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# Poster Abstracts

## Urinary Symptoms in an Obstetric Perineal Clinic

Cynthia Brincat, MD, PhD, Christina Lewicky-Gaup, MD, Gizeli Nazmi, Dee E. Fenner, MD

**Objectives:** Perineal trauma is common with vaginal birth. Complications of such trauma, including fistulas, fecal and urinary incontinence, as well as perineal pain, can be potentially devastating for new mothers. In July of 2007, we established a post-partum perineal clinic, staffed by urogynecologists to identify and treat such women. We describe here the incidence, patient profile, and treatment of the urinary complaints within the clinic during its first year.

**Methods:** After IRB approval, we reviewed the charts of those patients presenting in the first 12 months of the clinic, abstracting for demographic variables, presenting complaint, findings, treatment, number of visits and the presence or absence of urinary symptoms.

**Results:** In the first year of the clinic (July, 2007-June, 2008) 40 patients were seen. Their mean age was 31 years old  $\pm$  5years, and their median parity was 1.25 (range 1-3). All patients had undergone a vaginal delivery; 15% had undergone a forceps delivery and 5% had undergone a vacuum delivery. 22.5% of the patients were referred from an outside institution. Over half of the patients were referred for follow-up of a third degree laceration (55%), the remainder were seen for urinary incontinence (20%), follow-up of a fourth degree laceration (17.5%), and perineal pain (7.5%). Of the 32 patients that presented for non-urinary complaints, a substantial number of them reported bothersome urinary symptoms (28%). These included stress incontinence (22%), urge incontinence (22%), dysuria (34%) and incomplete emptying (22%). In the group of women incidentally found to have urinary complaints, the vast majority were referred for follow-up of their third degree laceration (67%), and the remainder had presented to clinic for perineal pain. All patients presenting for pain were ultimately found to have urinary complaints. Of those with urinary incontinence as their presenting symptom, stress urinary incontinence predominated, with only one case of urge incontinence and one case of mixed incontinence. Treatment included TVT in those patient done with child-bearing (25%), fitting with an incontinence pessary (37.5%), and pelvic floor exercises (37.5%). Half of the cohort were prescribed estrogen vaginal cream for vaginal atrophy. On average, these patients had 2.0 office visits (range 1-5). Half of the patients were seen only once. Of the remaining patients with return visits, 75% reported symptom resolution while 25% reported an improvement in symptoms.

**Conclusion:** A postpartum perineal clinic offers an opportunity for early assessment and treatment of pelvic floor dysfunction including urinary complaints, even when these are not the presenting problem. It is hoped that this can be used to reduce the long-term morbidity and stigma due to unrecognized or untreated perineal trauma.

## Overactive Bladder and Caffeine: Comparing women with and without mental health diagnoses

Vidya Chakravarthy, Margaret Tolbert, MSN, ANP-BC, Janis Miller, PhD ANP-BC

**Abstract:** Women suffering from overactive bladder have often been told that urinary frequency is caused by excess consumption of potentially irritating beverages (PIB). However, previous research has indicated that many of these women have also suffered from mental health disorders such as anxiety disorder, post traumatic stress disorder, bipolar disorder and depression. Based on these noted correlations, this study's purpose is to understand this relationship and determine if the above mental disorders cause excess consumption of PIB which will consequently cause overactive bladder symptoms in women. It has been hypothesized that

PIB activate the pleasure center in the brain which can cause a higher rate of consumption of PIB in people with mental health disorders. This can result in high rates of overactive bladder or urinary incontinence in this specific group of women. After an extensive literature review where past research projects related to the relationship between mental health disorders and overactive bladders were examined, and the eventual use of data from funded research at the University of Michigan School of Nursing, the amount of PIB consumed in the population diagnosed or treated for anxiety disorder, bipolar disorder, post traumatic stress disorder, and depression will be compared to the amount of PIB consumed by the population of people without the above disorders. The hypothesized conclusion is that the amount of potentially irritating beverages consumed by the population with the above mental health disorders is higher than the consumption of PIB of the population without the disorder.

**Awards:** Undergraduate Research Opportunity Program Award of Excellence for the presentation poster as well as the content.

## **Major Levator Ani Defect Effects on Pelvic Floor Structure and Function**

Natalie A. Clark, John O.L. DeLancey, MD

**Objective:** To compare the structure and function of the pelvic floor of women with and without major levator ani defects independently of prolapse.

**Method:** Case-control study among 20 women with major levator ani defects and 20 women with normal support, holding prolapse constant at 50%. Dynamic MRI with Kegel and Valsalva were taken and 2-D analysis was applied to characteristic anatomic points on MRI.

**Results:** At rest, maximum Kegel and maximum Valsalva the urogenital hiatus and levator hiatus are larger and the y-coordinate of the perineal body and external anal sphincter is lower in women with defects than those without. The y-coordinate of the bladder is lower and the bladder moved farther with maximum Valsalva in women with defects compared to those without. At rest and maximum Kegel the x-coordinates of the bladder of women with defects is farther away from the pubic symphysis than those without.

**Conclusions:** The pelvic floor anatomy of women with major levator ani defects is primarily deformed at rest, maximum Kegel and maximum Valsalva. This points to the necessity of levator ani integrity in maintaining normal pelvic floor structure and function.  
Supported by NIH HD 38665, ORWH SCOR HD 44406

## **A Stereophotogrammetric System for Measuring Vertex Descent Rate During the Second Stage of Labor**

Jinyong Kim, MS, James A. Ashton-Miller, PhD, John O. L. DeLancey, MD, Lisa Kane Low, PhD, CNM, FACNM

### **Abstract**

A stereophotogrammetric system has been developed to make non-contact measurements of the time rates of change of vertex diameter and perineal descent during the second stage of labor. The system consists of a mobile stand and three synchronized digital cameras which record the deformation in the pattern of structured light projected onto the perineum. A wireless foot switch is used to make measurements both at rest and during volitional pushing in either a single shot or burst mode. Major and minor vaginal diameters and 3-D pelvic floor shape will be measured relative to ink reference marks on the skin over bony pelvic landmarks. The 3-D perineal geometry then can be reconstructed mathematically offline using data from the sets of triple planar images uploaded to a PC.

We gratefully acknowledge the financial support of Project 1 of the PHS SCOR P50 HD044406-06 grant.

## **A Finite Element Model Investigation of Pubovisceral Muscle Enthesis Loading During the Second Stage of Labor**

Jinyong Kim, MS, James A. Ashton-Miller, PhD, John O. L. DeLancey, MD

### **Abstract**

The most vulnerable part of the pelvic floor muscle to injury during the second stage of labor is the pubovisceral muscle (PVM). Some 10-15% of parous women demonstrate a PVM muscle defect 1-year postpartum. The most common form of injury appears to be avulsion of the origin of the PVM, suggesting a failure at or near its entheses with the pubic bone. A simplified finite element model of the muscle was developed and placed under tension in the caudoposterior direction. The results raise questions about the detailed morphology of the PVM entheses, the effect of muscle anisotropy, and whether perineal descent plays a role in the injury mechanism.

We gratefully acknowledge the financial support of Project 1 of the PHS SCOR P50 HD044406-06 grant.

## **MRI-based 3-D model of anterior vaginal wall position at rest and maximal strain in women with and without prolapse: a pilot study investigating “what really occurs.”**

Kindra Larson, MD, Yvonne Hsu, MD, Luyun Chen, PhD, James A. Ashton-Miller, PhD, John O.L. DeLancey, MD

**Objective:** Data from 2-D mid-sagittal MR imaging during Valsalva demonstrates that both apical support and vaginal length contribute to anterior vaginal wall prolapse. Objective information is still lacking on the role played by paravaginal defects between the vagina and arcus tendineus fascia pelvis (ATFP) and the degree of transverse vaginal stretching. The aim of this study was to develop a 3-D technique to study the vagina and its relationship to the pelvic sidewall at rest and maximal Valsalva and to report preliminary findings.

**Methods:** Five symptomatic women with anterior vaginal wall prolapse and five asymptomatic women with normal support were recruited from an ongoing study. Supine, multi-planar MR imaging of the pelvis was performed at rest and maximal Valsalva with gel in the vagina to delineate the lateral sulci. 3-D reconstructions of the pelvic bones and anterior vagina at rest and during Valsalva were created using 3-D Slicer (Slicer2). The pelvic bones of resting and Valsalva scans for each subject were aligned to allow direct comparison of vaginal position. A line representing the normal ATFP location was constructed from the inferior pubic bone to the ischial spine to allow assessment of vaginal position relative to this landmark.

**Results:** With Valsalva the vaginal apex descended in women both with and without prolapse. In women with prolapse several other phenomena were also visible: (a) the vagina moved downward along its length, increasing the vertical distance between the lateral sulcus and normal ATFP; (b) the degree of apical descent allowed the lower vagina to slide below the introitus where it was no longer in contact with the perineal body; (c) the distal portion of the vagina not supported by the levator ani exhibited evidence of “cupping” (Fig. 1) with a modest increase in transverse diameter; (d) the vagina above this portion where it was in contact with the posterior wall did not reveal any transverse stretching; and (e) the distal end of the vagina appears to rotate downward along an arc centered on the inferior pubis (Fig. 2).

**Conclusion:** This novel technique allows objective analysis of vaginal position during Valsalva in women both with and without prolapse. This demonstrates additional processes which could

contribute to cystocele size and severity – not only the change in relationship between the vagina and pelvic sidewall with increased vertical distance from the normal ATRP, but also the distension and “cupping” of the unsupported distal wall, and the mobility inferior to the pubic bone.  
Supported by NIH HD 38665, ORWH SCOR HD 44406

### **Racial differences in bother for women with urinary incontinence in the Establishing the Prevalence of Incontinence (EPI) study**

Christina Lewicky-Gaupp, MD, Cynthia Brincat, MD, PhD, Elisa R. Trowbridge, MD, John O. L. DeLancey, MD, Kenneth Guire, PhD, Divya A. Patel, PhD, Dee E. Fenner, MD

**Objective:** To compare differences in degree of bother in women with urinary incontinence (UI) in a sample of black and white women.

**Methods:** A population-based study was conducted in black and white women of southeastern Michigan. Participants completed a telephone interview and the Incontinence Impact Questionnaire short form (IIQ-7). Statistical analysis included 2-way ANOVA for post-hoc comparisons of IIQ-7 scores between the two races at different frequencies, amounts, and types of UI.

**Results:** Black women with moderate UI had significantly higher IIQ-7 scores than white women ( $31.4 \pm 3.5$  vs.  $23.7 \pm 1.9$ ,  $p=.03$ ). Overall, black women with urge incontinence had higher scores than white women ( $30.5 \pm 4.0$  vs.  $21.0 \pm 3.0$ ,  $p=.05$ ). After adjusting for severity, black women with urge and mixed incontinence tended to be more bothered ( $p=.06$ ).

**Conclusion:** With moderate UI, black women are more bothered than their white counterparts. At this discriminatory level of UI severity, racial differences are important, as they may dictate care-seeking behavior.

We gratefully acknowledge research support from the National Institute of Child Health and Human Development Grant R01 HD 041123.

### **Are Urothelial Cells Involved in Urinary Incontinence?**

Monica Liebert, Ph.D.\*, Chanel Hamilton\*, Courtney Harris\*, Daniel McConnell, Ph.D.,\*\* Ann L. Oldendorf, M.D.\*

\*Department of Urology, Medical School and \*\*CLASS Laboratory, Department of Epidemiology, School of Public Health, University of Michigan, Ann Arbor, MI.

**Objective:** Most basic research on urinary incontinence focuses on nerve and smooth muscle activity. However, recent results in developmental models indicate that important interactions between urothelial cells lining the urinary bladder and other cellular components of the urinary bladder occur. We undertook this pilot study to explore whether urothelial cells are dysfunctional in patients with urinary incontinence.

**Methods:** Urine samples were obtained from patients from a urinary incontinence clinic. Normal urine samples were obtained from volunteers, who denied having urinary incontinence or recent bladder infections. All samples were obtained under University of Michigan Institutional Review Board approved protocols. Urine samples were screened for evidence of blood, leukocytes or bacteria using a standard urine dipstick test, and creatinine levels were determined using the Jaffe reaction. Levels of soluble e-cadherin (SEcad), a soluble released fragment of the e-cadherin cell adhesion molecule present only in epithelial cells, were evaluated using a commercially-available enzyme-linked immunosorbent assay (ELISA, R&D Systems). Statistical analyses were performed using a commercially-available computer statistical package (SigmaStat v 3.5).

**Results:** SEcad levels from urine samples from 36 patients at a urinary incontinence clinic were compared to those from 27 normal volunteers. Values were normalized by calculation of a SEcad/creatinine ratio. The median ratio from the patient samples was 792 pg SEcad/mg creatinine, while the median ratio from the normal samples was 246 pg SEcad/mg creatinine. These results are statistically significantly different ( $p=.029$ , Mann-Whitney U test).

**Conclusions:** These pilot data suggest that urothelial cell function is disrupted in patients with urinary incontinence and that urothelial cells may participate in bladder dysfunction related to urinary incontinence. These pilot data need to be confirmed and extended in better characterized patient populations.

Support: Supported in part by R21-DK66077 and P50-DK065313 from NIDDK, NIH.

### **Finding by MRI on Injury and Recovery of the Levator Ani muscles and Surrounding Structures After High Risk Vaginal Birth**

Janis Miller PhD ANP-BC, Catherine Brandon, MD, Lisa Kane Low, PhD, CNM, FACNM, James Ashton-Miller PhD, John DeLancey MD

**Objective:** To use serial magnetic resonance (MR) imaging and established criteria from musculoskeletal radiology to classify severity, type, and resolution of birth related injury to the levator ani muscle (LA) and surrounding structures.

**Methods:** We studied 21 women with factors associated with an increased risk of LA injury: first vaginal delivery, long 2<sup>nd</sup> stage, forceps delivery, or anal sphincter laceration (Kearney, 2006). MR was obtained at 2-6 weeks and 6 months post vaginal birth using multiplanar 3T proton density. In the last 11 women a fluid sensitive sequence was added to increase sensitivity to signal intensity changes indicative of edema. MR injury features noted were: 1) High signal intensity reflecting trauma-related edema. 2) Signal intensity pattern reflecting injury as diffuse or focal. 3) Muscle fiber discontinuity graded as partial or full tear.

The figure shows an early and late scan example. PB=pubic bone, R=Rectum, U=urethra. Note on early scan, high signal (lighter color) in the (R) LA's pubic portion (LA-p) but normal signal (dark) in adjacent obturator internus (OI). On the left (L) no LA-p is seen in the expected location (arrow) between the vagina and OI. At 6 months LA signal intensity has improved on the right, muscle absence persists on the left.

**Results:** In 21/21 women high signal intensity was seen in the LA but not in the OI on early scan. Reduction of the signal intensity occurred in all late scans though in women with fluid-sensitive images there remained mildly increased signal in the LA compared to the unaffected OI. Partial or full LA tears were seen at the location of the pubic bone attachment point in 6/21 women on early scan; none showed reattachment on late scan. (One woman with tear dropped before f/u). None of the women showed a pattern of muscle atrophy from early to late scans, which would be expected if there were overt denervation. Of the 11 women with fluid sensitive scans 4 with LA tears and 4 without showed focal bone marrow edema (high signal).

**Conclusion:** Results show feasibility of using MR to study birth related tissue injury and recovery. LA tears and focal bone marrow edema were seen. None of the LA tears observed in early scans resolved. *Comment:* Edema in the LA but not the OI is more consistent with stretch than compression injury.

Source Support: NIH R21 HD049818

### **Short term response to Knack therapy (no dedicated muscle strengthening) for treatment of incontinence**

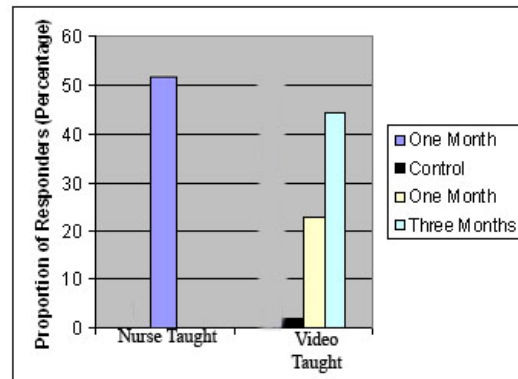
Janis Miller PhD, ANP-BC, Lee Park, MS, Meg Tolbert MS, James Ashton-Miller PhD, John DeLancey MD

**Introduction and Objectives:** The Knack treatment for urinary incontinence involves teaching women to contract their muscles in anticipation of expected leakage. It does not include dedicated muscle strengthening exercises. This “quick therapy” has demonstrated effectiveness in reducing leakage on standing stress test when evaluated in the clinic but is untested in daily life. This abstract summarizes three phases of a project designed to evaluate Knack effect in daily life: Phase 1) demonstrating short-term efficacy with personalized instruction, Phase 2) a randomized controlled trial of video instruction, and Phase 3) long-term efficacy at 1-year post-intervention.

**Methods:** In Phase 1, 64 incontinent women completed a pre- and post-test trial in which Knack instruction was provided individually by a nurse practitioner as part of a prospective clinical trial. The nurse taught how and when to use the Knack and provided feedback on technique through digital palpation and by demonstrating the woman’s own pelvic muscle contraction when coughing on perineal ultrasound. In Phase 2, 111 incontinent women completed a single-blinded randomized controlled trial of Knack instruction as provided by video. All women had a pelvic examination during which a nurse asked them to contract their pelvic muscles, including on ultrasound, but did not provide instruction in using them to reduce urine leakage. The treatment group watched a video about Knack therapy while the control group watched a video on food pyramid instruction. Both videos were approximately 10 minutes long. The Knack video included actresses portraying when to use the Knack in situations such as sneezing, coughing, on arising, and to suppress urge sensations triggered by running water or arriving home. The video also included an ultrasound showing use of the Knack to stabilize the bladder during a cough maneuver. Phase 3 recycles the control group women back into the study to receive the Knack intervention after their 1-month visit. Responders from all three phases will be followed to 1-year.

**Outcomes:** Strict *a priori* criteria were used to determine response. Positive response required 50% improvement on at least 2 of 3 measures: incontinence episodes on diary, leakage volume on quantified standing stress test, and self-reported improvement using a scale of 0 – 100%.

**Results:** In Phase 1, Knack instruction provided by a nurse resulted in 51% of the sample being categorized as a positive responder at 1-month f/u. In the RCT (Phase 2), at 1 month the control group (diet video) showed a 2% response rate whereas the treatment group (Knack video) showed 23% ( $p = .007$ ). This initial response rate to the Knack video improved to 44% at 3-months, without any additional intervention. Phase 3 to determine persistence of effect at 1-year post-intervention is in analysis phase.



**Conclusion:** Using stringent objective outcome criteria, half of women who learned the Knack from the nurse have a 50% reduction in their incontinence episodes during normal activities at one month. When Knack instruction is provided by video the response rate is lower at 1 month (23%), but similar at 3 months (44%) compared to a 2% response rate in control women at 1-month. *Comment:* These improvements occur without dedicated muscle strengthening exercises as part of the intervention, demonstrating that skill in using a muscle contraction to stop incontinence is effective at rates that are similar to those reported from muscle strengthening trials. Although personalized instruction in the Knack elicits a quicker response than video instruction, the exciting potential is that a brief video could be viewed, for instance on YouTube, with remarkable potential as a wide scale public health intervention.

## Recruitment 101: Strategies for a Multi-site Clinical Trial

Meg Tolbert, MSN, ANP-BC and Ruta Misiunas, BA

Recruitment of research participants can be challenging and costly, often making a project run over budget. The purpose of this abstract was to review recruitment strategies and costs from previous School of Nursing Pelvic Floor studies and identify the most effective strategies for recruitment to be used in a multi site clinical trial for a new FDA approved medication for urge urinary incontinence.

Findings show the most effective strategies (regardless of cost) were print advertisements, direct mailing, newsletter and research volunteer website.

Recommendations include: future studies budget adequately for recruitment time and costs; and evaluations of all recruitment strategies be conducted at study termination. This will ascertain that the skills, knowledge, and resources necessary to carry out new proposed lines of research are funded adequately and chosen recruitment strategies will result in the greatest amount of potential participants.

### **Dynamic Magnetic Resonance of Pelvic Structure and Function at 1 Month Compared to 7 Months after Vaginal Birth**

Aisha A. Yousuf, MD, John O. L. DeLancey, MD, Catherine J. Brandon, MD, Janis M. Miller, PhD

**Objectives:** To determine if changes exist in location and movement of pelvic floor structures at one and seven months postpartum.

**Study Design:** Mid-sagittal MR images from 13 primiparous women with birth events associated with levator ani damage at early (~ 1 month) and late (~ 7 months) postpartum time-points were analyzed. Pelvic floor structures locations at rest and displacements from rest to maximum Kegel and Valsalva were determined. Urogenital and levator hiatus diameters were measured as well.

**Results:** The perineal body was 7.1 mm and anal verge 7.9 mm higher at seven months postpartum ( $p = 0.003$ ). Both the urogenital and levator hiatus diameters were smaller at seven months ( $p < 0.05$ ). Displacement during Kegel and Valsalva was similar between the two time-points.

**Conclusion:** Resting locations of the perineal body and anal verge are higher at seven months postpartum, but the amount of movement during Kegel or Valsalva does not change.

### **Reliability and Validity of a Single Billed Instrumented Speculum for Measuring Vaginal Closure Force.**

Ruth Zielinski, MS,CNM; James Ashton-Miller PhD; John DeLancey MD; Janis Miller PhD, ANP-BC

**Objective:** The levator ani musculature play an important roll in supporting the bladder neck and maintaining urinary continence in women therefore measurement of maximum voluntary pelvic muscle (levator ani) strength is an important part in assessing pelvic floor function. Readings are subject to systemic bias due to the intra-abdominal pressure rise that inevitable accompany a maximum vaginal closure force attempt. The specific aims of this study are: 1) To test the reliability of a single billed weighted speculum adapted for measuring intravaginal closure pressure; and 2) To compare results with a similar double billed speculum reported in the literature.

**Methods:** The one billed speculum adapted by one of the authors (JAM) for measuring intravaginal closure pressure was tested for reliability of measurements across visits and compared with the results of a similar double billed speculum using the Bland-Altman method of analysis.

**Results:** There was adequate reliability of measurements despite the challenges associated with measuring intravaginal closure pressure.

**Conclusions:** The single billed speculum shows promise for use in future research and clinical areas.

