Bladder Filling in Cesarean Hysterectomy for Placenta Percreta: A Randomized Trial
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ABSTRACT
Background: Preserving the bladder border is an important step in the surgical approach to treat invasive placental disorders. Additional procedures such as filling the bladder with saline, administering intravenous dye, or instilling sterilized milk are used to preserve the bladder or determine bladder injury.
Objective: This study aimed to evaluate the effect of filling the bladder on prevention of bladder injury in pregnant women with placenta previa percreta undergoing elective cesarean hysterectomy.
Patients and methods: A prospective randomized controlled study that was conducted in Obstetrics and Gynecology Department, Mansoura University Hospital from December 2019 to March 2022. Sample size was 32 subjects per group i.e., the total sample size was 64 subjects. Studied case were 29 cases (45.3%) that had positive bladder filling and 35 (54.7%) cases had negative bladder filling.
Results: There was statistically significant lower urinary bladder injury among cases with bladder filling than in cases without filling (3.4% versus 57.1%, respectively). Moreover, none of the studied cases had ureteric injury. There was decrease in hospital stay as well as blood loss among group with filling technique. There was significantly higher post-operative HB level, lower blood loss and lower need for packed RBCS among bladder filling technique than in those with no filling technique
Conclusion: The filling bladder technique had significant role on prevention of bladder injury in managing women with placenta previa percreta undergoing elective cesarean hysterectomy with lower blood loss and need for blood transfusion and lower need for hospital stay than non-filling group.
Keywords: Bladder filling, Cesarean hysterectomy, Placenta percreta.

INTRODUCTION
The placenta accreta spectrum (PAS) which includes accreta, increta, and percreta represents a significant obstetric challenge. PAS complicates as many as 1 per 500 pregnancies and this risk is increased with prior caesarean deliveries. Ultrasound evaluation is the recommended first-line modality for diagnosing PAS. Ultrasound features suggestive of PAS include loss of the normal retroplacental clear zone, attenuation of the uterine-bladder interface, reduced retroplacental myometrial thickness, presence of intra-placental lacunar spaces, and bridging vessels between the placenta and bladder (1). Antenatal diagnosis of PAS allows for multidisciplinary planning and delivery before the onset of labor and/or vaginal bleeding. This approach has reduced maternal morbidity rates, including less blood loss, fewer transfusion requirements and intra-operative urinary tract injury as well as improvement of fetal outcome (2). A systematic review reported that the antenatal diagnosis of PAS significantly lowered the rate of urinary tract injury (from 63% to 39%) during cesarean hysterectomies in these cases (3).

Unlike other elective cesarean hysterectomies, cesarean hysterectomy with a placenta previa increta/percreta, is more difficult. There is a greater need to both keep a margin from the vascular cervical-placental mass and simultaneously protect the urinary bladder (4).

Case series reported that bladder filling helps the surgeon to more clearly identify the planes of dissection and secure the engorged aberrant vessels (5), thereby reduces bladder injury. Accordingly, a prospective randomized study on pregnant patients with placenta previa increta/percreta undergoing elective cesarean hysterectomy was conducted to address this important issue through evaluation of the effect of filling the bladder on prevention of bladder injury in pregnant women with placenta previa percreta undergoing elective cesarean hysterectomy.

PATIENTS AND METHODS
A prospective randomized controlled study was conducted from December 2019 to March 2022 in Obstetrics and Gynecology Department, Mansoura University Hospital.

Inclusion criteria: Pregnant women in their third trimester (34-37 W). Placenta accreta spectrum identified by US (low lying anterior or major degree anterior). With at least one prior caesarean section. Elective cesarean hysterectomy. Evidence of gross placental invasion at the time of surgery (FIGO grade 3a) (6).

The sample size was calculated using the following formula:

\[ n = \left[ \frac{Z_{\alpha/2} + Z_{\beta}}{p_1 - p_2} \right]^2 \left( p_1 q_1 + p_2 q_2 \right) \]

Where:
- \( n \) = sample size
- \( Z_{\alpha/2} = 1.96 \) (The critical value that divides the central 95% of the Z distribution from the 5% in the tail)
- \( Z_{\beta} = 0.84 \) (The critical value that separates the lower 20% of the Z distribution from the upper 80%)
- \( p_1 \) = rate of bladder injury with bladder filling patients = 10%
- \( p_2 \) = rate of bladder injury without bladder filling patients (control group) = 40% (5).
- \( q = 1 - P \)

So, by calculation, sample size was 32 subjects per group i.e. the total sample size was 64 subjects.

**Methods:**
A full history was obtained from each participant. Thorough clinical examination was performed. Basic laboratory workup including CBC, liver function test... etc., was revised. Every patient was evaluated by grayscale ultrasound and color Doppler for features suggestive of PAS including loss of the normal retroplacental clear zone, attenuation of the uterine-bladder interface, reduced retroplacental myometrial thickness, presence of intra-placental lacunar spaces, and bridging vessels between the placenta and bladder. Evidence of gross placental invasion at the time of surgery by placental tissue seen to have been invaded through the serosa of the uterus was documented (FIGO grade 3a). After delivery of the fetus through a higher uterine incision, patients were randomized either into the filled-bladder (with 300 ml diluted methylene blue) or the non-filled-bladder group using sealed opaque envelopes. Cesarean hysterectomy was carried out. An urologist was consulted in case of bladder injury. The primary outcome measure was the rate of bladder injury in the two treatment arms. Secondary outcome measures were estimated as blood loss, blood transfusion and any other intra-operative complications. Histopathological assessment of the hysterectomy specimens was done to confirm the diagnosis.

**Ethical consent:**
Approval of the local IRB (Mansoura University) and Ethical Committee was obtained before starting our research study. Code Number: MS.19.12.939. Every patient signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

**Statistical Analysis**
The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc., Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test (\( \chi^2 \)) was used to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean ± SD. Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value ≤ 0.05 was considered significant.

**RESULTS**
The present study was interventional study aiming at evaluation of the effect of filling the bladder on prevention of bladder injury in pregnant women with placenta previa percreta undergoing elective cesarean hysterectomy.
Table (1) showed that among studied case, 29 cases (45.3%) had positive bladder filling and 35 (54.7%) cases had negative bladder filling.

**Table (1): Distribution of the studied cases according to bladder filling**

<table>
<thead>
<tr>
<th>Bladder filling</th>
<th>N=64</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>-ve</td>
<td>35</td>
<td>54.7</td>
</tr>
<tr>
<td>+ve</td>
<td>29</td>
<td>45.3</td>
</tr>
</tbody>
</table>

Table (2) showed that mean age of the studied cases was 32.33 ± 4.99 years and, mean age at delivery was 35.58 ± 2.89 weeks. There was no statistically significant difference between studied groups with bladder filling and no filling as regards their demographic and obstetric history.

**Table (2): Demographic and obstetric history distribution according to bladder filling**

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>No bladder filling</th>
<th>Bladder filling</th>
<th>Test of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/years</td>
<td>32.33±4.99</td>
<td>32.34±5.44</td>
<td>32.31±4.49</td>
<td>( t=0.026 )  ( p=0.980 )</td>
</tr>
<tr>
<td>Age at delivery/weeks</td>
<td>35.58±2.89</td>
<td>34.94±3.68</td>
<td>36.34±1.11</td>
<td>( t=1.97 )  ( p=0.053 )</td>
</tr>
<tr>
<td>Gravidity</td>
<td>4(3-9)</td>
<td>5(3-9)</td>
<td>4(3-8)</td>
<td>( Z=1.43 )  ( P=0.154 )</td>
</tr>
<tr>
<td>Parity</td>
<td>3(2-7)</td>
<td>3(2-7)</td>
<td>3(2-7)</td>
<td>( Z=1.69 )  ( P=0.09 )</td>
</tr>
<tr>
<td>Number of CS</td>
<td>3(1-6)</td>
<td>3(2-5)</td>
<td>2(1-6)</td>
<td>( Z=1.80 )  ( P=0.072 )</td>
</tr>
</tbody>
</table>

Parameters described as mean ± SD or median (range), \( Z \): Mann Whitney U test, \( t \): Student t test
Table (3) showed statistically significant higher mean hemoglobin level among cases with bladder filling post-operative as compared to cases without bladder filling (P<0.001). Also, mean packed RBCS showed statistically significant higher value among cases without bladder filling than cases with bladder filling (P<0.05). There was statistically significant lower hospital stay with bladder filling group than in non-filling bladder group (p<0.001).

Table (3): Laboratory finding distribution according to bladder filling

<table>
<thead>
<tr>
<th>Parameters</th>
<th>No bladder filling N=35</th>
<th>Bladder filling N=29</th>
<th>Test of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>HB pre (gm/dl)</td>
<td>10.63±1.14</td>
<td>10.39±1.24</td>
<td>t=1.89, p=0.06</td>
</tr>
<tr>
<td></td>
<td>10.9±0.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HB post (gm/dl)</td>
<td>10.33±1.02</td>
<td>9.86±0.89</td>
<td>t=4.72, p&lt;0.001*</td>
</tr>
<tr>
<td></td>
<td>10.9±0.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood loss /mm</td>
<td>2053.13±71.01</td>
<td>2117.14±94.29</td>
<td>t=0.80, p=0.427</td>
</tr>
<tr>
<td></td>
<td>1975.86±73.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packed RBCS</td>
<td>5.28±1.96</td>
<td>5.74±1.95</td>
<td>t=2.12, p=0.038*</td>
</tr>
<tr>
<td></td>
<td>4.72±0.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasma</td>
<td>3(0-8)</td>
<td>3.43±1.48</td>
<td>t=1.79, p=0.078</td>
</tr>
<tr>
<td></td>
<td>2.76±1.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospita l stay /days</td>
<td>7 (4-15)</td>
<td>14 (6-15)</td>
<td>Z=5.28, p&lt;0.001*</td>
</tr>
<tr>
<td></td>
<td>6 (4-14)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: parameters described as mean ± SD or median (range). Z: Mann Whitney U test, t: Student t test, *statistically significant.

Table (4) showed that 32.8% have bladder injury and none of the studied cases have ureteric injury. Incidence of bladder injury was lower among cases with bladder filling than cases without filling (3.4% versus 57.1%, respectively).

Table (4): Complications distribution according to bladder filling

<table>
<thead>
<tr>
<th>Parameters</th>
<th>No bladder filling N=35 (%)</th>
<th>Bladder filling N=29 (%)</th>
<th>Test of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bladder injury</td>
<td>15(42.9)</td>
<td>28(96.6)</td>
<td>χ²=20.74, P&lt;0.001*</td>
</tr>
<tr>
<td>-ve</td>
<td>20(57.1)</td>
<td>1(3.4)</td>
<td></td>
</tr>
<tr>
<td>+ve</td>
<td>43</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Ureretic injury</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

FET: Fischer exact test, χ²=Chi-Square test, *statistically significant

Table (5) showed that 26 cases (40%) had placenta accrete, 20 cases (31.2%) had placenta increta, 7 cases (10.9%) had placenta previa and 11 cases (17.2%) had placenta percreta. There was a statistically significant higher frequency of placenta previa among cases without bladder filling than in cases with bladder filling (28.6% versus 3.4%) and higher frequency of placenta accreta among cases with bladder filling (55.2%) versus 28.6% among cases without filling.

Table (5): Pathology distribution according to bladder filling

<table>
<thead>
<tr>
<th>Pathology</th>
<th>Total number</th>
<th>No bladder filling N=35 (%)</th>
<th>Bladder filling N=29 (%)</th>
<th>Test of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placenta accrete</td>
<td>26</td>
<td>10 (28.6)</td>
<td>16</td>
<td>χ²=8.60, P=0.035*</td>
</tr>
<tr>
<td>Placenta increta</td>
<td>20</td>
<td>11 (31.4)</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Placenta percreta</td>
<td>7</td>
<td>4 (11.4)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Placenta previa</td>
<td>11</td>
<td>10 (28.6)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Note: χ²=Chi-Square test, *statistically significant 4 cases have no results of pathology.

DISCUSSION

We aimed in the present study to evaluate the effect of filling the bladder on prevention of bladder injury in pregnant women with placenta previa undergoing elective cesarean hysterectomy in comparison with the previous traditional concept. Among our patients, 29 cases (45.3%) had positive bladder filling and 35(54.7%) cases had negative bladder filling. The mean age of the studied cases was 32.33 ± 4.99 years, among our participants 40% had placenta accrete, 31.2% had placenta increta, 10.9% had placenta previa and 17.2% placenta percreta.

The median (range) gravidity of participants was 4(3-9) and median (range) of previous CS was 3(1-6), with no statistically significant difference between the studied groups.

Walters and Karram (7) reported that pregnant women with previous cesarean delivery have chance of bladder injury during next cesarean section increase 3-folds (0.6% repeat cesarean versus 0.19% primary cesarean section). In Rahman et al. (8) study, patients with repeated Cesarean sections were associated with bladder injury in 0.81% of cases while bladder injury was reported only in 0.27% of patients who had Cesarean section for first time. Urinary bladder injury complicates about 11.7% of cesarean sections in women with placenta accreta spectrum (PAS) (9). Silver et al. (10) concluded that a history of multiple CS or placenta previa increases the risk of placental invasion abnormalities. A high number (> 3) of previous cesarean section for first time. Urinary bladder injury complicates about 11.7% of cesarean sections in women with placenta accreta spectrum (PAS) (9). Silver et al. (10) concluded that a history of multiple CS or placenta previa increases the risk of placental invasion abnormalities. A high number (> 3) of previous
cesarean sections is an obvious risk factor for complications. In addition, the complication rate for patients with placenta percreta is much higher due to deep placental and vascular infiltration.

In the current study we found statistically significant lower urinary bladder injury among cases with bladder filling than in cases without filling (3.4% versus 57.1%, respectively). Moreover, none of the studied cases had ureteric injury. Our findings are in accordance with Abd El-Gaber et al. (11) study, which aimed to evaluate the role of full bladder or at least semi full bladder in minimizing or preventing bladder injury during cesarean delivery particularly in women who carry risk factor of previous dense adhesions. They found significant lower incidence of urinary bladder injuries in patients treated with inflated urinary bladder just before cesarean section than in the other group (5.2% and 13.1%) respectively. In the same line, Saaqib et al. (12) randomized controlled trial, used cystoinflation technique to inflate the bladder to prevent bladder injury in the adhesive disease of multiple caesarean sections. They found highly statistically significant difference as the bladder injury rate is very high in the control group (20%) than cystoinflation group (2.8%). On the other hand, Özcan et al. (13) in a study included 66 patients with placenta percreta did not find significant beneficial effect of bladder filling technique on prevention of urinary tract injury (as injury happened in 21.9% in filling group and 32.4% in non-filling group). This may be attributed to that their study enrolled only patients with placenta percreta where the incidence of urinary bladder injury rate in placenta accreta usually is high (15% - 43%) and even higher in placenta percreta (14).

Besides, that Özcan et al. (13) study included women who had hysterectomy, actually cesarean hysterectomy is associated with an increase in the urinary tract injury incidence rates (15,16). Furthermore, the management of such cases which are associated with placenta percreta is highly variable from institution to another with great impact of the skills of the operating surgery. Besides, massive bleeding may put surgeon in a great stress to overcome this marked blood loss in a timed manner that may endanger the urinary tract. In addition, in the present study placenta percreta cases had been presented in a small figure (11.4% in filling group and 10.3% in non-filling group) in comparison with the other risk factor. Finally, the threshold of surgeon for dense adhesions, classification system used and expertise of the surgeon to perform adhesiolysis are other factors which may influence the incidence of bladder injury. This discrepancy can be solved by conducting further trials with same criteria of dense adhesions.

In our study we found decreased blood loss among group with filling technique as there was significantly higher post-operative HB level, lower blood loss and lower need for packed RBCS among bladder filling technique than in those with no filling technique. In the same hand Saaqib et al. (12) showed a significant decrease in blood loss and blood transfusions with cystoinflation. The decrease of blood loss may suggest that adhesiolysis in correct planes due to cystoinflation contributed in the decrease of vascular injuries.

On the other hand, Abd El-Gaber et al. (11) and Özcan et al. (13) reported that the difference in the operative blood loss between the two groups was insignificant where urinary bladder inflation before starting surgery had no effect in minimizing the need for blood transfusion. While, this maneuver had minimized incidence of blood transfusion that needed during or immediately postoperative as reported by Matsubara (17). Furthermore, the later stated that the primary aims for the bladder inflation was to minimize the bleeding rather than to prevent the urinary bladder injury as this allowed easy cutting and ligation of the aberrant vessels. Massive and/or persistent hemorrhage, bladder injury, ureteral damage, and bowel injury are the most common complications resulting in admission to the intensive care unit (18).

Eller et al. (19) reporting on 76 cases, found that blood transfusion was required in more than 80% of cases. Maternal and prenatal fetal deaths from massive hemorrhage are the worst scenarios in women with placenta percreta (20).

We found statistically significant shorter hospital stay in filling bladder group than in no filling group. This finding agrees with Abd El-Gaber et al. (11) study as the hospital stay was significantly shorter in group I (inflation) than in group II with which they were very pleasant for the patients in minimizing the total cost and early return to their usual life. Our finding disagrees with Özcan et al. (13) as insignificant difference was found between both groups regarding operation time and hospital stay.

CONCLUSION

Regarding our findings we concluded that the filling bladder technique had significant role on prevention of bladder injury in managing women with placenta previa percreta undergoing elective caesarean hysterectomy with lower blood loss and need for blood transfusion and lower need for hospital stay than non-filling group.

RECOMMENDATION

The bladder filling technique is considered as upgrading technique that need further multi center studies with higher number of participants to determine its significance in urinary bladder injury prevention in cases with placenta previa as percreta and other causes lead to adhesions. Also, we need further studies to determine perfect timing of urinary bladder filling in relation to operation (start the filling post caesarian delivery, or immediately before caesarean section).
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Author contribution: Authors contributed equally in the study.

REFERENCES