery: a multicentre pilot study. BJOG 115:1695–1702
11. De Vogel J, Van der Leeuw-van Beek A, Gietelink D, Vujkovic M, De Leeuw JW, Van Bavel J et al (2012) The effect of a mediolateral episiotomy during operative vaginal delivery on the risk of developing obstetrical anal sphincter injuries. Am J Obstet Gynecol 206:404e401–405
12. Hudelist G, Gelle'n J, Singer C, Ruecklinger E, Czerwenka K, Kandolf O et al (2005) Factors predicting severe perineal trauma during childbirth: role of forceps delivery routinely combined with mediolateral episiotomy. Am J Obstet Gynecol 192:875–881
13. Youssef R, Ramalingam U, Macleod M, Murphy DJ (2005) Cohort study of maternal and neonatal morbidity in relation to use of episiotomy at instrumental vaginal delivery. BJOG 112:941–945
14. CNGOF (2006) Episiotomy: recommendations of the CNGOF for clinical practice. J Gynecol Obstet Biol Reprod 34:275–279
15. Bansal RK, Tan WM, Ecker JL, Bishop JT, Kilpatrick SJ (1996) Is there a benefit to episiotomy at spontaneous vaginal delivery? A natural experiment. Am J Obstet Gynecol 175:897–901
16. Goueslard K, Cottenet J, Roussot A, Clesse C, Sagot P, Quantin C (2018) How did episiotomy rates change from 2007 to 2014? Population-based study in France. BMC Pregnancy Childbirth 18:208
17. Fitzpatrick M, Behan M, O'Connell PR, O'Herlihy C (2003) Randomised clinical trial to assess anal sphincter function following forceps or vacuum assisted vaginal delivery. BJOG 110:424–429
18. Hamilton EF, Smith S, Yang L, Warrick P, Ciampi A (2011) Third- and fourth-degree perineal lacerations: defining high-risk clinical clusters. Am J Obstet Gynecol 204(309):e301–306
19. Simo Gonzalez M, Porta Roda O, Perello Capo J, Gich Saladich I, Calaf Alsina J (2015) Mode of vaginal delivery: a modifiable intrapartum risk factor for obstetric anal sphincter injury. Obstet Gynecol Int. https://doi.org/10.1155/2015/679470
20. Enquête national périnatale 2016. 2016. https://www.xn--epop-inserm-ebb.fr/wp-content/uploads/2017/10/ENP2016_rapport_complet.pdf. Accessed 28 Mar 2019
21. Ducarme G, Pizzoferrato AC, de Tayrac R, Schantz C, Thubert T, Le Ray C et al (2018) Perineal prevention and protection in obstetrics: CNGOF clinical practice guidelines. J Gynecol Obstet Hum Reprod. https://doi.org/10.1016/j.jogoh.2018.12.002
22. Lanz D, Moore P, Daru J (2018) Consent in obstetric emergency research—there is yet more to learn. BJOG. https://doi.org/10.1111/1471-0528.15340