Prevention of Childbirth Injuries to the Pelvic Floor

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The majority of childbirth injuries to the pelvic floor occur after the first vaginal delivery. Cesarean sections performed after the onset of labor may not protect the pelvic floor. Elective cesarean section is the only true primary prevention strategy for childbirth injuries to the pelvic floor. Alternative primary prevention strategies include elective cesarean section for women with nonmodifiable risks for childbirth injuries to the pelvic floor, antepartum pelvic floor exercises, or intrapartum pudendal nerve monitoring. Secondary prevention strategies must focus on modifying obstetric practices that predispose women to pelvic floor injury. These factors are best delineated for anal incontinence and include restrictive use of episiotomy, mediolateral episiotomy when necessary, spontaneous over forceps-assisted vaginal delivery, vacuum extraction over forceps delivery, and antepartum perineal massage. Finally, tertiary prevention strategies should address the mode of delivery made for women with childbirth injuries to the pelvic floor who desire future fertility.

Introduction

Childbirth injuries to the pelvic floor are a major risk factor for urinary incontinence, anal incontinence, and pelvic organ prolapse. In 1995, the economic costs of urinary incontinence totaled $26.3 billion or $3,565 per individual aged 65 and older. Of the $26.3 billion, 48% ($12.5 billion) was used to diagnose, treat, and care for patients with urinary incontinence [1]. From a public health standpoint, urinary incontinence costs impact society as monies are diverted away from healthcare programs that remain unfunded.

Approximately 28% to 54% of patients have symptoms of fecal urgency, flatal, or fecal incontinence 3 months to 3 years after a primary anal sphincter repair. Re-operation occurs in 29.2% of urinary incontinence and pelvic organ prolapse cases [2••]. Because cure rates are not 100%, physicians must prevent childbirth injuries to the pelvic floor to reduce the number of new cases of incontinence, or pelvic organ prolapse.

Strategies designed to prevent disease can effect change at three different levels. Primary prevention strategies effect change by modifying risk factors prior to the onset of a condition. Secondary prevention strategies effect change by identifying and treating people with preclinical disease. Tertiary prevention strategies effect change by treating and managing people with clinical disease in an attempt to postpone complications. This article reviews the medical literature to provide clinicians with evidence-based prevention strategies for reducing childbirth injuries to the pelvic floor.

Mechanisms of Injury

Denervation

The pudendal nerve innervates the anal (inferior hemorrhoidal nerve) and the urethral (perineal nerve) sphincters as the nerve travels along the pelvic sidewall. Along its circuitous route, the pudendal nerve is vulnerable to the traction and compressive forces of labor and delivery.

Tetzschner *et al.* [3] studied 146 pregnant women during pregnancy and 12 weeks postpartum to assess the impact of delivery mode on pudendal nerve function and relate delivery mode to the occurrence of anal and urinary incontinence. Women who delivered by vacuum extraction had a greater PNTML change than women who delivered unassisted or by cesarean section. Women who delivered unassisted or by cesarean section had similar PNTML changes because 56% (5/9) of the cesarean sections were done after the onset of labor. Women who underwent cesarean section after the onset of labor had a significantly increased PNTML, compared with women who underwent elective cesarean section. Age, pelvic instability, and vacuum extraction were independently associated with PNTML changes after delivery. Incontinent and continent women had similar PNTML changes after delivery [3].

Sultan *et al.* [4] studied 128 pregnant women beyond 34 weeks gestation to establish the effect of childbirth on pudendal nerve function and identify obstetric factors associated with pudendal nerve injury. Following vaginal delivery, PNTML was increased bilaterally and asymmetrically (left > right). In both the primiparous and multiparous groups, there was no difference in PNTML after elective cesarean section. Cesarean section performed after

the onset of labor was associated with prolongation of PNTML (left > right). Birthweight over 4 kg and active second stage of labor greater than 30 minutes were associated with PNTML prolongation. Because the researchers found no association between prolongation of PNTML and anal incontinence, they hypothesized that neurogenic fecal incontinence is the end result of a longstanding or progressive pudendal neuropathy rather than the consequence of an acute event.

Direct muscle injury

Meyer *et al.* [5] studied 149 nulliparous patients during pregnancy and 9 weeks postpartum to assess mode of delivery effects on pelvic floor function. Women who underwent forceps deliveries demonstrated weaker pelvic floors by digital exam than those who spontaneously delivered. Women who delivered spontaneously and by forceps had a greater decline in pelvic floor strength as measured by intra-anal pressures during contraction than women who underwent cesarean section.

Sultan *et al.* [6] used endoanal ultrasonography to study sphincter morphology in 202 consecutive women before delivery and 6 weeks postpartum. Thirty-five percent of primiparous and 44% of multiparous patients had anal sphincter disruptions after delivery. Only 4% of multiparous women developed new anal sphincter disruptions, which suggests that the risk of sphincter damage is greatest after the first vaginal delivery. Approximately one third of patients with sphincter defects had symptoms of fecal urgency or anal incontinence. However, almost 100% of patients with symptoms were found to have anal sphincter disruption.

Connective tissue damage

There is a clear association between connective tissue abnormalities and incontinence and pelvic organ prolapse. Patients with Ehlers-Danlos or Marfan syndrome [7], joint hypermobility and abdominal striae [8], decreased type I:type III collagen ratios [9], and altered collagen metabolism [10] are at increased risk for incontinence and pelvic organ prolapse.

Primary connective tissue abnormalities occur with pregnancy [11]. There are no histologic studies that show that vaginal delivery causes or elective cesarean prevents connective tissue abnormalities associated with urinary incontinence and pelvic organ prolapse. Investigators hypothesize that connective tissue abnormalities develop after years of decreased pelvic floor support, progressive pudendal neuropathy, and hypoestrogenism.

Primary Prevention Strategies

There are two problems with designing primary prevention strategies that reduce childbirth injuries to the pelvic floor.

First, the majority of childbirth injuries to the pelvic floor occur after the first vaginal delivery. Viktrup *et al.* [12••] surveyed 305 primiparous women at their first delivery and 5 years later to assess the impact of first pregnancy and delivery on long lasting symptoms. Women with stress incontinence during their first pregnancy (odds ratio [OR] 3.0, 95% Confidence Interval [CI] 1.7, 5.4) and after their first delivery (OR 4.6, 95% CI 1.8, 11.8) were at increased risk of stress incontinence 5 years later compared with continent women. Women with urge incontinence during their first pregnancy (OR 4.5, 95% CI 1.9, 10.8) and after their first delivery (OR 5.4, 95% CI 1.4, 20.4) were at increased risk of urge incontinence 5 years later, compared with continent women. If the initial onset of stress or urge incontinence was during or after the first pregnancy, the long-term risk of stress or urge incontinence did not differ. Maternal age, second deliveries, subsequent surgery, or abortions did not significantly influence the frequency of stress or urge incontinence 5 years after delivery (Fig. 1).

Secondly, cesarean section performed in labor, does not protect against childbirth injuries to the pelvic floor. Fynes *et al.* [13] followed 234 women (200 spontaneous vaginal delivery, 34 cesarean section) to determine the effects of cesarean delivery on postpartum anal sphincter structure and function. Nineteen percent of women developed anal incontinence after a spontaneous vaginal delivery. Women who delivered by cesarean section did not notice anal incontinence. Thirty-three percent of women had evidence for anal sphincter injury after spontaneous vaginal delivery. No evidence for anal sphincter injury was found after cesarean section regardless of the stage of labor in which it was performed. The researchers found no difference in postpartum PNTML after spontaneous vaginal delivery and cesarean section. Women delivered by cesarean section late in the first stage or during the second stage of labor had prolonged PNTML compared with women delivered by cesarean section in early labor. The researchers concluded that cesarean section late in labor was not protective of the anal sphincter, but that the injury was neurologic rather than mechanical.

Elective cesarean section

Elective cesarean delivery is the only true primary prevention strategy because childbirth injuries to the pelvic floor occur after the first vaginal delivery, and cesarean delivery after the onset of labor is not protective of childbirth injuries to the pelvic floor.

Elective cesarean section for all pregnant women may not be as unrealistic as it sounds. Al-Mufti *et al.* [14] mailed an anonymous postal questionnaire to 206 obstetricians to determine the preferred mode of delivery for themselves or their partners. Of all obstetricians surveyed, 17% chose elective cesarean section in the absence of any clinical indication. Of female obstetricians, 31% requested cesarean section compared with 8% of males. Of women who chose cesarean section, 88% did so out of fear of perineal damage. Of the 33 who chose cesarean section, all indicated a fear of long-term sequelae such as stress incontinence and anal sphincter damage. Nineteen (58%) women were concerned about the long-term effect of

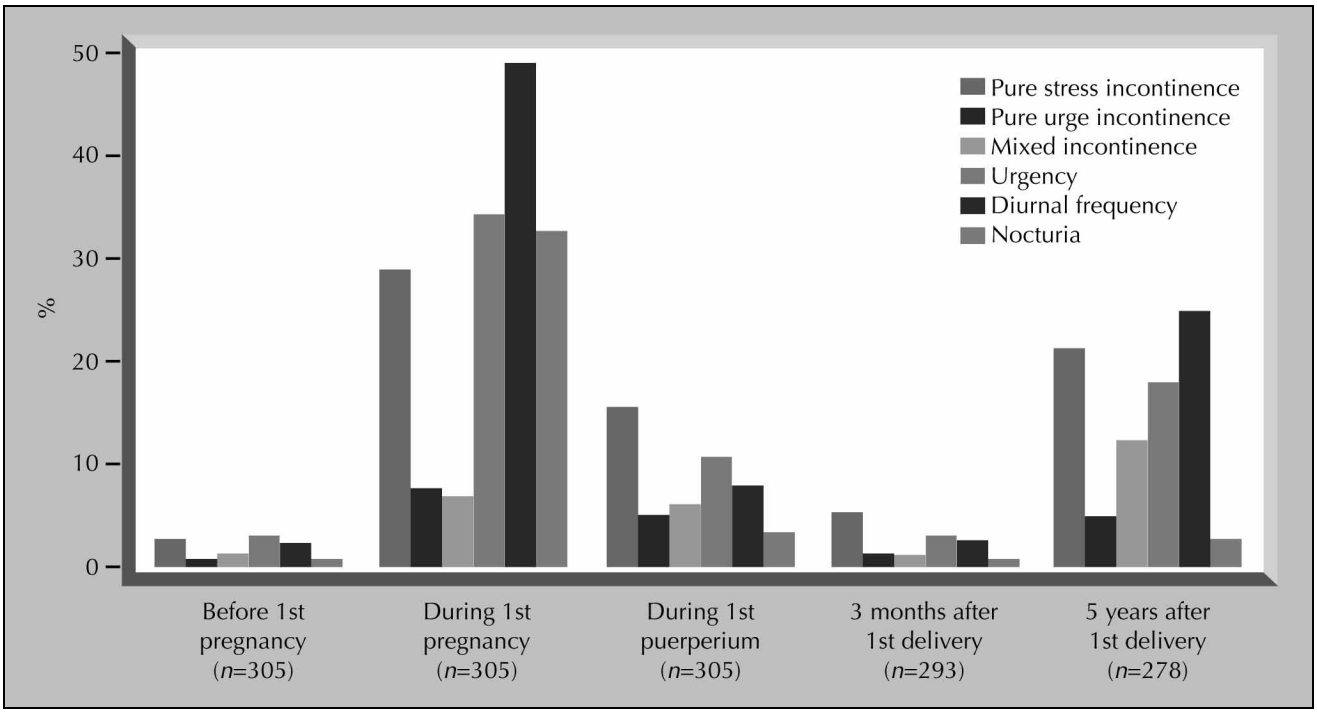

Figure 1. The prevalence of lower urinary tract symptoms during the first pregnancy, delivery, and at 5-year follow-up. (*From* Viktrup and Lose [12••]; with permission.)

vaginal delivery on sexual function. Consumer demand could contribute to the rising cesarean section rates because women envision greater freedom of choice in childbirth. These choices are not based on a knowledge deficit because one third of the most knowledgeable patients (female obstetricians) would choose elective cesarean section to protect their pelvic floor.

Elective cesarean section in women with nonmodifiable risk factors

Most obstetricians and gynecologists agree that elective cesarean delivery in all cases is unreasonable and would consider alternative primary prevention strategies to effect change. One strategy could be to perform elective cesarean sections on women with nonmodifiable factors who are destined to develop childbirth injuries to the pelvic floor after their first vaginal delivery.

Race and ethnicity

Biologic differences may explain the variance in incontinence susceptibility between racial and ethnic groups. Howard *et al.* [15] compared the delivery records of 176 primiparous black women with 1609 white women to determine if there were differences in perineal lacerations between the groups. Black women were less likely to have episiotomies (26.9% vs 37.9%) and less likely to have 2nd, 3rd, or 4th degree perineal lacerations (43% vs 59%) than white women. Black women were twice as likely to deliver with intact perineums after controlling for age, birthweight, second stage length, and episiotomy.

Family history

Skoner *et al.* [16] interviewed 140 women to identify risk factors for stress incontinence. A family history of stress incontinence in the mother (OR 2.88, 95% CI 1.08, 7.95) and any incontinence in multiple first degree relatives (mother, sister, daughter; OR 6.33, 95% CI 1.33, 41.1) were predictive of stress incontinence in the interviewee.

Antepartum bladder neck mobility

King and Freeman [17] studied 103 women with perineal ultrasonography to determine if antenatal bladder neck mobility contributed to postpartum stress incontinence. Antepartum bladder neck rotation greater than 10° was associated with 8.7-fold increased risk for postpartum stress incontinence, although mode of delivery was not controlled for in the analysis. The positive predictive value of antenatal bladder neck mobility for postpartum stress incontinence was only 48.3%. The authors did not support elective cesarean section in these women because 15% of them would have an unnecessary operative delivery.

Antepartum pelvic floor exercises

Sampselle *et al.* [18] randomized primigravida women to antepartum pelvic floor muscle exercises (30 ctx/d at maximum intensity) or routine care to test the effect of pelvic floor exercises on stress urinary incontinence and pelvic muscle strength during and after pregnancy. The pelvic muscle exercise group showed a significant decrease in urinary incontinence at 35 weeks gestation, and 6 weeks and 6 months postpartum compared with baseline. The

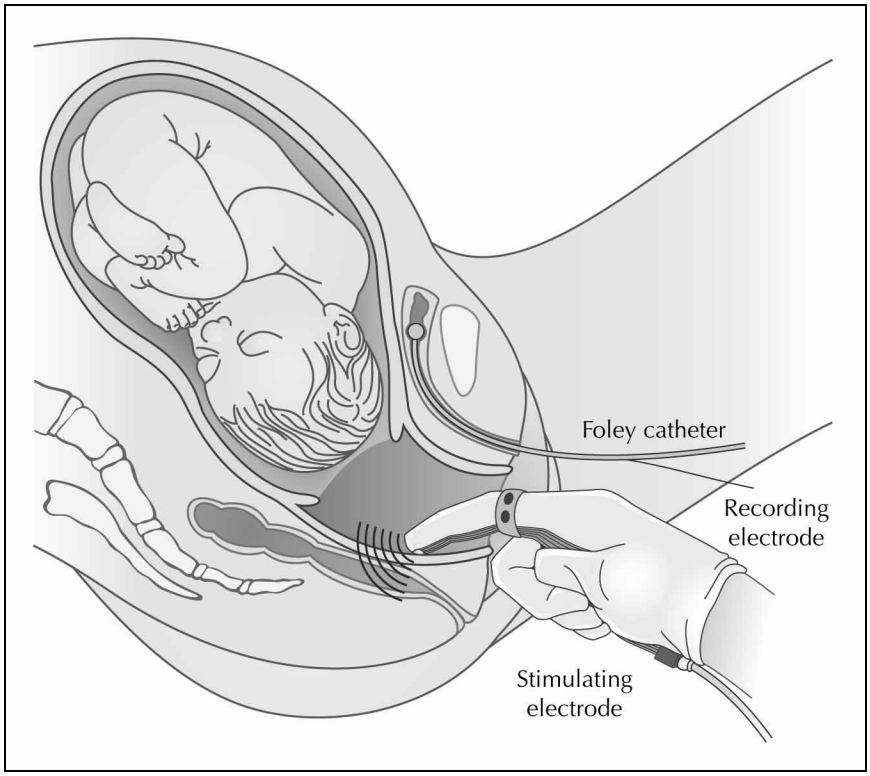

Figure 2. Intrapartum pudendal nerve monitoring using a St. Mark's electrode for intermittent testing. (*From* Clark *et al.* [20]; with permission.)

routine care group showed a significant increase in urinary incontinence during the same time intervals compared with baseline. The differences disappeared at the end of the 12-month evaluation period. The researchers noted a trend toward greater postpartum strength in the pelvic muscle exercise group than the routine care group. In the pelvic muscle exercise group, the muscle rehabilitation curve was shifted to the left, compared with the routine care group, suggesting accelerated restitution of muscle function in the pelvic muscle exercise group as a cause for the differences in continence status.

Intrapartum pudendal nerve monitoring

Pudendal nerve monitoring can be used to identify intrapartum pudendal neuropathy, suggesting the need for cesarean delivery. Clark *et al.* [19] used an electrode wire for continuous monitoring (n = 2) and a St. Mark's electrode for intermittent monitoring (n = 11) of the pudendal nerve, during the second stage of labor. The researchers found continuous monitoring technically difficult. Intermittent monitoring of pudendal nerve function during labor and delivery was possible, and could provide new insight into the effects of delivery on the maternal pelvic floor (Fig. 2).

Secondary Prevention Strategies

Secondary prevention strategies should address obstetric practices that can be modified when labor and vaginal delivery are inevitable.

Secondary prevention strategies for anal incontinence

Delayed versus early pushing in the second stage of labor

Fraser randomized 1862 nulliparous women at the time of full dilatation to a delayed pushing group (advised to wait at least 2 hours after full dilatation) or early pushing group (commence pushing as soon as they were randomized) to determine whether a policy of delayed pushing with epidural analgesia would reduce the risk of difficult delivery. Difficult delivery was defined as cesarean delivery, operative delivery from midpelvic position, or low-pelvic procedures with rotation greater than 45°. Delayed pushing was associated with a reduction in difficult deliveries (relative risk 0.79; 95% CI 0.66–0.95), compared with early pushing, after controlling for duration of the first stage of labor, station, and position of the fetal head at randomization. Episiotomy was performed in 75.6% of difficult deliveries, as compared with 37.5% of nondifficult deliveries. Third or fourth degree tears were observed in 18.2% of the difficult deliveries as compared with 8.4% of nondifficult deliveries. The frequencies of episiotomy and third and fourth degree tears did not differ in the delayed and early pushing groups because delayed pushing did not reduce the number of difficult deliveries enough to produce better perineal outcomes [20••].

Spontaneous versus forceps-assisted vaginal delivery

In 2000, Eason *et al.* [21••] reviewed randomized clinical trials to identify and highlight birthing strategies that prevented perineal trauma (Fig. 3).

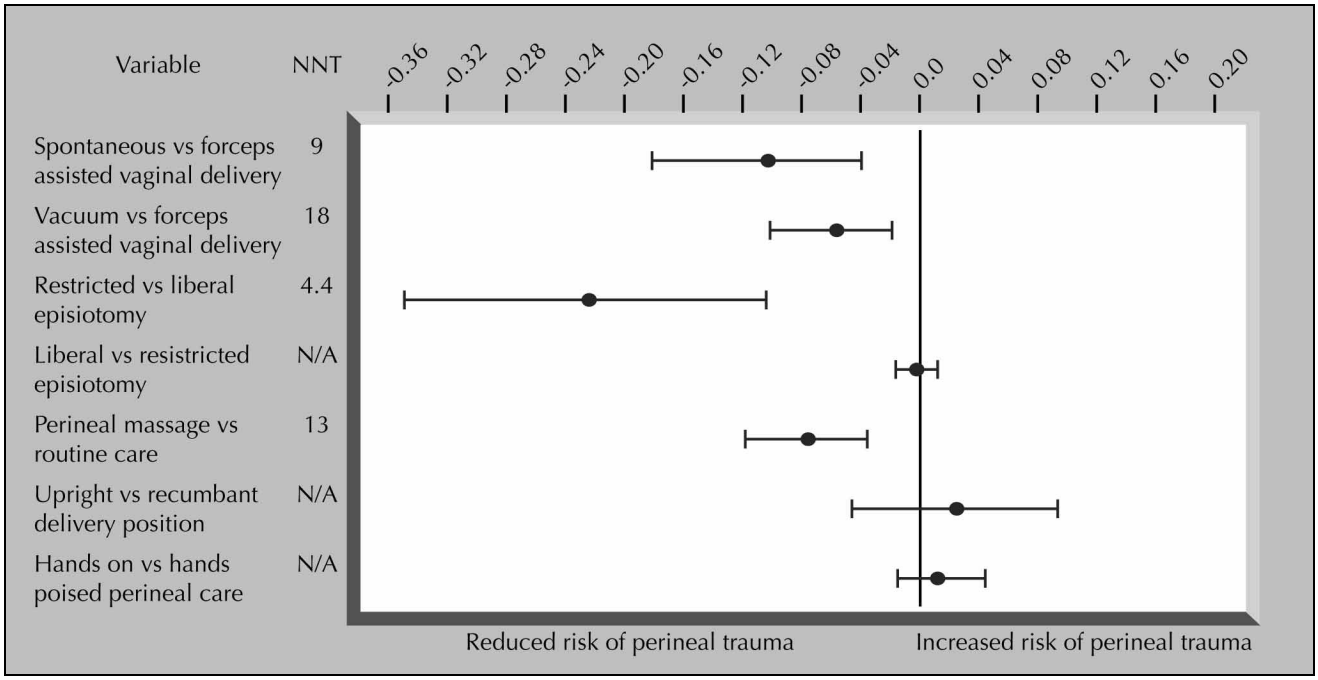

Figure 3. Risk differences for modifiable obstetric factors associated with perineal trauma. The *error bars* represent 95% Confidence Intervals. NNT—numbers needed to treat.

Eason *et al.* [21••] identified one randomized clinical trial that showed women who delivered with forceps assistance had more third degree tears than women who delivered by spontaneous vaginal delivery (18% vs 7%). The risk difference for third degree tears was –0.11 (95% CI –0.18, -0.04). Obstetricians would need to deliver nine women without spontaneous delivery, to prevent one case of perineal trauma.

Vacuum extraction versus forceps-assisted vaginal delivery

Eason *et al.* [21••] identified seven randomized clinical trials that showed women who delivered with forceps assistance had more anal sphincter trauma than women who delivered by vacuum extraction. The weighted risk difference for anal sphincter trauma was -0.06 (95% CI -0.10, -0.02). Obstetricians would need to deliver 18 women by vacuum rather than forceps to prevent one anal sphincter tear.

Restrictive versus liberal episiotomy use

Eason *et al.* [21••] identified five randomized clinical trials that studied restricted versus liberal use of episiotomy, and showed that restricted episiotomy use reduced perineal trauma that required suturing. The weighted risk difference for sutured perineal trauma was –0.23 (95% CI, -0.35, -0.11). Obstetricians would need to restrict episiotomy in 4.4 women, to prevent one case of perineal trauma requiring suturing. Liberal use of episiotomy did not prevent anal sphincter tears as previously thought. The weighted risk difference for anal sphincter tears was –0.004 (95% CI -0.02, 0.01).

In the only randomized clinical trial comparing restrictive and liberal midline episiotomy use, Klein *et al.* [22] found that multiparous women in the restrictive group were two times as likely to have intact perineums after vaginal delivery than multiparous women in the liberal group. In primiparous patients, midline episiotomy was associated with a 22-fold increased risk of third and fourth degree perineal laceration. Restricting midline episiotomy use had no effect on the prevalence of third and fourth degree lacerations because similar rates of episiotomies were used in the restrictive and liberal groups (44 vs 64%).

Coats *et al.* [23] randomized 407 primigravid patients undergoing vaginal delivery to midline versus mediolateral episiotomy. Midline episiotomy was associated with an 11.6% rate of third and fourth degree perineal lacerations compared with the 2% rate seen after mediolateral episiotomy. The risk difference for third and fourth degree perineal lacerations was –0.096. Obstetricians would need to perform 10.4 mediolateral rather than midline episiotomies to prevent one anal sphincter tear.

Perineal massage

Eason *et al.* [21••] identified three randomized clinical trials, which showed that antepartum perineal massage reduced the amount of perineal trauma that required suturing. The weighted risk difference for perineal trauma that required suturing in nulliparous women was –0.08 (95% CI –0.12, -0.04). Obstetricians would need to perform antepartum perineal massage on 13 nulliparous patients, to prevent one case of perineal trauma that required suturing.

Position for birthing

Eason *et al.* [21••] identified seven randomized clinical trials that showed that women who delivered in an upright birthing position using supportive furniture (birthing chair, low stool, or cushion) had equal amounts of perineal trauma requiring suturing as women who delivered in a recumbent position (supine, lateral, or propped up at a 20°–30° angle from horizontal). The weighted risk difference for perineal trauma requiring suturing was 0.02 (95% CI –0.05, 0.09).

Active restraint of the head in flexion and perineal protection at birth

Eason *et al.* [21••] identified one randomized clinical trial that showed women whose midwives used a hands-on approach had equal amounts of perineal trauma requiring suturing as women whose midwives used a hands-posed approach. The risk difference for perineal trauma requiring suturing was 0.01 (95% CI –0.02, 0.04).

Modification of anal sphincter repair

Fitzpatrick *et al.* [24] randomized 112 primiparous women with severe perineal lacerations to primary overlap or approximation repair. A total of 49% of women with an overlap repair and 58% of women with an approximation repair had alteration in fecal continence after primary repair. Most symptoms were mild and primarily related to flatal incontinence. Only 11% of women after overlap repair and 7% after approximation repair had ultrasonographic evidence for a satisfactory repair. A total of 62% of women after overlap repair and 70% of women after approximation repair had ultrasonographic evidence of a residual, full thickness external anal sphincter defect.

Secondary prevention strategies for urinary incontinence

Studies have inconsistently identified modifiable risk factors during vaginal delivery which predict urinary incontinence. Persson *et al.* [25••] performed a retrospective chart review of 1942 women to identify and evaluate obstetric and demographic risk factors for stress urinary incontinence as measured by a history of continence surgery. Parity was independently associated with later continence surgery after controlling for the women's age at delivery. Compared to nulliparous women, all parous women were at an increased risk of later continence surgery (OR 5.56, 95% CI 5.00, 6.25). Compared with elective cesarean delivery, vaginal delivery was associated with an increase risk for later continence surgery (OR 4.76). Birthweight over 4 kg of largest vaginally delivered infant (OR 1.3, 95% CI 1.17, 1.46), high body mass index (OR 1.68, 95% CI 1.18, 2.39), age 35 to 39 at first delivery (OR 2.61, 95% CI 2.14, 3.19), epidural analgesia (OR 1.41, 95% CI 1.22, 1.64), and maternal diabetes (OR 2.07, 95% CI 1.32, 2.33) were independently associated with an increased risk of later continence surgery. Delivery with forceps or vacuum (OR 0.78, 95% CI 0.67, 09.2), and mediolateral episiotomy (OR 0.82, 95% CI 0.68, 0.98) were associated with a decreased risk of later continence surgery. It is likely that the negative association found between instrumental delivery and later continence surgery was confounded by concomitant mediolateral episiotomy which was performed in the majority of instrumented vaginal deliveries in the study.

Foldspang *et al.* [26] surveyed 4345 women to determine if pregnancy, vaginal childbirth, age at childbirth, episiotomy, perineal suturing, forceps, and vacuum extraction delivery were predictive or urinary incontinence. In multivariate analysis, the strongest predictors for stress incontinence were age greater than or equal to 40 at the second vaginal childbirth (OR = 10.1), urinary incontinence immediately following childbirth (OR = 4.6), and urinary incontinence during pregnancy (OR = 3.4). None of the obstetric techniques were predictive of urinary incontinence, suggesting that these modifiable factors merely acted as proxy indicators for vaginal childbirth haven taken place.

Similar findings were reported by Farrell *et al.* [27] who concluded that, "until better studies are designed to identify specific obstetric factors that are independently responsible for the neurophysiologic damage sustained during parturition, guidelines for modifying labor management cannot be developed."

Secondary prevention strategies for pelvic organ prolapse

Samuelsson [28] surveyed 487 women to study the prevalence and risk factors for pelvic organ prolapse. Age, parity, and pelvic floor muscle strength remained independent predictors of pelvic organ prolapse after controlling for weight, birthweight, and hysterectomy.

Tertiary Prevention Strategies

Tertiary prevention strategies should address the delivery mode for women with childbirth injuries to the pelvic floor who desire future fertility.

Tertiary prevention strategies for of anal incontinence

Fynes *et al.* [29••] studied 59 previously nulliparous women through two successive vaginal deliveries to assess the effect of the second vaginal delivery on anal sphincter structure and function. She attempted to identify those women at risk for cumulative anal sphincter injury and development of anal incontinence. After two vaginal deliveries, 15 (25.4%) women reported symptoms of anal incontinence. Seven of eight women with anal incontinence during their second pregnancy noted deterioration after their second vaginal delivery. The remaining women had persistent symptoms. Five women developed new anal incontinence after their second vaginal delivery. Two women with transient anal incontinence after their first

delivery developed recurrent anal incontinence after their second vaginal delivery. The researchers identified anal sphincter defects in 20 (34%) women after their first vaginal delivery. Thirteen women with anal sphincter defects had anal incontinence. Five of 12 (42%) women with asymptomatic defects at the time of their second pregnancy developed anal incontinence after a second vaginal delivery. None of the four women who underwent emergency cesarean section during their second labor experienced any alteration in postpartum fecal incontinence. The authors concluded that women with persistent or transient anal incontinence, and asymptomatic women with anal sphincter defects after their first vaginal delivery, are at high risk for cumulative injury. The authors suggested repeat anal sphincter repair and cesarean delivery for women with persistent anal incontinence and a sphincter defect. Asymptomatic women with anal sphincter defects should be counseled about the risk of anal incontinence after a second vaginal delivery so they can make an informed choice about their subsequent mode of delivery.

Peleg *et al.* [30••] retrospectively reviewed 4015 delivery records to compare perineal outcomes in women with a history of a third or fourth degree laceration with those without a history of third or fourth degree laceration. Women with a previous third or fourth degree laceration were at increased risk of having an instrumental vaginal delivery and episiotomy than women without a history of previous laceration. Women with a history of third or fourth degree perineal laceration were 2.3 times as likely to have a repeat laceration in a subsequent delivery (7.5% vs 3.2%), than women without a history of third or fourth degree perineal laceration. Women sustaining a third or fourth degree laceration in their first delivery followed by an instrumental vaginal delivery with episiotomy in their subsequent delivery were at the highest risk for a recurrent third or fourth degree laceration (21.4%). The data were stratified to control for the higher episiotomy and instrumental delivery rate in women with a previous third or fourth degree laceration. In the group of women without episiotomy or instrumentation at either delivery, women with a previous third or fourth degree laceration were 7.5 times as likely to have a repeat third or fourth degree laceration than women without a previous third or fourth degree laceration (2.1% vs 0.3%). In the group of women with episiotomy at both deliveries, but without instrumentation at either delivery, women with a previous third or fourth degree laceration were 2.25 times as likely to have a repeat severe perineal laceration than women without a pervious third or fourth degree laceration (10.6% vs 5%).

Tertiary prevention strategies for urinary incontinence

Dainer *et al.* [31] surveyed 149 incontinence specialists to determine the appropriate delivery mode for women who, after continence surgery, desired future fertility. Of all respondents, 28% felt that a trial of labor and vaginal delivery was indicated following continence surgery. Of all respondents, 40% stated that they would always perform cesarean section in these patients. The authors reported continence rates after delivery in 152 women who had undergone previous continence surgery. Women who underwent vaginal delivery following continence surgery reported a lower rate of postpartum continence than women who underwent cesarean section (73.3 vs 92%).

Tertiary prevention strategies for pelvic organ prolapse

Kovac and Cruikshank [32] reported on 19 patients who underwent sacrospinous uterosacral ligament fixation for pelvic organ prolapse and a desire to maintain fertility. Five of the 19 patients successfully conceived and underwent vaginal delivery after repair. At the time of last follow-up, two of the five patients had recurrent prolapse, requiring repair in one patient.

Conclusions

Prevention of childbirth injury to the pelvic floor and its long-term sequelae is a major public health concern because the cost of managing incontinence and pelvic organ prolapse to society is great (Table 1). The majority of childbirth-related injuries to the pelvic floor occur after the first vaginal delivery. Cesarean after the onset of labor may not protect the pelvic floor. Elective cesarean section in all cases is the only true primary prevention strategy for reducing childbirth injuries to the pelvic floor. Alternative primary prevention strategies include elective cesarean section for women with nonmodifiable risks for childbirth injuries to the pelvic floor, antepartum pelvic floor exercises, or intrapartum pudendal nerve monitoring. Secondary prevention strategies must focus on modifying obstetric practices that predispose women to pelvic floor injury. These factors are best delineated for anal incontinence, and include restrictive use of episiotomy, mediolateral episiotomy when necessary, spontaneous over forceps-assisted vaginal delivery, vacuum extraction over forceps delivery, and antepartum perineal massage. Delayed pushing in the second stage of labor has an unclear effect on pelvic floor function. Finally, tertiary prevention strategies should address the delivery mode for women with childbirth injuries to the pelvic floor who desire future fertility. All women after corrective continence or prolapse surgery and symptomatic women with anal sphincter defects should have cesarean section. Asymptomatic women with a history of a third or fourth degree perineal laceration or a clinically evident anal sphincter defect should consider cesarean section because of the increased risk of recurrent third and fourth degree perineal lacerations and anal incontinence after a second vaginal delivery. Intervention studies will be required to determine if any of these prevention strategies are capable of reducing childbirth injury to the pelvic floor.

Table 1. Recommendations for preventing childbirth injury

Primary prevention strategies
Elective cesarean section
Elective cesarean section in women with nonmodifiable risk factors
Family history
White race
Antenatal bladder neck mobility
Antepartum pelvic floor exercises
Intrapartum pudendal nerve monitoring
Secondary prevention strategies
Modifiable obstetric risk factors (based on perineal trauma literature)
Spontaneous delivery over forceps-assisted vaginal delivery
Vacuum extraction over forceps-assisted vaginal delivery
Restricted episiotomy
Mediolateral episiotomy
Antepartum perineal massage
Tertiary prevention strategies
Mode of delivery for subsequent pregnancy
Cesarean section for women after corrective continence or reconstructive pelvic surgery
Cesarean section for symptomatic women with clinically evident anal sphincter defects
Consider cesarean section for asymptomatic women with clinically evident anal sphincter defects
Consider cesarean section for asymptomatic women with previous history of third or fourth degree perineal laceration

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- • Of importance
- •• Of major importance

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The authors prospectively followed 91% (278 patients) of their original sample for 5 years to determine the prevalence and risk factors for stress urinary incontinence. Physicians should use these data to provide patients who report antepartum urinary incontinence with a prognosis.

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