What is known about 3rd and 4th degree lacerations occurring during vaginal birth?

Evidence Summary No. 9

Developed as part of the OHRI-Champlain LHIN Knowledge to Action research program For BORN Ontario

December 2010

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What is known about 3rd and 4th degree lacerations during birth?

This report summarizes evidence around 3rd and 4th degree perineal lacerations) occurring from vaginal birth (both spontaneous and assisted). Specifically, it provides information on the incidence of and risk factors for 3rd/4th degree lacerations, as well as best practices for their prevention. Its intention is to support efforts that seek to reduce rates of this type of perineal trauma in women who give birth in Ontario.

Key Messages

- Third and 4th degree tears are severe vaginal lacerations extending from the perineum to the anal sphincter and anus. They can occur during spontaneous or assisted vaginal delivery and are associated with significant short- and long-term morbidity, including pain, incontinence, and impaired sexual function. Accordingly, efforts to prevent 3rd/4th degree tears should be maximized.

- Nationally, rates of 3rd and 4th degree lacerations are 3.3% and 0.6%, respectively. Provincially however, Ontario reports higher rates than several provinces and territories. There is opportunity for improvement.

- Risk factors commonly found to be associated with 3rd/4th degree lacerations from prospective data include nulliparity, higher birth weight, and forceps delivery. In addition, risks identified by retrospective data are persistent occipitoposterior position, induction of labour, epidural analgesia, second stage labour longer than 1 hour, shoulder dystocia, and midline episiotomy.

- Data from RCTs indicate that while the preventative practice of antenatal perineal massage does not improve rates of 3rd/4th degree tears specifically, it does reduce perineal trauma generally (mainly from reduced episiotomies). This practice can be recommended. This pattern was similar with the practices of upright delivery position and the 'hands-poised' technique.

Who is this summary for?

This summary was undertaken for BORN Ontario and is intended for use by local health systems stakeholders, policy-makers and decision-makers within Ontario.

Information about this evidence summary

This report covers a broad collection of literature and evidence sources **with a search emphasis on systematic reviews.**

As such, evidence summarized from systematic reviews is highlighted in blue boxes, like this one. Systematic reviews are generally favoured over other study designs, because they incorporate evidence from multiple primary studies, instead of reporting evidence from just one study.

☑ This summary includes:

- **Key findings** from a broad collection of recent literature and evidence sources.

☒ This summary does not include:

- **Recommendations**;
- **Additional information** not presented in the literature;
- **Detailed descriptions of the interventions** presented in the studies.

Many sections conclude with a **"Bottom line"** subsection that provides a statement summarizing the studies or aims to provide some context. These statements are not meant to address all of the evidence in existence on the subject, rather, only that which is featured in this document.

All papers summarized in this document are available by request to kkonnyu@ohri.ca.

I. Background

Vaginal tears can occur during childbirth as a consequence of a baby's presenting part passing through the vaginal opening. Relatively minor tears (i.e. lacerations) are restricted to the perineal skin (1st degree), whereas more serious tears run deeper into the perineal muscle (2nd degree) and can involve the anal sphincter and anus (3rd and 4th degree).[1] Lacerations can occur with both spontaneous and assisted vaginal deliveries (forceps or vacuum extraction), although they occur more frequently with the latter.[2] Following perineal trauma, women can experience significant short- and long-term morbidity, including pain, incontinence, and impaired sexual function.[3] Women experiencing 3rd and 4th degree tears tend to have more severe adverse outcomes.

Accordingly, extensive work has been undertaken to understand and reduce the rates of 3rd and 4th degree lacerations. The purpose of this evidence summary is to advance the understanding of 3rd and 4th degree lacerations – their incidence, determinants, and best practices for prevention.

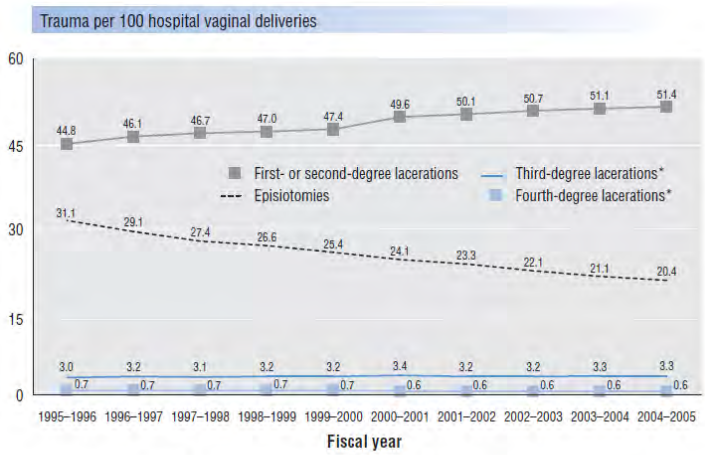
II. Evidence

a. Rates of 3rd/4th degree lacerations

According to the Canadian Perinatal Health Report, the combined national rate of 3rd and 4th degree lacerations in 2004-2005 was 3.9% (Figure 1; 3rd degree=3.3%; 4th degree=0.6%). This value has remained relatively constant since 1995-1996, fluctuating only from 3.7-4.0%.[4]

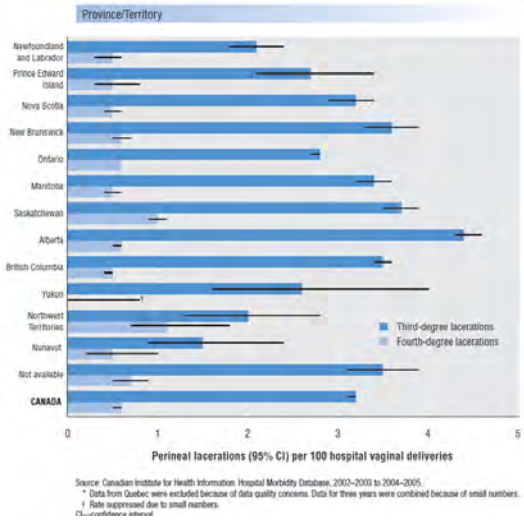
Regionally however, rates have been more variable. In the combined years 2002/2003 to 2004/2005, rates of 3rd and 4th degree tears varied across the provinces and territories (Figure 2). Ontario rates appear to be in the middle of other Canadian provinces and territories.

Figure 1. Rate of trauma to the perineum by perineal laceration and episiotomy in Canada, 1995-1996 to 2004-2005



Source: Canadian Institute for Health Information. Hospital Morbidity Database, 1995–1996 to 2004–2005.
* Data for Quebec were excluded because of data quality concerns.

Figure 2. Rate of third- and fourth-degree perineal laceration, by province/territory



Source: Canadian Institute for Health Information. Hospital Morbidity Database, 2002–2003 to 2004–2005.
* Data from Quebec were excluded because of data quality concerns. Data for three years were combined because of small numbers.
† Rate suppressed due to small numbers.

According to recent estimates from 2009-2010, over 11% of women having a vaginal birth in Ontario suffer a 3rd or 4th degree laceration. Of these, 1.9% occurred during spontaneous vaginal birth, and 9.8% occurred during assisted vaginal birth.[5]

Canadian rates (and their variability) are consistent with those reported in a recent Cochrane review, that is, 3rd/4th degree tears being identified after 3-4% of all vaginal births.[3] This report cited inconsistency in definitions and reporting practices as explanatory factors for the considerable variation of rates observed. [3]

b. Determinants of 3rd/4th degree lacerations

Study	Country (n, demographic)	Primary methods	Question	Incidence of 3rd/4th degree lacerations	Significant predictors
i. Studies assessing multiple risk factors					
Klein et al. (1997) [6]	Canada (n=459 nulliparous women having vaginal birth from 3 hospitals)	Prospective cohort (secondary analysis RCT); logistic regression	What are the risk factors for 3rd/4th degree tears?	16.3%	*Risk factors* • Heavier birth weight • Forceps delivery
Zetterström et al. (1999) [7]	Sweden (n=845 women having a vaginal birth from a single hospital)	Prospective cohort; multivariate logistic regression	What are the risk factors for 3rd/4th degree tears?	6.0%	*Risk factors* • Nulliparity • Postmaturity gestational age (>294 days) • Fundal pressure • Midline episiotomy • Heavier birth weight
Varma et al. (1999)[8]	United Kingdom (n=159 women giving birth (vaginal and c- section included; mixed parity) from a single maternity unit)	Prospective cohort; multivariate analyses	What is the correlation between routinely collected obstetric variables and 3rd/4th degree tears?	13.2%	*Risk factors* • Forceps delivery
Parnell et al. (2001)[9]	Denmark (n=254 primiparous women having a vaginal birth from a single hospital)	Prospective case-control; multivariate analyses	What is the association between midwifery technique at vaginal delivery and 3rd/4th degree tears?	8.4%	*Risk factors* • Prenatal: High maternal age, heavier birth weight, shoulder dystocia, edema of the perineum • Non instrumental vaginal delivery: easing the perineum • Vacuum extraction: looking at the perineum, semi-reucumbent position at delivery
Andrews et al. (2006)[10]	United Kingdom (n=241 primparous women having a vaginal birth from a single hospital)	Prospective cohort; multiple logistic regression	What are the risk factors for 3rd/4th degree tears?	24.8%	*Risk factors* • Heavier birth weight • Mediolateral episiotomy
Dahen et al. (2007)[11]	Australia (n=6,595 women having vaginal birth from a single hospital)	Prospective cohort; multivariate logistic regression	What are the risk factors for 3rd/4th degree tears?	2.0%	*Risk factors* • Primiparity • Instrumental birth • Asian ethnicity • Heavier birth weight (≥4000g)
ii. Studies assessing single risk factors					
Dua et al. (2009)[12]	United Kingdom (n=1000; 457 primigravid, 543 multigravid women from a single hospital)	Prospective cohort; correlation; logistic regression	What is the correlation between perineal length during 1st stage of labour with perineal tears?	2.5%	• Adjusting for confounders (BMI, fetal position, parity, birth weight), there was a strong correlation between short perineal length and 3rd degree tears
Rode et al. (2005)[13]	Denmark (n=3,635 women with a single cephalic delivery at ≥37 weeks)	Prospective cohort; multivariate logistic regression	What is the association between prepregnancy BMI and complications [perineal	NR	• BMI was not found to be associated with 3rd/4th degree tears

			rupture one of maternal complications assessed]?		
Robinson et al. (1999)[14]	United States (n=1,942 nulliparouss women having term vaginal births (spontaneous and induced labours) from a single hospital)	Prospective cohort; logistic regression	What is the association between epidural analgesia and 3rd/4th degree tears during vaginal deliveries?	14.1%	• Adjusting for confounders (birth weight, use of oxytocin, and maternal age) epidural remained a significant predictor of 3rd/4th degree tears; however epidural was no longer significant when operative vaginal delivery and episiotomy were included in the model
Rouse et al. (2009)[15]	United States (n=4,126 nulliparous women having ≥36 weeks vaginal births (spontaneous and induced) who reached 2nd stage of labour from a network hospitals)	Prospective cohort (secondary analysis RCT); logistic regression	What is the relationship between the duration of 2nd stage labour in nulliparous women and adverse maternal or neonatal outcomes?	8.7% total (<3hr = 7.5%; ≥3hr=30.7%)	• 2nd stage duration of at least 3hrs is associated with 3rd/4th degree lacerations
Dahlen & Homer (2008)[16]	Australia (n=697 nulliparous women having term vaginal births from two maternity units)	Prospective cohort (secondary analysis RCT); multivariate logistic regression	What is the relationship between Asian ethnicity and perineal morbidity?	6.6% total (Asian=11%; non-Asian=4%)	• Asian women had significantly more 3rd/4th degree tears then non-Asian women
Abenhaim et al. (2008) [17]	Canada (n=1,756 nulliparous women having term vaginal births from multiple centres)	Prospective cohort (secondary analysis RCT); logistic regression	What is the effect of suboptimal 2nd stage pain control during delivery?	Total=NR (suboptimal analgesia=10.5%; optimal analgesia=9.3%)	• Women with suboptimal analgesia had an increased risk of 3rd and 4th degree perineal tears

Bottom line: Twelve studies from 7 countries were assessed with respect to determinants of 3rd/4th degree lacerations; half the studies assessed multiple predictors, whereas the other half assessed the impact of a single predictor. Based on findings from the 2 Canadian studies alone, risk factors for severe lacerations included forceps delivery, heavier birth weight, and suboptimal maternal analgesia. Looking at all studies included, the most common risk factors to emerge included nulliparity, forceps delivery, and heavier birth weight. Other significant predictors to emerge (although occasionally less consistently) included episiotomy, epidural anesthesia, duration of 2nd stage or labour, and Asian ethnicity. Based on 1 study, pre-pregnancy BMI was not found to be correlated with 3rd/4th degree tears.

The Royal College of Obstetricians and Gynaecologists (RCOG), in their 2001 guideline on the management of 3rd/4th degree perineal tears, also report risk factors for 3rd degree lacerations.[18] Of note however, the guideline used only retrospective studies. The guideline reports, "Taking an overall risk of 1% of vaginal deliveries, the following factors are associated with an increased risk of a 3rd-degree tear:

- Birth weight over 4 kg (up to 2%)
- Persistent occipitoposterior position (up to 3%)
- Nulliparity (up to 4%)
- Induction of labour (up to 2%)
- Epidural analgesia (up to 2%)
- Second stage longer than 1 hour (up to 4%)
- Shoulder dystocia (up to 4%)
- Midline episiotomy (up to 3%)
- Forceps delivery (up to 7%)"

c. Best practices for prevention
Multiple practices

4/10 A 2000 systematic review conducted by Eason and colleagues at The Ottawa Hospital, assessed the evidence of practices aimed at preventing perineal trauma during childbirth.[19] Techniques assessed included: episiotomy (median and mediolateral), assisted vaginal delivery (vacuum or forceps), perineal massage before or during labor, birthing position, whirlpool baths, head flexion, head restraint, perineal support or easing back to the perineum, perineal compresses or lubrication, different maternal pushing instructions, timing of delivery relative to contractions, and perineal analgesia.

Findings from this report are reinforced by more recent and higher quality reviews and thus were not extracted in detail. Main conclusions of the review authors were as follows: "Factors shown to increase perineal integrity include avoiding episiotomy, spontaneous or vacuum-assisted rather than forceps birth, and in nulliparous, perineal massage during the weeks before childbirth. Second-stage position has little effect. Further information on techniques to protect the perineum during spontaneous delivery is sorely needed".

2/10 A 2008 systematic review by Kettle and Tohill evaluated the effects of intrapartum surgical and non-surgical interventions on rates of perineal trauma.[2] The review included evidence from systematic reviews, RCTs, and observational studies.

<u>Surgical interventions</u>
Based on 1 systematic review (Cochrane below) and 1 subsequent RCT, ***restrictive use of episiotomy*** was determined to be 'beneficial' as compared with routine use of episiotomy in reducing perineal trauma. Benefits, however, are not due to a reduction in 3rd degree tears (4th not mentioned), but improvements in other perineal outcomes (posterior perineal trauma, perineal pain at discharge, healing complications, and the need for suturing). Yet, given the overall benefit, the reviewers conclude in their 'clinical guide' that "there is strong clinical evidence for benefit of restricted use of episiotomy compared to routine episiotomy".

Based on 1 systematic review (Cochrane below) and 3 subsequent RCTs, ***vacuum extraction*** was determined to be 'beneficial' with a 'trade off between benefits and harms' as compared with forceps delivery. Findings from the systematic review indicated that women who delivered via vacuum extraction as opposed to forceps were significantly less likely to suffer severe perineal injury. Subsequent RCTs demonstrated reductions in severe perineal trauma and 3rd degree tears among women who delivered via vacuum extraction as compared to forceps, but these findings were not significant. The reviewers conclude in their 'clinical guide' that "there is strong clinical evidence that vacuum extraction reduces the rate of severe perineal trauma compared with forceps delivery".

Based on 1 quasi-randomized trial and 2 retrospective cohort studies, ***midline episiotomy*** was deemed as 'unlikely to be beneficial' as compared with mediolateral episiotomy incision. While the reviewers determined the quality of this evidence to be low, studies suggested midline episiotomy to be significantly associated with increased risk of 3rd or 4th degree tears. The reviewers conclude in their 'clinical guide' that while it "is claimed that midline incision is easier to repair, and is associated with less blood loss, better healing, less pain, and earlier resumption of sexual intercourse", "[w]e found no reliable evidence to support these claims".

Based on 1 systematic review, ***epidural analgesia*** was deemed 'likely to be ineffective or harmful' as compared with non-epidural analgesia or no analgesia during labour. While the reviewers determined the quality of the trials to be variable, >80% reported increased rates of instrumental delivery (assisted vaginal birth by forceps or vacuum extraction) among women receiving analgesia. The authors conclude in their 'clinical guide' that "there is fairly strong evidence that epidural analgesia

increases the risk of instrumental delivery compared with non-epidural analgesia or no analgesia in labour", and in turn that "instrumental deliveries are associated with an increased risk of perineal trauma".

Non-surgical interventions

Based on 1 systematic review (Cochrane below), ***continuous support during labor*** was deemed to be 'beneficial' as compared to usual care based on the finding that it significantly reduced the incidence of instrumental delivery. Interestingly however, although instrumental delivery is typically associated with an increased risk of perineal trauma, the systematic review found no significant differences in the overall rate of perineal trauma and thus its direct impact on reducing rates of lacerations remains unclear.

Based on 1 systematic review of low quality evidence, ***upright position during delivery*** was determined to be 'beneficial' but with a 'trade off between benefits and harms' as compared with delivery in the supine or lithotomy positions. Again however, although upright position (e.g. birthing chairs, stools, Gardosi cushion, and squatting) was found to be associated with fewer episiotomies and assisted vaginal deliveries, it made no difference in overall rates of 3rd and 4th degree tears, and actually led to an increase in 2nd degree tears.

Based on 1 RCT and 1 quasi-randomized trial ***"Hands-poised" method of delivery*** was also determined to be 'beneficial' but with a 'trade off between benefits and harms' as compared with "hand-on" method of delivery. Evidence from this limited data set suggest that while "hands-poised" method may be more effective in reducing rates of episiotomy, it has no effect on rates of perineal trauma requiring suturing or 3rd and 4th degree tears.

Finally, based on what the reviewers determined to be a very low quality of evidence, the reviewers deemed there was 'unknown effectiveness' for non-surgical interventions of ***immersion in water*** (vs. no immersion), ***passive descent in 2nd stage of labour*** and ***sustained breath holding (Valsalva method) of pushing***. Of the limited evidence available, passive descent and sustained breath holding showed no difference in perineal trauma.

Bottom line: Kettle and Tohill's practice-oriented review included evidence from 7 systematic reviews, 8 RCTs/quasi-randomized trials and 2 retrospective cohorts assessing 4 surgical and 6 non-surgical interventions aimed at reducing perineal trauma during vaginal birth. With respect to avoiding 3rd/4th degree lacerations, there is fairly robust evidence to support the practice of ***vacuum extraction*** over ***forceps delivery*** when conducting assisted vaginal births. While the practice of ***restrictive*** or ***mediolateral episiotomies*** do not appear to impact the rates of 3rd/4th degree lacerations directly (high and low quality evidence, respectively), they do appear protective against perineal trauma in general, and according to this review, should be prioritized if such intervention is necessary. Similarly, while there is high quality evidence to indicate that the practice of ***epidural analgesia*** leads to increased rates of assisted vaginal deliveries, and thus theoretically higher rates of 3rd/4th degree lacerations, there is not direct evidence to support this supposition. Finally, although there was evidence indicating reduced rates of episiotomy and/or assisted vaginal delivery for non-surgical practices of ***continuous support***, ***upright position***, and ***"hands-poised"***, these practices made no difference with respect to rates of 3rd/4th degree lacerations.

Single practice – Routine vs. restrictive episiotomy

8/10 A 2009 Cochrane systematic review assessed the effects of restrictive vs. routine episiotomy during vaginal birth.[1] Eight RCTs were included (n=5,541). Although the practice of restrictive episiotomy significantly reduces rates of perineal trauma (33% overall), this improvement is the result of reductions in the rates of episiotomies themselves and not 3rd/4th degree lacerations. Subgroup analysis indicated that these results were consistent when various methods of episiotomy (e.g. mediolateral, midline) and parity were taken into account.

Single practice – Choice of instruments for assisted vaginal delivery

8/10 A 2010 Cochrane systematic review assessed different delivery instruments used in assisted vaginal births to answer the question: "When assisted vaginal birth is needed, which instrument would be best?"[20] Thirty-two trials were included (n=6,597). With respect to achieving a successful delivery, forceps are more effective than vacuum, and result in significantly less failed deliveries with the allocated instrument. With respect to neonatal outcomes, forceps also appear to result in fewer cases of cephalhaematoma, although this finding was not significant. Facial injury was however less likely with vacuum, and there was no difference between instruments with respect to scalp injury.With respect to maternal outcomes, the use of forceps significantly increases rates of 3rd/4th degree tears (with or without episiotomy), as well as vaginal trauma, use of general anesthesia, and flatus incontinence or altered continence. Comparing different types of vacuums, the metal cup as compared with the soft cup appears to be more effective in achieving a successful vaginal birth, however leads to more cases of scalp injury and cephalhaematoma. Taken together, "forceps or the metal cup appears to be most effective at achieving a vaginal birth, but with increased risk of maternal trauma with forceps and neonatal trauma with the metal cup." The review authors conclude "There is a recognized place for forceps and all types of ventouse in clinical practice. The role of operator training with any choice of instrument must be emphasized. The increasing risk of failed delivery with the chosen instrument from forceps to metal cup to hand-held to soft cup vacuum, and trade-offs between risk of maternal and neonatal trauma identified in this review need to be considered when choosing an instrument."

Single practice – Rapid vs. stepwise negative pressure application

8/10 A 2008 Cochrane systematic review assessed the efficacy and safety of rapid vs. stepwise negative pressure application for assisted vaginal delivery by vacuum extraction.[21] Although 2 studies were identified, 1 study was excluded due to poor quality. Results from the remaining RCT (n=94) showed no difference in degree of perineal tears among women delivered by rapid or stepwise vacuum extraction.

Single practice – Fundal pressure during 2nd stage of labor

8/10 A 2009 Cochrane systematic review assessed the efficacy and safety of fundal pressure (pushing on the upper part of the uterus towards the birth canal to assist with vaginal birth) in the 2nd stage of labor.[22] Severe lacerations are cited as a potential adverse outcome associated with this practice. Unfortunately, there were no quality studies assessing the more commonly used manual technique and only 1 study of good quality (n=500) assessing fundal pressure by means of an inflatable belt. In this single study, fundal pressure did not increase the rate of spontaneous vaginal births and there was insufficient evidence regarding the safety of the baby. Importantly with respect to lacerations, findings were inconclusive; while the intervention appeared to increase the number of women with intact perineum, it also led to an increase in the number of women with 3rd/4th degree tears. This contradiction may have been the result of the study's lack of blinding introducing bias into the assessment of this outcome.

Single practice – Continuous support

9/10 A 2009 Cochrane systematic review evaluated the effects of continuous, one-to-one intrapartum support compared with usual care.[23] Sixteen trials (n=13,391) were included in the review, but only 2 studies (n=7,328) assessed the outcome of perineal trauma (defined in this review as both trauma from episiotomy and lacerations requiring suturing). Based on these studies, continuous support made no difference on perineal trauma, compared with usual care.

Single practice – Antenatal perineal massage

9/10 A 2009 Cochrane systematic review evaluated the effect of antenatal perineal massage on the incidence of perineal trauma at birth.[3] It was hypothesized that massage would increase the flexibility of the perineal muscles, such that they stretch with greater ease during birth, preventing tears or the need for episiotomy. Four trials (n=2,497) were included, all comparing digital perineal massage with control. All studies were determined by reviewers as being of good quality.
Although the practice of antenatal perineal massage reduced the incidence of trauma requiring suturing, this improvement was mainly due to the reduced incidence of episiotomy, with no difference being observed in the rates of 1st, 2nd, 3rd/4th degree tears. The benefit of massage was also only significant among nulliparous women. Although massage did not directly improve rates of lacerations, the review authors conclude that "antenatal perineal massage reduces the likelihood of perineal trauma" and that "women should be made aware of the likely benefit of perineal massage and provided with information on how to massage".

Bottom line: This section presented several obstetric surgical and non-surgical interventions designed either to prevent and/or limit 3rd/4th degree lacerations. While the quality of the individual studies varied, the overall quality of the systematic reviews (mostly Cochrane) were strong. As compared with ***routine episiotomy, restrictive episiotomy*** does not benefit 3rd/4th degree lacerations directly, but rather only reduces perineal trauma generally. Compared to ***delivery by forceps***, ***vacuum extraction*** is protective of the perineal floor, but is associated with increased (albeit uncommon) rates of neonate cephalhaematoma. Subsequent assessments of varying methods of extraction (pressure, cups) had no impact on perineal tears. The effect of ***belt-applied fundal pressure*** during 2nd stage of delivery on 3rd/4th degree tears is inconclusive. ***Continuous support*** does not appear to impact perineal trauma. Finally, while ***antenatal perienal massage*** improves multiple perineal outcomes, including perineal trauma, this is the result of reduced rates of episiotomies; 3rd/4th degree tears are not improved by this practice.

III. Guidelines

In 2001 the Royal College of Obstetricians and Gynaecologists (RCOG) published a guideline on the management of 3rd and 4th degree tears.[18] With respect to prevention, the guideline recommends, "where episiotomy is indicated, the mediolateral technique is recommended, with careful attention to angle the cut away from the midline".

Methods

Detailed search strategies were developed by an experienced Information Specialist (specific search terms available upon request). Searching was limited to the following databases:

- Biomed Central;
- Cochrane Database of Systematic Reviews (CDSR);
- Database of Abstracts of Reviews of Effects (DARE)
- National Health Service Economic Evaluation Databases (NHS EED)

Search concepts included Medical Subject Headings (MeSH) and non-thesaurus terms (i.e. text words). A 'grey literature' search was also conducted for potentially relevant studies by reviewing the web sites of relevant organizations (available upon request).

Screening and extraction was conducted by one reviewer, and thus may have introduced a marginal amount of error. Relevancy of citations was assessed based on the question they addressed:
1) Rates of lacerations: citations had to be specific to the Canadian context.
2) Determinants of lacerations: citations had to have been published after 1990, and report data collected prospectively from ≥100 subjects in a Western/industrialized hospital setting.
3) Best practices: reviews were considered relevant if they had been conducted systematically (i.e., report an explicit review methodology) and evaluated interventions to prevent lacerations/perineal trauma. In absence of systematic reviews, relevant RCTs were considered. To be included, all citations had to have been published in English and be available in full text electronically.

The search strategy yielded 1,187 articles, of which 404 had abstracts/titles that made them potentially relevant articles. Two additional systematic reviews were identified by included reports. In all, one guideline, one governmental report, 8 systematic reviews, and 12 observational studies met the inclusion criteria and are reported here. The systematic reviews provided the majority of the data for this summary, while other relevant individual studies were included where the data from systematic reviews was lacking. The risk of bias was only evaluated for systematic reviews, using the AMSTAR tool.

Risk of Bias Assessment of Systematic Reviews

AMSTAR is an 11-item measurement tool created to assess the methodological quality of systematic reviews. Each question is scored according to 1 of 4 options (yes, no, cannot answer, not applicable) and the number of 'yes' answers tallied. A higher score indicates increased methodological quality.[24]

The 11 assessment criteria are as follows:

1. Was an "a priori" design provided?
2. Was there duplicate study selection and data extraction?
3. Was a comprehensive literature search performed?
4. Was the status of publication (i.e. grey literature) used as an inclusion criterion?
5. Was a list of studies (included and excluded) provided?
6. Were the characteristics of the included studies provided?
7. Was the scientific quality of the included studies assessed and documented?
8. Was the scientific quality of the included studies used appropriately in formulating conclusions?
9. Were the methods used to combine the findings of studies appropriate?
10. Was the likelihood of publication bias assessed?
11. Was the conflict of interest stated?

The AMSTAR score (from 0 to 10) for each systematic review in this evidence summary is reported in the box that appears at the beginning of each finding.

**Note: item #9 was not applicable to the included SRs thus the maximum number of 'yes' responses was 10.*

Additional Information

This summary was produced by:
The Knowledge to Action research program, a project of the Ottawa Methods Centre at the Ottawa Hospital Research Institute, which is funded by the Canadian Institutes of Health Research [KAL-86796].

Conflict of Interest
None declared

Acknowledgements
Many thanks to Rebecca Skidmore, Information Scientist, for designing and executing the search strategies for this review and to Raymond Daniel, Information Technician, for acquiring the resources. Thanks also go to Justin Thielman, MSc Student Research Assistant, for preliminary screening of studies for this review and to Chantelle Garrity, Senior Research Project Manager, for conceptual feedback.

The format of this report is based on that developed by the SUPPORT Collaboration Network www.support-collaboration.org.

This summary should be cited as
Konnyu K, Grimshaw J, Moher D. What is known about 3rd and 4th degree lacerations occurring during vaginal birth? Ottawa Hospital Research Institute; December 2010.

References

1 Carroli G, Mignini L. Episiotomy for vaginal birth. *Cochrane Database of Systematic Reviews* 2009, Issue 1. Art. No.: CD000081. DOI: 10.1002/14651858.CD000081.pub2.

2 Kettle C, Tohill S. Perineal care. *Clin evid* 2008;9(1401).

3 Beckmann MM, Garrett AJ. Antenatal perineal massage for reducing perineal trauma. *Cochrane Database of Systematic Reviews* 2006, Issue 1. Art. No.: CD005123. DOI: 10.1002/14651858.CD005123.pub2.

4 Public Health Agency of Canada. Canadian Perinatal Health Report, 2008 Edition. Ottawa, 2008.

5 BORN Ontario. Rates of 3rd and 4th tears among women with spontaneous vaginal births and assisted vaginal births. Personal communication 2010.

6 Klein MC, Janssen PA, MacWilliam L, Kaczorowski J, Johnson B. Determinants of vaginal-perineal integrity and pelvic floor functioning in childbirth. *Am J Obstet Gynecol* 1997;176(2):403-410.

7 Zetterström J, López A, Anzén B, Norman M, Holmström B, Mellgren A. Anal sphincter tears at vaginal delivery: risk factors and clinical outcome of primary repair. *Obstet Gynecol* 1999;94(1):21-28.

8 Varma A, Gunn J, Lindow SW, Duthie GS. Do routinely measured delivery variables predict anal sphincter outcome? *Dis Colon Rectum1999*;42(10):1261-1264.

9 Parnell C, Langhoff-Ross J, Møller H. Conduct of labor and rupture of the sphincter ani. *Acta Obstet Gynecol Scand* 2001; 80: 256–261.

10 Andrews V, Sultan AH, Thakar R, Jones PW. Risk factors for obstetric anal sphincter injury: a prospective study. *Birth* 2006;33(2):117-122.

11 Dahlen HG, Ryan M, Homer CSE, Cooke M. An Australian prospective cohort study of risk factors for severe perineal trauma during childbirth. *Midwifery* 2007;23:196-203.

12 Dua A, Whitworth M, Dugdale A, Hill S. Perineal length: norms in gravid women in the first stage of labour. *Int Urogynecol J* 2009;20:1361–1364.

13 Rode L, Nilas L, Wøjdemann K, Tabor A. Obesity-related complications in Danish single cephalic term pregnancies. *Obstet Gynecol* 2005;105(3):537-542.

14 Robinson JN, Norwitz ER, Cohen AP, Mcelrath TF, Lieberman ES. Epidural analgesia and third- or fourth-degree lacerations in nulliparas. *Obstet Gynecol* 1999;94(2):259-262.

15 Rouse DJ, Weiner SJ, Bloom SL, Varner MW, Spong CY, Ramin SM, Caritis SN, Peaceman AM, Sorokin Y, Sciscione A, Carpenter MW, Mercer BM, Thorp JM Jr., Malone FD, Harper M, Iams JD, Anderson GD. Second-stage labor duration in nulliparous women: relationship to maternal and perinatal outcomes. *Am J Obstet Gynecol* 2009;201:357.e1-7.

16 Dahlen H, Homer C. Perineal trauma and postpartum perineal morbidity in Asian and non-Asian primiparous women giving birth in Australia. *JOGNN* 2008;37:455-463.

17 Abenhaim HA, Fraser WD. Impact of pain level on second-stage delivery outcomes among women with epidural analgesia: results from the PEOPLE study. *Am J Obstet Gynecol* 2008;199:500.e1-500.e6.

18 Royal College of Obstetricians and Gynaecologists (RCOG). The management of third- and fourth-degree perineal tears. London (UK): Royal College of Obstetricians and Gynaecologists (RCOG); 2007 Mar. 11 p.

19 Eason E, Labreque M, Wells G, Feldman P. Preventing perineal trauma during childbirth: a systematic review. *Obstet Gynecol* 2000;95(3):464-471.

20 O'Mahony F, Hofmeyr GJ, Menon V. Choice of instruments for assisted vaginal delivery. *Cochrane Database of Systematic Reviews* 2010, Issue 11. Art. No.: CD005455. DOI: 10.1002/14651858.CD005455.pub2.

21 Suwannachat B, Lumbiganon P, Laopaiboon M. Rapid versus stepwise negative pressure application for vacuum extraction assisted vaginal delivery. *Cochrane Database of Systematic Reviews* 2008, Issue 3. Art. No.: CD006636. DOI:10.1002/14651858.CD006636.pub2.

22 Verheijen EC, Raven JH, Hofmeyr GJ. Fundal pressure during the second stage of labour. *Cochrane Database of Systematic Reviews* 2009, Issue 4. Art. No.: CD006067. DOI: 10.1002/14651858.CD006067.pub2.

23 Hodnett ED, Gates S, Hofmeyr GJ, Sakala C. Continuous support for women during childbirth. *Cochrane Database of Systematic Reviews* 2007, Issue 3. Art. No.: CD003766. DOI: 10.1002/14651858.CD003766.pub2.

24 Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, Porter AC, Tugwell P, Moher D, Bouter LM. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Med Res Methodol. 2007 Feb 15;7:10.