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# Obesity and Pelvic Floor Disorders: A Review of the Literature

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Overweight and obesity are becoming a worldwide health problem associated with numerous co-morbidities. National costs of obesity and pelvic flor disorders have been rising since the 1950s across the world. Obesity is thought to have a very strong effect on pelvic floor disorders, and, considering the high prevalence of both problems worldwide, it is of utmost importance to evaluate the association between these pathologies as well as the impact of obesity on treatment efficacy. This review is based on a selection of reports in the literature (PubMed search), including guidelines and Cochrane reviews.

Obesity seems to be a well-documented risk factor for lower urinary tract symptoms (LUTS) and is a predictor of exacerbation of stress urinary incontinence (SUI) and overactive bladder (OAB). Weight loss is also associated with improvement or resolution of SUI and OAB. In the case of pelvic organ prolapse (POP), weight loss is associated with improvement in quality of life. Although obesity is associated with POP in general, the exact role of obesity in symptomatic POP remains uncertain. While outcomes of anti-incontinence surgery among obese women are similar to those in non-obese women, postoperative urge incontinence is more likely to occur. It seems that obesity is not a risk factor for postoperative complications or short-term efficacy of POP surgical treatment. Long-term effects are still uncertain.

Obesity is a strong risk factor for LUTS, but in most cases it does not affect efficacy of operative treatment. It may be associated with some post-operative complications. Weight loss in many cases allows avoiding surgical intervention.

**MeSH Keywords:** Obesity • Pelvic Organ Prolapse • Suburethral Slings • Urinary Incontinence

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## Epidemiology of Overweight and Obesity

Obesity has been defined by the World Health Organization as abnormal or excessive fat accumulation that presents a risk to health. Overweight and obesity are described by body mass index (BMI); BMI value of 25 or above indicates overweight and 30 or above indicates obesity.

Overweight and obesity are among the greatest contemporary health problems. It was estimated that in 2008 in the United States alone, the cost of the medical consequences of obesity are around $150 billion [1]. It is a risk factor for many chronic diseases, including diabetes, cardiovascular disease, strokes, some types of cancer, and hepatic cirrhosis requiring transplantation [2–4].

Prevalence of overweight and obesity varies worldwide. From 1980 to 2013 it increased among both adults and children. The percentage of men in the world with a BMI of 25 kg/m$^2$ or higher increased from 28.8% to 36.9% and in women from 29.8% to 38% [5]. Weight loss is the second most common modifiable risk factor after tobacco use, and has the greatest impact on health care costs and the risk of premature death [6].

Obese patients who do not respond to conservative treatment can be offered a number of surgical procedures. In a retrospective study that followed a study group of 9949 patients after bariatric surgery (gastric bypass), a 40% reduction in mortality was observed in the study group [7].

## Epidemiology and Risk Factors of Urinary Incontinence

Urinary incontinence is the complaint of any involuntary leakage of urine. Urinary incontinence is a sign of various conditions, including stress urinary incontinence (SUI) (involuntary leakage on effort or exertion) and overactive bladder syndrome (OAB) (involuntary leakage accompanied by or immediately preceded by urgency). Mixed urinary incontinence (MUI) is the complaint of involuntary leakage associated with urgency and also with exertion, effort, sneezing, or coughing.

Stress urinary incontinence represents approximately 50% of urinary incontinence cases in women. Urge urinary incontinence constitutes approximately 10–20% of cases and mixed urinary incontinence approximately 30–35% [8]. The prevalence of all types of urinary incontinence increases with age.

Patients perceive urinary incontinence as a significant health problem that negatively affects their quality of life, social relations, and occupational activities. According to estimates of the National Institutes of Health (2000), economic consequences of urinary incontinence are at a level similar to the costs associated with HIV/AIDS or breast cancer. The prevalence of at least 1 daily episode of urinary incontinence in women is about 20%. Depending on the age group, it varies from about 5–6% for women aged 18–30 years to about 40% in women over 80 years [9]

Many studies have focused on potential risk factors. The prevalence of urinary incontinence is strongly associated with patient age [9]. Parity is another risk factor [9–12] and the association is strongest in young women between 20 and 34 years, while in patients over 65 years it is practically absent [10]. Additionally, during pregnancy and the postpartum period, urinary incontinence is reported 2–3 times more often than before pregnancy [13].

According to the literature, the following factors may influence the prevalence of urinary incontinence: lower respiratory tract infections [14], depression [15], constipation [11], nocturnal enuresis in childhood [16], the use of certain drugs (e.g., benzodiazepines and diuretics) [11,17], coexistence of other pelvic floor disorders (e.g., pelvic organ prolapse), and fecal incontinence [12].

Menopause alone (without oestrogen replacement therapy) [18], physical activity [9,19], and smoking [13] are no longer considered risk factors of urinary incontinence. Consumption of alcohol and coffee has been reported to not be associated with urinary incontinence [15] or the association is weak [20].

## Epidemiology and Risk Factors of Pelvic Organ Prolapse

Pelvic organ prolapse (POP) is defined as the descent of 1 or more of the following: the anterior vaginal wall, the posterior vaginal wall, and the apex of the vagina-cervix/uterus, or vault (cuff) after hysterectomy. There is a consensus that for clinical and research purposes, the POP-Q scale (Pelvic Organ Prolapse Quantification) should be used in the assessment of degree of the defect. POP-Q refers to an objective system for describing, quantifying, and staging pelvic support in women. POP may be caused by the loss of support for organs such as the uterus, urinary bladder, urethra, sigmoid colon, and rectum.

According to published data, the prevalence of POP varies depending on the criteria and conditions of the specific study. For studies making the diagnosis of POP based on subjective criteria as reported by the patient's sensation of a mass bulging into the vagina, the reported prevalence range is 6–10% [21]. Symptoms reported by patients are strongly associated with prolapse below the level of the hymeneal ring. Studies determining POP based on standardized methods (POPQ scale) reported





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a significantly higher prevalence of approximately 25–40%. [22] Therefore, low-stage pelvic organ prolapses found by application of objective scales, such as POP-Q, may comprise normal anatomical variants that are asymptomatic for patients.

According to the literature, parity is the strongest risk factor of POP [23,24]. Most studies suggest that higher risk of pelvic organ prolapse is associated with history of vaginal birth compared to caesarean sections [24,25]. Instrumental births and birth weight may also serve as risk factors for POP [25], but other studies confirmed neither that association nor the association with labor duration or episiotomy [24,26]. Non-obstetrical risk factors for POP include: constipation [23], family history [26], hysterectomy (especially vaginal hysterectomy [25]), and ethnicity [22,23].

## Obesity as A Risk Factor of Urinary Incontinence and Pelvic Organ Prolapse

It is widely agreed that obesity influences various kinds of lower urinary tract symptoms (LUTS), including different types of urinary incontinence. In a Chinese population-based, cross-sectional study conducted by Zhu et al. on a group of 5300 randomly selected female residents, obesity described by BMI is a strong risk factor for all types of urinary incontinence in women [9].

The associations of BMI and waist circumference with urinary incontinence were also evaluated in the Nurses' Health Study. Waist circumference was associated with stress UI, suggesting that overweight and obesity results in higher risk of that pathology. Increased body weight is also a predictor of severity of future symptoms. Comparing women with BMI of 35 kg/m$^2$ or higher with lean women (BMI 21–22.9 kg/m$^2$), the OR for at least monthly incontinence was 2.11 (95% CI 1.84–2.42) [27].

Another population-representative, cross-sectional, Internet-based survey showed that BMI is associated with a higher risk or urinary incontinence. Obesity was shown to be a high risk factor for both stress urinary incontinence (SUI) and mixed urinary incontinence (MUI) [28].

An epidemiological study conducted by Markland et al. showed that the increased female prevalence of UI could be partially explained by obesity and diabetes across the survey periods [29].

It was also documented that another parameter of overweight, visceral adipose index (VAI), is a useful index for the risk evaluation of stress urinary incontinence, confirming its role in development of that pathology [30].

The most probable mechanism of SUI development among obese women is the increase of intra-abdominal pressure that causes weakening of pelvic floor muscles and fascia [31]. The degree of obesity is correlated with a higher prevalence of stress and urge incontinence.

As reported by the Leicestershire MRC Incontinence Study Group, in the multivariate model for the onset of an overactive bladder, the increased risk was significantly associated with obesity, smoking, and consumption of carbonated drinks, and the reduced risk was associated with higher consumption of vegetables, bread, and chicken. Obesity and carbonated drinks were also significant risk factors for the onset of stress incontinence [32].

In a Brazilian study, 1050 women age 20–45 were interviewed for the prevalence of overactive bladder symptoms using the ICIQ-OAB questionnaire. Women with BMI ≥30 presented more nocturia and more urgency cases than women with normal BMI. A significant difference was also found regarding urge-incontinence; women with BMI 25–29.9 presented a higher score than women in the 18.5–24.9 group (p=0.0017) [33].

The association of obesity with POP seems to be uncertain and requires further evaluation. Most published studies demonstrate existence of that relationship [22,34], while others show no statistically significant difference [35,36]. The study by Kudish et al. on a group of 16 608 women demonstrated a progression of POP with increasing body weight [34]. In Myers' study, almost 40% of women seen because of pelvic organ prolapse were obese [39].

In a study by Wasserberg, 358 morbidly obese females completed 2 validated, condition-specific, quality of life questionnaires on pelvic floor dysfunction that assessed pelvic organ prolapse, colorectal-anal, and urogenital incontinence. Over 90% of obese females experienced pelvic floor disorders, and 50% of those females reported that the symptoms adversely impacted their quality of life. The authors concluded that obesity is as important as obstetric history in predicting pelvic floor dysfunction [38].

In a cross-sectional analysis of women who were enrolled in the Women's Health Initiative Hormone Replacement Therapy Clinical Trial (n=27 342 women), parity and obesity were strongly associated with the increased risk for uterine prolapse, cystocele, and rectocele [22].

On the other hand, in another cross-sectional study of women referred for urogynecological care, obesity was not associated with stage > or = II prolapse but was associated with increased pelvic floor symptoms secondary to urinary and anal incontinence subscales [35]. It was also shown that stress urinary incontinence is more prevalent in women with metabolic syndrome. In the whole group, pre- and postmenopausal





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increased fasting glucose levels and larger waist circumference levels both were statistically significant as risk factors for stress urinary incontinence [39].

There are no convincing data demonstrating the association between POP and metabolic syndrome. Nevertheless, Rogowski et al. demonstrated that the presence of elevated triglycerides may be associated with the severity of POP in uro-gynecological patients [40]. The association of metabolic syndrome and obesity with pelvic floor disorders may apply to patients at very high risk of surgical intervention, such as organ recipients. They require individually tailored therapy due to anatomical abnormalities and immunosuppression [41].

## The influence of Obesity on Results of Surgical Management of SUI and POP

As described above, obesity is a serious problem causing many uro-gynecological disturbances. A very important question is how it influences the outcome of surgical management of the above conditions. Most of the relevant studies did not report the negative impact on surgery results and safety in obese patients, but it must be noted that most of these were short-term observations.

In a study evaluating the impact of obesity on the length of surgery, blood loss, and intra- and postoperative complications in women who underwent retro-pubic surgery for stress urinary incontinence, there were no differences in the level of complications; however, the procedure duration was significantly longer in obese patients [42]. Similar results were described by Skiapas et al. [43]. Observations published after 1 year of observational study that included objective and subjective (IIQ7 and UDI 6 questionnaire) outcome of TVT in obese and non-obese patient are in line with the above results [44].

In another retrospective analysis of patients who underwent trans-obturator tape (TOT) procedure, the authors demonstrated that although the symptoms of stress urinary stress incontinence were evaluated by cystometrography and the symptom perception scale, and they were more severe in obese patients, the outcome of the TOT procedure was no different in the overweight and normal BMI patients [45]. Another group analyzed the effectiveness of SPARC and MONARC mid-urethral procedures, showing no BMI-associated differences in effectiveness [46]. Several studies analyzing the outcome of mini-slings in obese and non-obese women demonstrated that higher BMI is not a risk factor for failure of that procedure [47,48].

Not all authors confirm that there is no difference in the outcome of anti-incontinence procedures in overweight and obese patients as compared to non-obese women. The observation of worse outcome of anti-incontinence procedures was described by Rafii et al. Their study found no increase in number of intraoperative complications of TVT implantation; however, there was a significantly increased incidence (17.9% *vs.* 3.4%) of post-operative urge incontinence compared to patients with normal body weight [49].

In a 3-year follow-up conducted after the TOT procedure, Yonguc et al. demonstrated that although obesity does not affect the outcome of the anti-incontinence procedure, it influences the higher prevalence of postoperative urgency, constituting a very serious post-operative complication [50]. Jeong et al. suggest that the higher success rate of mid-urethral sling surgery (both TVT and TOT procedures) in non-obese patients is associated with lower incidence of mixed urinary incontinence in non-obese women, thus confirming Yonguc's observations [51].

In summary, there are authors who report that obese patients experience lower rates of cure after mid-urethral sling procedures as compared to non-obese ones [52]. It seems that short-term observations of results of anti-incontinency procedures are similar, but the long-term results are uncertain and need further evaluation. Despite a longer operative time and an increased blood loss, the surgical treatment of POP in obese patients seems to have no effect on the incidence of postoperative complications and efficacy.

As far as POP surgeries are concerned, it was shown that the risk of recurrence after anterior colporrhaphy is relatively higher in obese women [53]; however, colporrhaphy is a method of a surgical repair based on a patients' own tissues. On the other hand, surgical outcomes of anterior trans-obturator mesh and vaginal sacrospinous ligament fixation in obese patients were not inferior compared to outcomes in non-obese women [54]. McDermott et al. also showed no significant differences in recurrence of POP after sacral colpopexy *vs.* vaginal mesh colpopexy with better anatomical outcome of sacral fixation [55]. On the other hand, in the comparison of recurrence of prolapse after vaginal uterosacral ligament suspension in normal-weight versus overweight or obese women, it was demonstrated that obese women had greater incidence of prolapse recurrence compared to normal-weight women, but the difference was not statistically significant [56].

In vaginal surgeries (i.e., anterior and posterior colporrhaphy, iliococcygeal hitch, or posterior intravaginal sling) there were no differences in intra-operative and short-term surgery complications between obese and non-obese patients [57]. Similarly, the complication rate and short-term outcomes of laparoscopic sacrocolpopexy were no different in obese and non-obese patients [58]. These observations were confirmed by Thubert et al. [59].





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## The Impact of Weight Loss on Urinary Incontinence and Pelvic Organ Prolapse

It is widely agreed that obesity has an impact on the development of urinary incontinence and POP. The association between weight loss and LUTS is currently the subject of numerous studies. The Longitudinal Assessment of Bariatric Surgery 2 (an observational cohort study at 10 US hospitals) demonstrated that with a mean 1-year weight loss of 29.5% (95% CI, 29.0–30.1%) in women, the prevalence of urinary incontinence was significantly lower after 1 year (18.3%; 95% CI, 16.4–20.4%). The 3-year prevalence was higher than the 1-year prevalence (24.8%; 95% CI, 21.8–26.5%). Weight loss was independently related to urinary incontinence remission. The authors concluded that weight reduction may help in management of voiding dysfunction [60].

Burgio et al., in a study group of 101 patients after the bariatric surgery, demonstrated that 71% of patients with urinary incontinence and subsequent reduction of BMI greater than 18 points no longer experienced symptoms of urinary incontinence [61]. Palleschi et al. prospectively recruited 120 morbidly obese patients, evaluated by a 3-day voiding diary, and the OAB questionnaire. Outcomes were assessed 7 days before and 6 months after the LSG, and results were compared to a similar control group (the LSG waiting group). Reduction of body weight was associated with the improvement in OAB symptoms, whereas no change was observed in untreated controls [62].

Similar results may be achieved after non-surgical weight loss. Subak et al. described the positive effect of weight loss on LUTS in obese patients. A 6-month behavioral intervention targeting weight loss reduced the frequency of self-reported UI episodes. A decrease in urinary incontinence may be another benefit in patients with moderate non-surgical weight reduction [63].

Those observations were confirmed in another study demonstrating that weight losses of between 5% and 10% of body weight were sufficient to achieve significant urinary incontinence benefits. Thus, as the authors suggest, weight loss should be considered an initial treatment for incontinence in overweight and obese women [64].

The influence of body weight reduction was also investigated in relation to POP symptoms. Gozukara studied 378 obese women randomly allocated either to behavioral weight loss or to structured education programs. The patients were evaluated by voiding diary, Pelvic Floor Distress Inventory (PFDI), and Pelvic Organ Prolapse Quantification (POP-Q) system at baseline and after 6 months. When there was POP-Q system reduction by approximately 10% of body weight, only genital hiatus, perineal body, and Ap measurements were significantly lower in the weight loss group compared to the control group after 6 months. The authors concluded that there are few or no changes in the parameters of the POP-Q system with weight reduction [65].

In another study, the existence of overweight/obesity was strongly associated with the "feeling" a vaginal bulge. However, weight loss did not improve the bothersome prolapse symptoms [37]. On the other hand, a study analyzing quality of life in patients with pelvic organ symptoms showed that body mass reduction following the bariatric surgery resulted in improvement in fecal incontinence as well as in QOL, as far as the symptoms of pelvic organ symptoms were concerned [66]. In conclusion, it should be stressed that obesity is a very strong risk factor for urinary incontinence and for pelvic organ prolapse in women. It also has a negative impact on intensification of stress urinary incontinence and on overactive bladder syndrome. After vaginal delivery, it is one of the most important factors influencing pelvic floor stability.

## Conclusions

Obesity does not seem to be a strong risk factor for intraoperative complications of the above-mentioned pathologies, and does not seem to influence their results in short-term observations. However, a long-term increase in intra-abdominal pressure may have a negative impact on postoperative results. As discussed above, the reduction of body mass has a highly positive impact on symptoms of UI. Although the improvement of objective POP evaluation was not observed, patients after bariatric surgeries report better QOL, as far as the POP symptoms are concerned. All these observations associated with the impact of obesity on uro-gynecological symptoms should result in extension of educational programs, knowledge, and awareness among the population and health services on health problems caused by obesity, as well as on the positive impact of weight loss on those pathologies.

### Conflict of interests

The authors declare no financial support and no conflict of interests.





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