Archives of Gynecology and Obstetrics (2019) 299:317–325
https://doi.org/10.1007/s00404-018-5009-9

REVIEW

Long-term effects of episiotomy on urinary incontinence and pelvic organ prolapse: a systematic review

Matteo Frigerio[1] · Salvatore A. Mastrolia[2] · Federico Spelzini[3] · Stefano Manodoro[3] · David Yohay[4] · Adi Y. Weintraub[4]

Received: 16 August 2018 / Accepted: 7 December 2018 / Published online: 18 December 2018

Abstract

Purpose To focus attention on the long-term effects of episiotomy on urinary incontinence and pelvic organ prolapse.

Methods A systematic review was conducted including only studies with mean follow-up ≥ 5 years. We searched using combinations of the following keywords and text words: "episiotomy", "perineal laceration", "perineal tear", "perineal damage" and "long term", "long term outcomes", "prolapse", "pelvic organ prolapse", "pelvic floor", "pelvic floor dysfunction", "urinary incontinence", "hysterocele", "cystocele" and "rectocele".

Results The electronic database search provided a total of 6154 results. After exclusions, 24 studies were included yielding the following results: (1) episiotomy might be detrimental with respect to urinary incontinence symptoms; (2) the relationship between episiotomy and anti-incontinence surgery is not clear; (3) episiotomy does not seem to negatively influence genital prolapse development and might even be protective with respect to prolapse severity and prevalence; (4) episiotomy does not seem to affect genital prolapse surgery rate.

Conclusions We did not find evidence for a long-term beneficial effect of episiotomy in the prevention of urinary incontinence symptoms and anti-incontinence surgery. Episiotomy does not seem to negatively influence genital prolapse development and might even be protective with respect to prolapse severity and prevalence without affecting surgery rates.

Keywords Episiotomy · Long-term outcomes · Pelvic organ prolapse · Pelvic floor dysfunction · Urinary incontinence · Systematic review

Introduction

Pelvic floor disorders (PFD), such as urinary incontinence (UI) and pelvic organ prolapse (POP), are extremely common and bothering conditions. Based on a cross-sectional study of women in the USA, the prevalence of at least one PFD is 23.7% [1]. Moreover, data suggest that PFD often coexist suggesting shared risk factors. For example, 7% of women over 40 years of age report both UI and POP [2]. The high prevalence of PFD results in a significant economic burden. Direct costs of ambulatory care for PFD in the USA were estimated to be $412 million in 2006 [3]. These costs, according to population projections based on population aging, are going to greatly increase in the next four decades [4]. Moreover, evidences suggest that epidemiological studies underestimate public health burden of PFD, as a significant portion of women with symptoms do not seek care [5]. Therefore, it is crucial to understand the pathophysiology of PFD to evaluate possible prevention strategies.

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00404-018-5009-9) contains supplementary material, which is available to authorized users.

✉ Matteo Frigerio
frigerio86@gmail.com

[1] Department of Obstetrics and Gynecology, Milano-Bicocca University, ASST Monza, Ospedale San Gerardo, Monza, University Milano-Bicocca, Via Pergolesi 33, 20900 Monza, MB, Italy

[2] Department of Obstetrics and Gynecology, Ospedale dei Bambini Vittore Buzzi, University of Milan, Milan, Italy

[3] Department of Obstetrics and Gynecology, AUSL Romagna, Ospedale Infermi, Rimini, Italy

[4] Department of Obstetrics and Gynecology, Soroka University Medical Center, Ben Gurion University of the Negev, Beer Sheva, Israel

The most accounted model describing the pathophysiology of PFD is the chronic disease life span approach, which emphasizes the chronological impact of different types of exposure variables as well as their inter-relationship [6, 7]. According to DeLancey, three specific phases can be identified [7]. Phase I accounts for predisposing factors such as genetic predisposition and growth. Phase II corresponds to provoking factors, in which birth-induced damage to the pelvic floor has a major role. Phase III accounts for intervening factors such as aging, obesity and lifestyle practices.

Current literature suggests that childbirth and in particular vaginal childbirth has the strongest association with PFD. Childbirth appears to be significantly associated with both UI and POP [8]. In contrast, cesarean delivery reduces the odds of pelvic floor disorders later in life [9]. Therefore, identifying modifiable risk factors for PFD such as obstetrical interventions during vaginal childbirth is of the utmost importance. In particular, the role of episiotomy in the prevention of future PFD is still controversial.

Episiotomy was first described by Ould [10]. It was recommended starting from the early 1900s as a strategy to protect the pelvic floor from extreme lacerations and to thereby reduce "pelvic relaxation" [11–13]. However, more recent reports claimed that episiotomy had no such benefits on pelvic floor [14–16]. A systematic review concluded that the impact of episiotomy on the development of PFD remains unknown [17]. This is even truer with respect to long-term pelvic floor symptoms.

Our goal was to focus attention on the long-term effects of episiotomy on UI and POP, by systematically reviewing the best available evidence. Specifically, we sought to describe outcomes such as prevalence, severity and surgical intervention for UI and POP conditions.

Materials and methods

Study protocol

This systematic review was conducted and reported according to the PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses. Study objectives, eligibility criteria, outcome definitions, search strategy, data extraction process, statistical analyses, and method of study quality assessment were all defined in a protocol.

Eligibility criteria

Studies assessing the long-term effect of episiotomy on pelvic floor dysfunction were included. Only studies with mean follow-up ≥ 5 years were included to assess long-term effects of episiotomy. In addition, reviews, letters to editor, conference abstracts, book chapters, guidelines, Cochrane reviews, and expert opinions were excluded.

Outcome definition

We divided our analysis according to the pelvic floor dysfunction using POP and UI prevalence and surgery rate as outcome measures. In particular, we considered as outcomes for urinary incontinence the prevalence and the rate of anti-incontinence surgery. When data on stress UI and urge UI subtypes were available, we considered the different prevalences. Similarly for POP, we considered prevalence and surgical repair rates as outcomes. We also considered data on severity in terms of symptoms or stage/grade when available.

Data source and literature search

To identify potentially eligible studies, we searched PubMed, Scopus, Cochrane Library, and ISI Web of Science (up to August 31, 2017). Reference lists of identified studies were also reviewed. No language restrictions were initially applied. We used a combination of keywords and text words represented by "episiotomy", "perineal laceration", "perineal tear", "perineal damage" and "long term", "long term outcomes", "prolapse", "pelvic organ prolapse", "pelvic floor", "pelvic floor dysfunction", "urinary incontinence", "hysterocele", "cystocele", and "rectocele". An example for the complete search strategy used for the PubMed search is presented in Suppl. Table 1. Two reviewers (SAM, MF) independently screened titles and abstracts of the records that were retrieved through the database searches. Both reviewers independently recommended studies for the full-text review. Full texts of records recommended by at least one reviewer were screened independently by the same two reviewers and assessed for inclusion in the systematic review. Disagreements between reviewers were solved by consensus.

Data extraction

Data were extracted using a form specifically designed for capturing information on study and characteristics (inclusion and exclusion criteria, sample size, end points and follow-up).

Results

Study assessment

The electronic database search provided a total of 6154 results (Fig. 1). After duplicate exclusion, there were

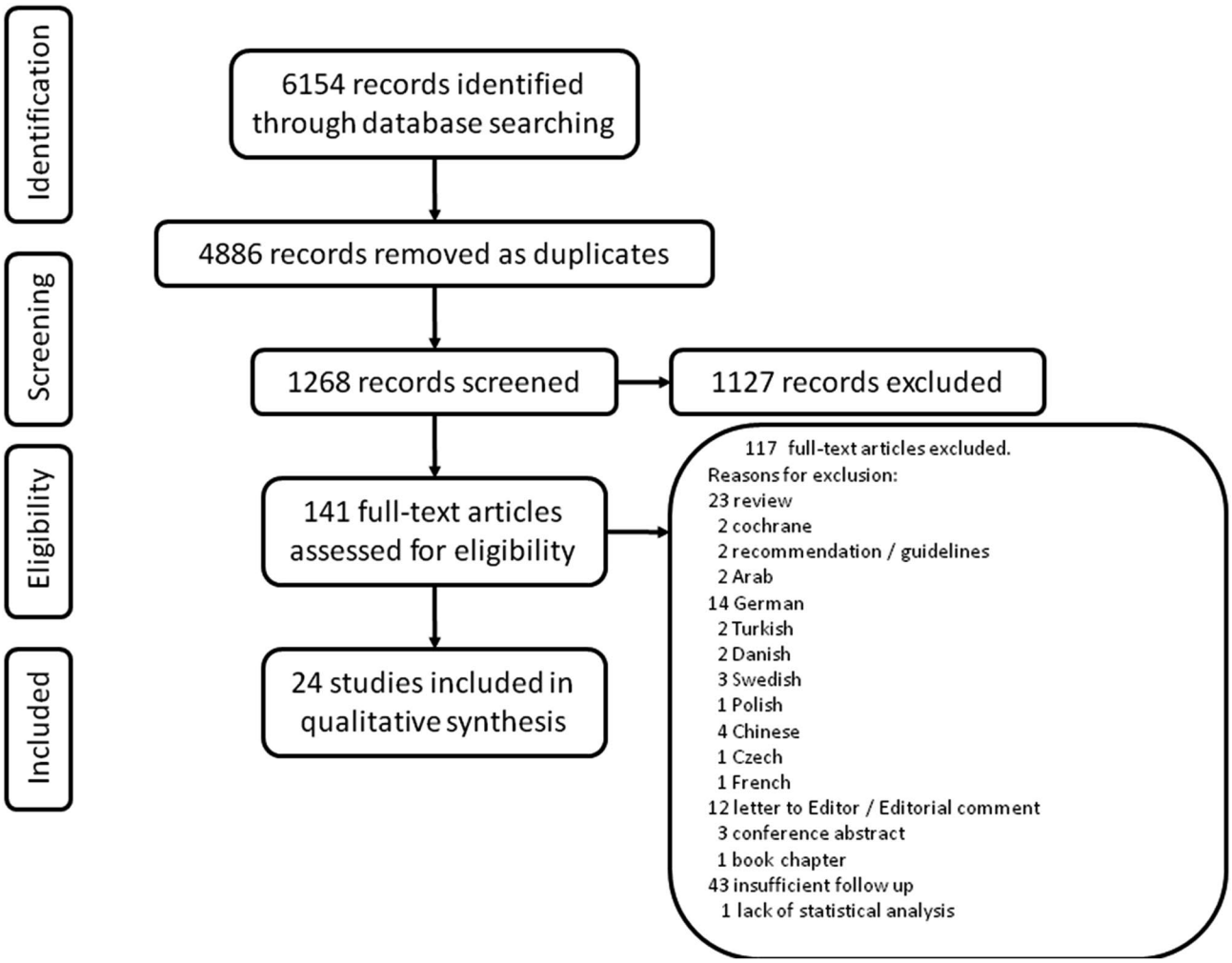

Fig. 1 The electronic database search

1268 citations left. Of them, 1127 were not relevant to the review based on title and abstract screening. One hundred and forty-one studies were considered for full-text assessment, of which 117 were excluded for the following reasons. There were 3 conference abstracts, 33 reviews, 2 Cochrane reviews, 2 guidelines, 12 letters to the editors, and 1 book chapter. We could not translate 30 papers (14 German, 4 Chinese, 3 Swedish, 2 Danish, 2 Arabic, 2 Turkish, 1 Polish, 1 Czech, and 1 French). Forty-three papers were excluded due to insufficient follow-up. Finally, one paper was excluded due to lack of statistical analysis. Overall, 24 studies met the inclusion criteria and were incorporated into the final assessment [16, 18–40]. The main characteristics of these studies and their individual results are listed in Table 1 for UI and Table 2 for POP. Different study designs resulted from the selection process, including register linkage, case–control, cross-sectional and prospective studies. The studies included were very heterogenic clinically. All the outcome measures for UI and POP stated in "Materials and methods" were considered.

The long-term effect of episiotomy on urinary incontinence

Upon evaluating the long-term impact of episiotomy on UI, 18 studies were analyzed [18–35]. In 11 studied we were able to retrieve the effect of episiotomy on the overall prevalence of UI. A higher prevalence of UI was noted after episiotomy in three studies (56.9% vs 43.1%, $p=0.047\%$; n/a vs n/a, $p=0.039$; n/a vs n/a, OR 1.95 [1.66–2.28]) [18–20]. On the converse, prevalence of UI showed similar results in the remaining eight studies [21–28]. With respect to the subtype of UI, SUI was specifically evaluated by four studies [29–32]. Three of the four studies [29–31] did not find any difference in the prevalence of SUI among women with and without an episiotomy, while the remaining one study [32] showed a higher prevalence of SUI after episiotomy.

Table 1 Main characteristics of the studies incorporated in the systematic review for urinary incontinence

Study	Country	Type of study	Outcome	Outcome detection	Mean follow-up	Patients included in the analysis	Episiotomy rate (%)	Episiotomy (+)	Episiotomy (−)	*p* value	OR
Abdel-Fattah et al. [33]	UK	Register linkage	UI surgery	Registry	n/a	33,263	27.3	239 (2.6%)	523 (2.2%)	0.035	1.22 [1.01–1.46]
Akkus et al. [18]	Turkey	Cross-sectional	Prevalence of UI	Questionnaire	n/a	150	57.5	56.9%	43.1%	0.047	n/a
Alling Moller et al. [29]	Denmark	Cross-sectional	Prevalence of SUI	Questionnaire	n/a	1244	56.7	275 (46.1%)	227 (35.0%)	0.332	n/a
Dogan et al. [21]	Turkey	Case–Control	Prevalence of UI	Questionnaire	≥5 years	150	n/a	0 (0%)	0 (0%)	ns	n/a
Foldspang et al. [22]	Denmark	Cross-sectional	Prevalence of UI	Questionnaire	n/a	6240	60.2	n/a	n/a	ns	n/a
Ge et al. [19]	China	Cross-sectional	Prevalence of UI	Questionnaire	n/a	3058	36.9	n/a	n/a	0.039	1.26 [1.01–1.57]
Handa et al. [30]	USA	Prospective	Prevalence of SUI Prevalence of UUI	Questionnaire	7.5 years	449	61.0	39 (14.3%) 28 (10.3%)	32 (18.2%) 17 (9.7%)	0.470 0.718	0.71 [0.41–1.25] 0.90 [0.45–1.81]
Kilic [23]	Turkey	Cross-sectional	Prevalence of UI	Medical interview	n/a	430	43.2	73 (39.2%)	87 (35.7%)	0.769	1.00 [0.91–1.09]
Oliveira et al. [24]	Brazil	Cross-sectional	Prevalence of UI	Questionnaire	n/a	253	57.0	74 (55.2%)	28 (23.5%)	0.06	2.4 [0.95–6.5]
Persson et al. [34]	Sweden	Register linkage	UI surgery	Registry	n/a	1463	32.7	n/a	n/a	n/a	0.82 [0.68–0.98]
Rincon Ardila [25]	Chile	Cross-sectional	Prevalence of UI	Questionnaire	n/a	213	81.2	115 (66.5%)	23 (57.5%)	0.28	1.16 [0.87–1.54]
Samuelsson [26]	Sweden	Cross-sectional	Prevalence of UI	Questionnaire	n/a	264	20.1	35 (35.7%)	75 (45.2%)	ns	n/a
Song et al,. [32]	China	Cross-sectional	Prevalence of SUI Prevalence of UUI	Questionnaire	n/a	4684	34.8	384 (23.5%) 228 (17.1%)	393 (12.9%) 240 (7.9%)	<.001 <.001	1.7 [1.4–2.0] 1.4 [1.1–1.8]
Thom et al. [27]	USA	Cross-sectional	Prevalence of UI	Questionnaire	n/a	1257	90.8	36%	33.9%	ns	1.1 [0.67–1.81]
Torkestani et al. [28]	Iran	Case–control	Prevalence of UI	Questionnaire	n/a	250	62.8	94 (75.2%)	31 (24.8%)	ns	1.2 [0.37–1.95]
Uma et al. [35]	UK	Register linkage	Pelvic floor surgery	Registry	14–51 years	1755	44.0	173 (21.1%)	189 (19.2%)	ns	1.46 [0.99–2.10]
Viktrup [31]	Denmark	Prospective	Prevalence of SUI	Questionnaire	5 years	278	52	n/a	n/a	ns	n/a

Table 1 (continued)

Study	Country	Type of study	Outcome	Outcome detection	Mean follow-up	Patients included in the analysis	Episiotomy rate (%)	Episiotomy (+)	Episiotomy (−)	*p* value	OR
Zhang et al. [20]	China	Cross-sectional	Prevalence of storage symptoms	Questionnaire	n/a	6066	n/a	n/a	n/a	n/a	1.95 [1.66–2.28]

Urge urinary incontinence was analyzed in two studies [30, 32] and was found to be associated with episiotomy only in one [32]. Overall, none of the considered manuscripts reported a protective effect of episiotomy on the prevalence of UI. When considering the impact of episiotomy on anti-incontinence surgery rate, three register linkage studies were analyzed with a total of 37,849 patients and demonstrated contrasting results [33–35]. While Abdel-Fattah et al. [33] showed an increased risk of anti-incontinence surgery after episiotomy compared to controls, Persson et al. [34] reported a protective effect of episiotomy from anti-incontinence procedures. Differently, the study from Uma et al. [35] did not show any difference between patients in the episiotomy group and controls in terms of mixed pelvic floor surgery rate (including anti-incontinence surgery).

The long-term effect of episiotomy on pelvic organ prolapse

In evaluating the long-term impact of episiotomy on genital prolapse, nine studies were analyzed [16, 30, 33, 35–40]. Five studies evaluated the prevalence of POP. Four of the five did not find any significant difference between the episiotomy group and controls [16, 30, 36, 37], although one study reported a borderline significant association ($p=0.05$) [37]. Interestingly no differences were also found when specific prolapse compartments (anterior, posterior, central) were analyzed [36]. The remaining study conversely showed a protective effect of episiotomy from POP (0% vs 25%, $p=0.046$) [38]. When we studied the effect of episiotomy on the prevalence of prolapse symptoms (such as feeling of a vaginal bulge), no differences were found in the analyzed papers [30, 39]. Conversely, prolapse severity was found to be reduced after episiotomy compared with non-episiotomized controls [40]. Finally, no differences were found in POP/pelvic floor surgery rates in the register linkage studies [33, 35].

Discussion

Principal findings of the study

Pelvic floor dysfunction includes a group of disorders causing abnormalities of urine and bowel storage and emptying prolapse of the pelvic organs with their accompanying symptoms, as well as chronic pelvic pain and sexual dysfunction. Genital prolapse and urinary incontinence are common and bothersome conditions that may affect performance in all aspects of life including work, traveling, physical exercise, sexual function, and sleep. Episiotomy is a surgical incision of the perineum and the posterior vaginal wall aimed to quickly enlarge the opening for the baby performed

Table 2 Main characteristics of the studies incorporated in the systematic review for pelvic organ prolapse

Study	Country	Type of study	Outcome	Outcome detection	Mean follow-up	Patients included in the analysis	Episiotomy rate	Episiotomy (+)	Episiotomy (−)	*p* value	OR
Abdel-Fattah et al. [33]	UK	Register linkage	POP surgery	Register	n/a	34,631	27.3%	412 (4.4%)	109 (4.4%)	0.37	1.05 [0.94–1.18]
Aytan et al. [36]	Turkey	Cross-sectional	POP-Q stage Prevalence of POP ≥ 2 stage	Outpatient visit	n/a	549	80.0%	n/a 42 (38.2%)	n/a 141 (32.1%)	0.26 0.23	n/a n/a
Espitia [37]	Colombia	Cross-sectional	Prevalence of POP	Outpatient visit	n/a	13,826	n/a	80.7%	70.5%	0.05	n/a
Garshasbi et al. [40]	Iran	Cross-sectional	POP severity	Outpatient visit	n/a	3730	n/a	n/a	n/a	< 0.002	0.34 [0.14–0.53]
Gurel et al. [38]	Turkey	Cross-sectional	POP prevalence	Outpatient visit	n/a	250	20.8%	0 (0%)	52 (25%)	0.046	n/a
Gyhagen et al. [39]	Sweden	Cross-sectional	Symptomatic POP prevalence	Questionnaire	20 years	5236	9.5%	13.7%	14.8%	n/a	0.92 [0.70–1.20]
Handa et al. [30]	USA	Prospective	Prevalence of POP symptoms Prevalence of POP ≥ 2 grade	Questionnaire	7.5 years	449	61.0%	11 (4.0%) 39 (14.3%)	8 (4.5%) 25 (14.2%)	0.249 0.999	n/a 1.01 [0.55–1.84]
Tegerstedt et al. [16]	Sweden	Cross-sectional	Prevalence of POP	Questionnaire	n/a	491	39.5%	137 (62.6%)	144 (52.9%)	ns	1.4 [0.97–2.1]
Uma et al. [35]	UK	Register linkage	Pelvic floor surgery	Registry	14–51 years	1755	44.0%	173 (21.1%)	189 (19.2%)	ns	1.46 [0.99–2.10]

during second stage of labor. We reviewed in the current literature the long-term effects of episiotomy on UI and POP. Twenty-four studies [16, 18–40] were included in the present review, yielding the following results: (1) episiotomy does not seem to be protective with respect to stress and urge urinary incontinence symptoms and might even be detrimental; (2) the relationship between episiotomy and anti-incontinence surgery is not clear due to conflicting reports; (3) episiotomy does not seem to negatively influence genital prolapse development and might be protective with respect to prolapse severity and prevalence; (4) episiotomy does not seem to affect the rate of genital prolapse surgery. It should be stressed that these findings are based mainly on retrospective case–control, cross-sectional, and register linkage studies and no RCT were available. Hence, our results should be taken as pointing toward a direction for further investigation, acknowledging the limited available data.

What is the effect of episiotomy on the prevalence of urinary incontinence?

In evaluating the long-term impact of episiotomy on the prevalence of UI, 15 studies were analyzed [18–32]. The majority (11/15) reported a similar risk of overall UI [21–28], SUI [29–31] and urge UI [30] irrespective of previous episiotomy. None of the considered papers reported a protective effect of episiotomy on the prevalence of UI. Conversely, three studies reported a higher incidence of overall UI (56.9% vs 43.1%, $p=0.047$%; n/a vs n/a, $p=0.039$; n/a vs n/a, OR 1.95 [1.66–2.28]) [18–20]. Akkus et al. [18] in a cross-sectional study of 150 patients found a 56.9% prevalence of urinary incontinence in patients with previous episiotomy compared to 43.1% in controls ($p=0.047$). Ge et al. [19] reported an increased risk of UI after episiotomy in a cohort of 3058 patients (OR 1.26; 95% CI 1.01–1.57). Similarly, Zhang et al. [20] found in a large cross-sectional study a significant association between UI and episiotomy (OR 1.95; 95% CI 1.66–2.28). Finally, with regard to the type of UI, Song et al. [32] reported an increase in both stress (OR 1.7; 95% CI 1.4–2.0) and urge (OR 1.4; 95% CI 1.1–1.8) UI. In conclusion, episiotomy does not seem to be protective against UI symptoms, including both stress and urge UI, and it might represent a risk factor.

What is the effect of episiotomy on anti-incontinence surgery rate?

In total, three register linkage studies were available to analyze the impact of episiotomy on UI surgery [33–35]. Abdel-Fattah et al. [33], in a large register linkage study, reported a rate of anti-incontinence procedures of 2.6% in women with a previous episiotomy versus 2.2% in controls (OR 1.22; 95% CI 1.01–1.46). Conversely, Persson et al. [34] in a smaller register linkage study found a protective effect of episiotomy on anti-incontinence surgery (OR 0.82; 95% CI 0.68–0.98). Finally, Uma et al. [35] did not show any difference between the episiotomy group and controls in terms of mixed pelvic floor surgery rate including anti-incontinence procedures (21.1% vs 19.2%; CI 0.99–2.10). Hence, the relationship between episiotomy and anti-incontinence surgery is yet unclear due to contrasting reports.

What is the effect of episiotomy on the prevalence and severity of pelvic organ prolapse?

In total, seven studies were available to analyze the impact of episiotomy in the prevention of POP [16, 30, 36–40]. The majority of studies (5/7) reported a similar risk of prolapse (62.6% vs 52.9%, $p=$ ns; 14.3% vs 14.2%, $p=0.99$; 38.2% vs 32.1, $p=0.23$; 80.7% vs 70.5%, $p=0.05$) [16, 30, 36, 37] and symptomatic prolapse (4.0% vs 4.5%, $p=0.25$; 13.7 vs 14.8, $p=$ n/a, OR 0.92 [0.70–1.20]) [30, 39] irrespective of previous episiotomy. None of the studies reported a statistically significant increase of POP risk. However, two papers showed a protective effect of episiotomy against POP [38, 40]. Gurel et al. [38] in a cross-sectional study of 250 patients found no cases of POP in women who underwent episiotomy as compared with 25% in controls ($p=0.046$). According to Garshasbi et al. [40], POP severity according to the POP-Q stage seemed to be reduced after episiotomy compared with controls (OR 0.34; 95% CI 0.14–0.53). In conclusion, episiotomy at least does not seem to detrimentally affect the development of POP and might even be protective with respect to POP prevalence and severity. It may be speculated that episiotomy may shorten the second stage of labor, thus reducing nerve injury and trauma to the levator ani muscles. Moreover, scar tissue and fibrosis generated after the correction of episiotomy might act as a protective factor against future prolapse.

What is the effect of episiotomy on pelvic organ prolapse surgery rate?

Two studies were reviewed to investigate the relationship between POP surgery and episiotomy. Abdel-Fattah et al. [33], in a large register linkage study, reported a POP surgery rate of 44% irrespective of previous episiotomy. The difference between groups was not significantly different (OR 1.05, 95% CI 0.94–1.18). Similarly, Uma et al. [35] did not show any difference between patients who underwent episiotomy and controls in terms of POP surgery rates (21.1% vs 19.2%; CI 0.99–2.10; $p=$ n/a). Based on these studies, episiotomy does not seem to affect POP surgery rates.

Strengths and limitations of the study

The major strength of our analysis is the large sample size, robust methodology, and consistency of the results in the analyses. Another strength of our study is that in contrast to prior systematic reviews, only studies with long-term follow-up were included (≥ 5 years). However, there are certain limitations inherent to any systematic review. Firstly, different obstetrical practices for episiotomy in different countries may affect the results. Unluckily, data on specific indication for episiotomy (maternal/fetal) were not available. Similar considerations can be made about the type of episiotomy, since comparison between mediolateral and midline episiotomy is not available. The second point is the high heterogeneity among the study designs and outcomes measures, which leads to the fact that we cannot compare/merge data about pelvic floor disorders. Finally, the lack of randomized controlled trials (RCT) makes it impossible to perform a meta-analysis.

In conclusion, according to our systematic review we did not find evidences for a long-term beneficial impact of episiotomy in the prevention of urinary incontinence symptoms and anti-incontinence surgery. Episiotomy does not seem to negatively influence genital prolapse development and might even reduce prolapse severity and prevalence without affecting surgical rates. The role of episiotomy in the prevention of pelvic floor disorders needs to be evaluated in specifically targeted prospective studies before further conclusions can be made.

Author contributions MF: project development, data collection, manuscript writing. SAM: project development, data collection, manuscript writing. FS: project development, data collection, manuscript writing. SM: project development, data collection, manuscript writing. DY: project development, data collection, manuscript writing. AYW: project development, data collection, manuscript writing.

Funding None.

Compliance with ethical standards

Conflict of interest We declare that we have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. Nygaard I, Barber MD (2008) Prevalence of symptomatic pelvic floor disorders in US women. JAMA 300(11):1311–1316
2. Rortveit G, Subak LL, Thom DH, Creasman JM, Vittinghoff E, Van Den Eeden SK et al (2010) Urinary incontinence, fecal incontinence and pelvic organ prolapse in a population-based, racially diverse cohort. Female Pelvic Med Reconstr Surg 16(5):278–283
3. Sung VW, Washington B, Raker CA (2010) Costs of ambulatory care related to female pelvic floor disorders in the United States. Am J Obstet Gynecol 202(5):483.e1–483.e4
4. Wu JM, Kawasaki A, Hundley AF, Dieter AA, Myers ER, Sung VW (2011) Predicting the number of women who will undergo incontinence and prolapse surgery, 2010 to 2050. Am J Obstet Gynecol 205(3):230.e1–230.e5
5. Minassian VA, Yan XS, Lichtenfeld MJ, Sun H, Stewart WF (2012) The iceberg of health care utilization in women with urinary incontinence. Int Urogynecol J 23(8):1087–1093
6. Ben-Shlomo Y, Kuh D (2002) A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. Int Epidemiol Assoc 31:285–293
7. DeLancey JOL, Low LK, Miller JM, Patel DA, Tumbarello JA (2008) Graphic integration of causal factors of pelvic floor disorders: an integrated life span model. Am J Obstet Gynecol 199:610.e1–610.e5
8. Hallock JL, Handa VL (2016) The epidemiology of pelvic floor disorders and childbirth: an update. Obstet Gynecol Clin North Am 43(1):1–13
9. Handa VL, Blomquist JL, Knoepp LR, Hoskey KA, McDermott KC, Muñoz A (2011) Pelvic floor disorders 5–10 years after vaginal or cesarean childbirth. Obstet Gynecol 118:777–784
10. Ould F (1748) A treatise on midwifery in three parts. Oli Nelson and Charles Connor, Dublin
11. DeLee JB (1920) The prophylactic forceps operation. Am J Obstet Gynecol 1:34–44
12. Aldridge AH, Watson P (1935) Analysis of end-results of labor in primiparas after spontaneous versus prophylactic methods of delivery. J Obstet Gynecol 30:554–565
13. Nugent FB (1935) The primiparous perineum after forceps delivery. Am J Obstet Gynecol 30:249–256
14. Steiner N, Weintraub AY, Wiznitzer A, Sergienko R, Sheiner E (2012) Episiotomy: the final cut? Arch Gynecol Obstet 286(6):1369–1373
15. Viktrup L, Lose G (2001) The risk of stress incontinence 5 years after first delivery. Am J Obstet Gynecol 185:82–87
16. Tegerstedt G, Miedel A, Maehle-Schmidt M, Nyrén O, Hammarström M (2006) Obstetric risk factors for symptomatic prolapse: a population-based approach. Am J Obstet Gynecol 194:75–81
17. Hartmann K, Viswanathan M, Palmieri R, Gartlehner G, Thorp J, Lohr KN (2005) Outcomes of routine episiotomy: a systematic review. JAMA 293:2141–2148
18. Akkus Y, Pinar G (2016) Evaluation of the prevalence, type, severity, and risk factors of urinary incontinence and its impact on quality of life among women in Turkey. Int Urogynecol J 27(6):887–893
19. Ge J, Yang P, Zhang Y, Li X, Wang Q, Lu Y (2015) Prevalence and risk factors of urinary incontinence in Chinese women: a population-based study. Asia Pac J Public Health. 27(2):NP1118–NP1131
20. Zhang W, Song Y, He X, Xu B, Huang H, He C et al (2005) Prevalence and risk factors of lower urinary tract symptoms in Fuzhou Chinese women. Eur Urol 48(2):309–313
21. Doğan B, Gün İ, Özdamar Ö, Yılmaz A, Muhçu M (2017) Long-term impacts of vaginal birth with mediolateral episiotomy on sexual and pelvic dysfunction and perineal pain. J Matern Fetal Neonatal Med. 30(4):457–460
22. Foldspang A, Mommsen S, Djurhuus JC (1999) Prevalent urinary incontinence as a correlate of pregnancy, vaginal childbirth, and obstetric techniques. Am J Public Health 89(2):209–212
23. Kılıç M (2016) Incidence and risk factors of urinary incontinence in women visiting Family Health Centers. Springerplus. 5(1):1331

24. Oliveira E, Zuliani LMM, Ishicava J, Silva SV, Albuquerque SSR, Souza AMB et al (2010) Evaluation of factors related to the occurrence of female urinary incontinence. Rev Assoc Med Bras 56(6):688–690
25. Rincón AO (2015) Caracterización clínica de la incontinencia urinaria y factores asociados en usuarias de la Unidad de la Mujer del Centro de Salud Familiar "Ultraestación" en la ciudad de Chillán, Chile. Rev Méd Chile 143(2):203–212
26. Samuelsson E, Victor A, Svärdsudd K (2000) Determinants of urinary incontinence in a population of young and middle-aged women. Acta Obstet Gynecol Scand 79(3):208–215
27. Thom DH, Brown JS, Schembri M, Ragins AI, Creasman JM, Van Den Eeden SK (2011) Parturition events and risk of urinary incontinence in later life. Neurourol Urodyn 30(8):1456–1461
28. Torkestani F, Zafarghandi N, Davati A, Hadavand SH, Garshasbi M (2009) Case-controlled study of the relationship between delivery method and incidence of post-partum urinary incontinence. J Int Med Res. 37(1):214–219
29. Alling Møller L, Lose G, Jørgensen T (2000) Risk factors for lower urinary tract symptoms in women 40 to 60 years of age. Obstet Gynecol 96(3):446–451
30. Handa VL, Blomquist JL, McDermott KC, Friedman S, Muñoz A (2012) Pelvic floor disorders after vaginal birth: effect of episiotomy, perineal laceration, and operative birth. Obstet Gynecol 119(2 Pt 1):233–239
31. Viktrup L (2002) The risk of lower urinary tract symptoms five years after the first delivery. Neurourol Urodyn 21(1):2–29
32. Song YF, Zhang WJ, Song J, Xu B (2005) Prevalence and risk factors of urinary incontinence in Fuzhou Chinese women. Chin Med J (Engl). 118(11):887–892
33. Abdel-Fattah M, Familusi A, Fielding S, Ford J, Bhattacharya S (2011) Primary and repeat surgical treatment for female pelvic organ prolapse and incontinence in parous women in the UK: a register linkage study. BMJ Open 1(2):e000206
34. Persson J, Wolner-Hanssen P, Rydhstroem H (2000) Obstetric risk factors for stress urinary incontinence: a population-based study. Obstet Gynecol 96(3):440–445
35. Uma R, Libby G, Murphy DJ (2005) Obstetric management of a woman's first delivery and the implications for pelvic floor surgery in later life. BJOG 112(8):1043–1046
36. Aytan H, Tok EC, Ertunc D, Yasa O (2014) The effect of episiotomy on pelvic organ prolapse assessed by pelvic organ prolapse quantification system. Eur J Obstet Gynecol Reprod Biol 173:34–37
37. Espitia de la Hoz FJ (2015) Factores de riesgo asociados con prolapso genital femenino: estudio de casos y controles. Urol Colomb 24:12–18
38. Gürel H, Gürel SA (1999) Pelvic relaxation and associated risk factors: the results of logistic regression analysis. Acta Obstet Gynecol Scand 78(4):290–293
39. Gyhagen M, Bullarbo M, Nielsen TF, Milsom I (2013) Prevalence and risk factors for pelvic organ prolapse 20 years after childbirth: a national cohort study in singleton primiparae after vaginal or caesarean delivery. BJOG 120(2):152–160
40. Garshasbi A, Faghih-Zadeh S, Falah N (2006) The status of pelvic supporting organs in a population of iranian women 18–68 years of age and possible related factors. Arch Iran Med. 9(2):124–128