OBJECTIVE: To evaluate the impact of rapid weight loss following bariatric surgery on urinary symptom frequency and overall quality of life.

STUDY DESIGN: Validated questionnaires (Urinary Distress Inventory [UDI-6] and Incontinence Impact Questionnaire [IIQ-7]), were mailed to all women who underwent bariatric surgery at Temple University Hospital between January 2004 and March 2006. McNemar test of paired proportions was used for analysis.

RESULTS: Mean body mass index prior to surgery was 47.5 and after surgery was 31.0, with an average weight loss of 49.2 kg. About half the subjects had stress incontinence, 32% had frequency and 24.8% had urgency at baseline. Twenty-six percent of the subjects were frustrated and emotionally distressed by the urinary symptoms at baseline, while one fifth reported interference with performing household chores, travel and other activities. There was a significant improvement in stress incontinence (p < 0.001), frequency and leakage of any degree and overall quality of life subsequent to surgery.

CONCLUSION: Body mass index has a significant effect on urinary symptoms as an independent factor. We report a marked improvement in stress incontinence symptom frequency and symptom bother with rapid weight loss subsequent to bariatric surgery in morbidly obese women. (J Reprod Med 2009;54:597–602)

Keywords: bariatric surgery, morbid obesity, urinary tract.

Morbid obesity accounts for 5% of the U.S. population.1 Dietary changes and drugs are not shown to be consistently effective in treating morbid obesity. Bariatric surgery has been shown to result in significant weight loss in these patients.2-4 From an epidemiologic standpoint, obesity is at least associated with, if not a risk factor for, both stress incontinence and overactive bladder.5-8 Sugerman et al9 found excessive body weight specifically measured in sagittal diameter to be associated with development of stress incontinence. In a canine model, obesity was shown to be associated with sphincteric incontinence.10,11 In human experiments involving subjects under anesthesia, a direct correlation was noted between increasing body mass index (BMI) and increase in intraabdominal and intravesical pressure.12 It is also postulated that elevated intraabdominal pressure...
places chronic strain on the muscular and fascial elements of the pelvic floor, which contributes to continence. There may also be a neurogenic component since obesity has been shown to lead to decreased median nerve conduction. Similarly, obesity-induced neurologic disease may cause decreased conduction through Onuf’s nucleus and the hypogastric nerve, which could potentially contribute to stress incontinence and urethral dysfunction in obese women.

Weight reduction has been shown to improve symptoms of urinary incontinence. Subak et al showed weight reduction with diet and exercise to be effective treatment for urinary incontinence. Weight loss of 5–10% resulted in an improvement similar to that after surgical correction of incontinence. Dietel et al, in a study of gynecologic changes in women subsequent to bariatric surgery, reported a decrease in incidence of stress incontinence from 61% to 11% in a group of 138 women. Comprehensive pelvic floor questionnaires were not used in that study, and the primary objective was not an evaluation of pelvic floor dysfunction.

The aim of this study was to evaluate the impact of rapid weight loss following bariatric surgery on symptoms of urinary incontinence frequency and bother using standardized questionnaires.

Materials and Methods

All women who underwent bariatric surgery at Temple University Hospital between January 2004 and March 2006 were identified from the Preoperative Information Systems database. This database is a product of McKesson Corporation (San Francisco, California), specifically Pathways Healthcare Scheduling (PHS) and Horizon Surgical Manager (HSM) systems. In this database surgical cases are charted in real time in the operating room using HSM. Questionnaires were mailed to all the subjects through U.S. mail. Nonresponders were again contacted through mail at 3–4-week intervals. Three such mailings were done to obtain the maximum response.

Validated questionnaires, specifically urinary distress inventory short form (UDI-6) and incontinence questionnaire short form (IIQ-7), were used. To improve subject understanding, incontinence questions in lay terms were added to the survey. In addition, information on demographic data, weight prior to and after bariatric surgery, obstetric history (vaginal deliveries, cesarean sections, instrumental deliveries, weight of largest infant), prior hysterectomy, oophorectomy, menopause and use of anticholinergics prior to and after surgery was also collected.

Questionnaires were scored by standard scoring system for each questionnaire. UDI-6 included 6 questions scored 1–4 (1 = no bother, 2 = somewhat, 3 = moderately, and 4 = quite a bit). The mean of the score multiplied by 25 gives the total score. IIQ-7 included 7 questions involving impact of incontinence on daily living activities, scored 0–3 (0 = none, 1 = somewhat, 2 = moderate, 3 = quite a bit). Score is calculated by obtaining the mean of all answered items multiplied by 100/3. Decrease in score indicates improvement in symptoms.

Analysis was performed using SPSS statistical software (Chicago, Illinois). McNemar test of paired proportions was used to analyze the mean change in the symptom scores. Categorical variables were analyzed using descriptive procedures and expressed as percentages and ORs. Outcome measures included both change in symptom scores, expressed as individual items on the questionnaires, and change in symptom score, expressed as total score on the questionnaires.

Results

Demographics are presented in Table I. One hundred twenty-six surveys were returned after 3 mailings. The mean age was 44.4 years, the mean BMI prior to surgery was 47.5, and that after surgery was 31.0, with an average weight loss of 49.2 kg. The average interval since the surgery was performed was 1.7 years. Over half the subjects had a vaginal delivery, 31% had a cesarean section, 22% had instrumental delivery, and 12% underwent hysterectomy. A third of the subjects (35%) were postmenopausal, and 14% were smokers. Only 2% of the women underwent prior surgery for pelvic organ prolapse, and a significant proportion of these young women were on anticholinergic medications (8.73%) prior to surgery.

Symptoms of urinary incontinence before and after surgery related to daily activities were assessed.
along with demographics and reported in Figure 1. Prior to surgery, 45% of women had symptoms of urinary incontinence as compared to 20% after surgery. There was a tremendous improvement in symptoms of stress incontinence following weight loss, especially with coughing (OR 0.30), laughing (OR 0.23), walking (OR 0.39), lifting (OR 0.26) and sneezing (OR 0.28). No significant improvement was noted in carrying, shopping, climbing stairs, or changing positions. Overall, the improvement in urinary leakage following bariatric surgery was significant: the odds of urinary leakage prior to surgery were 7.56 times the odds of urinary leakage after surgery, with p value < 0.0001. Overall symptoms of incontinence improved significantly, with an OR of 0.13 and p value < 0.0001 following bariatric surgery. Need for anticholinergics following weight loss decreased significantly (8–2%), with an OR of 7.0.

Table 1  Demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>126</td>
<td>21</td>
<td>69</td>
<td>45.4</td>
<td>10.49</td>
</tr>
<tr>
<td>Height (in)</td>
<td>125</td>
<td>59</td>
<td>72</td>
<td>65.22</td>
<td>2.75</td>
</tr>
<tr>
<td>Weight presurgery (kg)</td>
<td>124</td>
<td>88</td>
<td>221</td>
<td>132.4</td>
<td>22.53</td>
</tr>
<tr>
<td>Current weight</td>
<td>123</td>
<td>54</td>
<td>199</td>
<td>82.8</td>
<td>19.11</td>
</tr>
<tr>
<td>Weight loss</td>
<td>123</td>
<td>8.8</td>
<td>102</td>
<td>49.24</td>
<td>17.72</td>
</tr>
<tr>
<td>Pre BMI</td>
<td>124</td>
<td>33.27</td>
<td>73.53</td>
<td>47.5</td>
<td>8.12</td>
</tr>
<tr>
<td>Post BMI</td>
<td>123</td>
<td>20.9</td>
<td>66.2</td>
<td>31.0</td>
<td>6.47</td>
</tr>
<tr>
<td>Years since surgery</td>
<td>123</td>
<td>0.4</td>
<td>2</td>
<td>1.7</td>
<td>1.08</td>
</tr>
</tbody>
</table>

*Indicates p < 0.0001 for comparison of presurgery to postsurgery.

UDI-6 showed that urinary symptoms were common in women at baseline. About half the subjects had stress incontinence (49.6%), 32% had frequency, and another 24.8% had urgency. Overall, 36.8% had some degree of urinary leakage. Pain with urination was noted by 12.9% of the subjects (Figure 2). There was a significant improvement in symptoms of stress incontinence (p < 0.001), frequency and leakage of any degree (Table II). Although there was a slight improvement in urgency symptoms, no significant difference was noted. There was no improvement in symptoms of pain and difficulty in voiding.

IQ-7 showed that 26% of the subjects were frustrated and emotionally distressed by the urinary symptoms at baseline, and one fifth of the subjects...
reported interference with performing household chores, travel and social activities (Figure 3). Subsequent to surgery there was a statistically significant decrease in problems related to various functions, like household chores, physical activities, entertainment activities and travel more than 30 minutes and also an improvement in emotional distress and frustration (Table III). Overall improvement in total score was 17 points (32%).

**Discussion**

This study demonstrated a marked improvement in urinary incontinence symptoms subsequent to weight loss among morbidly obese women. Both the symptom frequency and symptom bother were significantly improved. Symptoms of stress incontinence and urinary frequency showed most improvement, while urge incontinence showed only modest improvement. The use of anticholinergics was reduced following surgery. As expected from prior studies, marked weight reduction was noted after bariatric surgery.4,19,20

The finding of an increased baseline rate of urinary symptoms in morbidly obese women was in accordance with prior studies.5-8 Lambert et al21 objectively assessed increased intraabdominal pressure in morbidly obese women and established a correlation with various comorbidities, including urinary incontinence. Noblett et al12 noted a strong correlation between obesity and stress incontinence and some association with urge incontinence.

Weight loss with dietary modification and exercise were shown to improve urinary incontinence symptoms.14-16 Dietel et al,17 in a study of gynecologic changes in women subsequent to bariatric surgery, reported a decrease in the incidence of stress incontinence from 61% to 11% in a group of 138 women. As expected, overactive bladder was shown to be less strongly associated with obesity as compared to stress incontinence.8,22-25

Anal incontinence was shown to be strongly associated with urinary incontinence and prolapse. Some degree of anal incontinence was noted in a third of morbidly obese subjects (32%),8 which is more than twice the incidence reported in the general population (2–16.9%). Associated comorbidities, such as diabetes, gastrointestinal disturbances, hyperlipidemia and decreased mobility secondary to arthritis, can predispose to anal incontinence in obese populations. Obesity has been shown to increase intraabdominal pressure, thus causing chronic stress on the pelvic floor, leading to pelvic floor muscle weakness and neuronal damage, which in turn causes pelvic floor dysfunction.12 The

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**Table II Pelvic Floor Distress Inventory/Urinary Distress Inventory (PFDI-20) (UDI-6)**

<table>
<thead>
<tr>
<th>Function</th>
<th>Paired difference (mean)</th>
<th>SD</th>
<th>Lower</th>
<th>Upper</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>0.30</td>
<td>1.00</td>
<td>0.13</td>
<td>0.48</td>
<td>0.00093*</td>
</tr>
<tr>
<td>Urgency</td>
<td>0.11</td>
<td>0.86</td>
<td>−0.04</td>
<td>0.26</td>
<td>0.14948</td>
</tr>
<tr>
<td>Stress incontinence</td>
<td>0.45</td>
<td>1.22</td>
<td>0.24</td>
<td>0.67</td>
<td>0.00006*</td>
</tr>
<tr>
<td>Leakage</td>
<td>0.23</td>
<td>0.99</td>
<td>0.06</td>
<td>0.40</td>
<td>0.61017</td>
</tr>
<tr>
<td>Difficulty emptying bladder</td>
<td>0.04</td>
<td>0.81</td>
<td>−0.10</td>
<td>0.18</td>
<td>0.88975</td>
</tr>
<tr>
<td>Pain or discomfort</td>
<td>−0.03</td>
<td>0.73</td>
<td>−0.16</td>
<td>0.10</td>
<td>0.62437</td>
</tr>
</tbody>
</table>

*Indicates p < 0.0001 for comparison of presurgery to postsurgery.

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**Figure 3** Pelvic floor impact (UIQ-7) questionnaire score prior to and after surgery. Scores are calculated by obtaining the mean value for all answered items within the corresponding scale (possible value, 0–3: 0 = never, 1 = sometimes, 2 = quite a bit, 3 = always) then multiplied by (100/3) to obtain a scale score of 0–100.
same etiology postulated for urinary incontinence can explain anorectal symptoms. The neurologic function appears to recover following weight loss since the damage is due mainly to stretching rather than cutting. Prior research has shown that neuronal cells demonstrate high tolerance to dynamic stretch injury.26

The main limitation of this study is its retrospective nature, which limits the conclusions that can be derived. There is possible recall bias in answering the questionnaires retrospectively. In addition, since the subjects feel good because of the general improvement in well-being following weight loss, they tend to answer positively to almost any item in the questionnaire. This “halo effect” is a well-known cognitive bias whereby the perception of positive qualities in one thing results in the perception of positive qualities in all others. It will be difficult to isolate the true benefit in such a scenario. Despite the limitations, the improvement in bladder symptoms appears to be substantial.

With obesity a public health epidemic and bariatric surgery becoming the standard of care for morbid obesity, it is important to counsel women regarding the multisystemic benefits related to rapid weight loss, including those on pelvic floor function. Surgical treatment is technically challenging in women with high BMI and perceived to be less effective as well. Obese women are therefore discouraged from undergoing surgical procedures for incontinence as initial management. In addition, anticholinergic medications have substantial morbidity related to their use. Therefore, obese women should be counseled to lose weight as the first step in the management of urinary symptoms.

Although there are rational explanations for how obesity and increasing BMI can contribute to stress urinary incontinence and overactive bladder, there is little objective physiologic data in the literature to support these assumptions. Prospective weight loss studies with a thorough assessment of lower urinary tract symptoms and complete urodynamic data should give us new insights into the pathophysiology of these conditions.

References

Table III | Pelvic Floor Impact/UIQ-7

<table>
<thead>
<tr>
<th>Function</th>
<th>Paired difference (mean)</th>
<th>SD</th>
<th>95% CI of the difference</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household chores</td>
<td>0.22</td>
<td>0.66</td>
<td>0.11–0.34</td>
<td>0.0002*</td>
</tr>
<tr>
<td>Physical activity</td>
<td>0.40</td>
<td>0.88</td>
<td>0.24–0.56</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Entertainment activities</td>
<td>0.20</td>
<td>0.71</td>
<td>0.07–0.33</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Travel</td>
<td>0.22</td>
<td>0.63</td>
<td>0.11–0.34</td>
<td>0.0001*</td>
</tr>
<tr>
<td>Social activities</td>
<td>0.22</td>
<td>0.63</td>
<td>0.10–0.33</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Emotional distress</td>
<td>0.30</td>
<td>0.81</td>
<td>0.15–0.44</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Frustration</td>
<td>0.46</td>
<td>1.03</td>
<td>0.28–0.65</td>
<td>&lt;0.0001*</td>
</tr>
</tbody>
</table>

*Indicates p < 0.0001 for comparison of presurgery to postsurgery.