

## THE MATERNAL SEQUELAE OF CHILDBIRTH: A PROSPECTIVE STUDY OF THE STRUCTURE AND FUNCTION OF THE PELVIC FLOOR USING MRI, PERINEOMETRY, OXFORD SCORE, POPQ, AND ICIQ-UI

### Hypothesis / aims of study

This study objectively compares the effects of vaginal delivery (VD) and Caesarean section (CS) on the pelvic floor, and correlates them with clinical outcomes and quality of life measures. We also aimed to determine whether delivery by CS prevents pelvic floor injury and subsequent development of stress urinary incontinence (SUI) and pelvic organ prolapse (POP).

### Study design, materials and methods

This is a prospective cohort observational study using magnetic resonance imaging (MRI), Oxford score, perineometry, pelvic organ prolapse quantification system (POP-Q) and a validated Arabic language version of the International Consultation on Incontinence Modular Questionnaire- Urinary Incontinence (ICIQ-UI).

Continent primiparous women aged 18 years or more were recruited in the third trimester. Participants had the following investigations antenatally: stress test, Oxford score, perineometry, POPQ, and ICIQ-UI. All investigations, in addition to static and dynamic MRI, were repeated 12 months postpartum. Investigators and radiologists were blinded to the mode of delivery.

Magnetic resonance images were assessed by three board certified radiologists, with long experience/ subspecialty in pelvic floor and musculoskeletal imaging. Analysis of static images included:

urethral supporting structures (urethral ligaments, level III fascial support and puborectalis muscle), vaginal supporting structures (level I/II fascial support and iliococcygeus muscle) and the anal sphincters (internal and external). Analysis of dynamic images included: descent of pelvic organs below the pubococcygeus line and the status/weakness of the levator ani muscle (1).

Participants who had instrumental vaginal delivery, prolonged second stage or third/fourth degree tears were excluded. All CS cases were either elective or emergency (in the first stage before pushing and before engagement of the head).

### Results

Results of ninety-eight participants are described. Among those, 66(67.3%) delivered vaginally and 32 (32.7%) by CS. SUI was found in 21 participants; two (6.3%) delivered by CS and 19 (28.8%) by VD,  $p = 0.008$ . Severity of SUI is shown in table 1.

Table 1. Severity of UI according to mode of delivery

| Mode of Delivery | ICIQ-UI  | N (%)   |
|------------------|----------|---------|
| VD               | Mild     | 9(47.4) |
|                  | Moderate | 9(47.4) |
|                  | Severe   | 1(5.3)  |
| CS               | Mild     | 1(50)   |
|                  | Moderate | 1(50)   |

N= number (percentage); VD vaginal delivery; CS Caesarean section.

There was significant reduction in pelvic floor muscle strength as assessed by Oxford score after VD,  $p = 0.001$ , but not after CS. Similar results were detected by perineometry (table 2).

Table 2. Perineometry before and after delivery.

| Mode of Delivery |        | Mean $\pm$ SD     | Mean Difference | P-value |
|------------------|--------|-------------------|-----------------|---------|
| VD               | before | 26.61 $\pm$ 9.14  | 4.29            | <0.001* |
|                  | after  | 22.32 $\pm$ 7.44  |                 |         |
| CS               | before | 25.25 $\pm$ 9.47  | 0.81            | 0.314   |
|                  | after  | 26.06 $\pm$ 10.02 |                 |         |

SD; standard deviation; \* Wilcoxon signed rank test.

POP was detected in 20 (30.3%) of the VD group and none of the CS group. Nineteen (28.8%) participants developed puborectalis (PR) muscle injuries after delivery (all delivered vaginally); of those, eight (42.1%) developed POP and 10 (52.6%) developed SUI,  $p$ -values were 0.009 and <0.001 respectively.

There was a significant relationship between PR muscle injury and reduction in Oxford score and perineometry,  $p$ -value = 0.014 and 0.008 respectively

Twenty-four cases (all delivered vaginally) developed fascia level III injuries, of those 15 (62.5%) were stress incontinent,  $p$ -value < 0.001.

### Interpretation of results

The results of this study show that VD is associated with more SUI and POP in comparison to CS. In addition, a significant negative relationship was found between VD and pelvic floor muscle strength as assessed objectively by perineometry and subjectively by Oxford score.

There was a significant relationship between PR muscle injury, the development of SUI and POP. The mechanism of development of SUI and POP is probably related to PR muscle and fascial injuries.

### Concluding message

Vaginal delivery results in injuries to the pelvic floor musculature, ligaments and fascia. It is significantly associated with pelvic floor muscle weakness, POP, SUI and negative impact on quality of life. Despite the potential increase in maternal morbidity and mortality, CS (elective/first stage before pushing and head engagement) appears to be protective to the pelvic floor and to the development of SUI and POP in primiparous women.

### References

1. Farouk ElSayed, R. The urogynecological side of pelvic floor MRI: the clinician's needs and the radiologist's role. *Abdom Imaging*. 2013 Oct;38(5):912-29.

### Disclosures

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**Subjects:** HUMAN **Ethics Committee:** KAIMARC Institutional Review Board (IRB) reference : RC08/116/J **Helsinki:** Yes  
**Informed Consent:** Yes