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ORIGINAL ARTICLE

# Outcomes of stress urinary incontinence in women undergoing TOT versus Burch colposuspension with abdominal sacrocolpopexy

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## Abstract

**Introduction and hypothesis** To compare postoperative rates of stress urinary incontinence (SUI) in patients with pelvic organ prolapse and SUI undergoing abdominal sacrocolpopexy (ASC) with Burch colposuspension or a transobturator tape (TOT) sling.

**Methods** In this retrospective cohort study, medical records of 117 patients who underwent ASC with Burch ($n = 60$) or TOT ($n = 57$) between 2008 and 2010 at NYU Winthrop Hospital were assessed. Preoperative evaluation included history, physical examination, cough stress test (CST), and multichannel urodynamic studies (MUDS). Primary outcomes were postoperative continence at follow-up up to 12 weeks. Patients considered incontinent reported symptoms of SUI and had a positive CST or MUDS. Secondary outcomes included intra- and postoperative complications. Associations were analyzed by Fisher's exact, McNemar's and Wilcoxon-Mann-Whitney tests.

**Results** The groups were similar regarding age, BMI, parity, Valsalva leak point pressure (VLPP), and prior abdominal surgery ($p = 0.07$–$0.76$). They differed regarding preoperative SUI diagnosed by self-reported symptoms, CST, or MUDS (TOT 89.5–94.7%, Burch 60.7–76.3%, $p < 0.0001$–$0.007$). The TOT group had lower rates of postoperative SUI (TOT 12.5%, Burch 30%, OR = 0.15, 95% CI 0.04, 0.62). Relative risk reduction (RRR) in postoperative SUI for the TOT group compared with the Burch group was 79%–86%. There were no differences concerning intra- and postoperative complications. The Burch group had a higher rate of reoperation for persistent/recurrent SUI (Burch 25%, TOT 12% $p = 0.078$).

**Conclusions** The TOT group experienced a greater reduction in postoperative incontinence, and the Burch group underwent more repeat surgeries. The TOT sling may be superior in patients undergoing concomitant ASC.

**Keywords** Abdominal sacral colpopexy · Burch colposuspension · Pelvic organ prolapse · Stress urinary incontinence · Transobturator tape sling

## Introduction

Pelvic organ prolapse (POP) and stress urinary incontinence (SUI) are two conditions that frequently co-exist [1]. More specifically, as many as 80% of women with POP suffer from concomitant SUI, when occult SUI is taken into account [2, 3]. However, the optimal surgical management for coexisting pelvic organ prolapse and stress urinary incontinence continues to be controversial. There is no single procedure that will treat both POP and SUI.

A recent survey of practice patterns of International Urogynecological Association (IUGA) members found that the procedure of choice for proven SUI in patients with concomitant POP was the transobturator mid-urethral (TOT) sling (46.13%), followed by the retropubic mid-urethral sling (TVT) (28.48%), single-incision sling (4.95%), and Burch colposuspension (2.79%) [4]. These results differ from a similar survey carried out in 2002, where TVT was the preferred anti-incontinence procedure for patients with SUI and POP [5].

In the years between these two surveys, there has been much debate over the use of Burch colposuspension in patients receiving abdominal sacrocolpopexy (ASC) for treatment of POP [3, 6–13]. At the same time, the popularity of

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mid-urethral slings has grown. Their comparable efficacy to the Burch colposuspension and less invasive nature have made slings an attractive alternative [13, 14]. In addition, TVT has not been shown to be significantly superior to TOT regarding objective and subjective short- and long-term outcomes [15]. Data regarding the combination of ASC with a mid-urethral sling compared with ASC with a concomitant Burch colposuspension have shown TVT to be superior to Burch at the time of ASC regarding postoperative continence [16]. To our knowledge, only one study conducted in Korea has compared outcomes of the ASC with Burch colposuspension to ASC with TOT.

The primary objective of our study is to examine the postoperative rates of SUI in patients with concomitant POP and SUI who underwent ASC with either Burch colposuspension or transobturator tape sling. Our secondary objective is to compare rates of intra- and postoperative complications between these two groups. Finally, the null hypothesis was that women who underwent the combined ASC-TOT procedure would have no significant difference in postoperative SUI compared with those who underwent the combined ASC-Burch procedure.

## Materials and methods

A retrospective chart review was conducted to identify patients who underwent ASC with TOT or Burch colposuspension between 2008 and 2010 at NYU Winthrop Hospital.

Information regarding patient demographics, perioperative data, postoperative complications, and follow-up was obtained from the charts. All included patients were determined to have preoperative SUI by either subjective measures (self-reported symptoms) or a positive cough stress test with a full bladder (at least 300cc volume) and/or confirmation by (MUDS) multichannel urodynamic studies (objective measures). The cough stress test was performed by the patients coming in to the office with a full bladder. The bladder volume was not confirmed by ultrasound, nor was the bladder retrogradely filled, unless the patients were symptomatic.

All patients received treatment for their apical vault prolapse with an open laparotomy (ASC). ASC was performed using a Y-shaped polypropylene mesh, securing the vaginal apex to the anterior longitudinal ligament at S1–S2 [8].

The decision regarding which anti-incontinence procedure to perform, TOT versus Burch, was made at the discretion of the surgeon. TOT was the procedure of choice, if intrinsic sphincter deficiency, a Valsalva leak point pressure (VLPP) < 60 $cmH_2O$ on multichannel urodynamic testing, was present. The TOT sling was placed using the out-to-in technique, as previously described by Delorme [17]. Burch colposuspension was performed after retropubic dissection, using two number 0-Ethibond braided sutures on each side and securing these to Cooper's ligaments [18]. All procedures were performed by two fellowship-trained urogynecologic surgeons at NYU Winthrop Hospital in Mineola, NY. This study was approved by the Institutional Review Board of NYU Winthrop (IRB no. 178165-1).

After surgery, patients underwent an active trial of void during which the patient's bladder was retrogradely filled via a Foley catheter until they had a sensation of fullness (at least 300 ccs). Following this, the patient was asked to void. If the patients voided over 80% of the infused volume, the catheter was removed. If the patient failed the trial, they were discharged with a Foley catheter. The primary outcome measured was postoperative SUI, which was evaluated during three scheduled follow-up visits at 4, 6–8, and 12 weeks. This is the follow-up generally employed by our practice in all such cases. Patients who reported symptoms of SUI were further investigated by a cough stress test and MUDS. Patients were considered postoperatively incontinent if they were found positive on at least one of the measures mentioned above.

Secondary outcomes consisted of intraoperative outcomes, including estimated blood loss, duration of procedure, injury to the bladder, ureters, bowel, or other surrounding organs, and postoperative outcomes of presence of postoperative fever, length of hospital stay, duration of Foley catheterization in the hospital, rates of discharge home with a Foley catheter, and rates of reoperation for SUI.

Categorical data were analyzed using Fisher's exact and McNemar's tests as appropriate. Continuous variables were analyzed using the Wilcoxon-Mann-Whitney test. Multivariate logistic regression analysis was used to adjust for confounders. Odds ratios (OR) were calculated to adjust for the significant differences in preoperative presence of SUI to analyze postoperative SUI. The $p$ value for statistical significance was defined as $< 0.05$.

## Results

Of the 127 patients identified, 57 underwent ASC with TOT, while 70 underwent ASC with Burch. From the Burch group, ten cases were excluded from our analysis, as they were found to have a preoperative VLPP of < 60 $cmH_20$. Ultimately 57 women who underwent ASC with TOT and 60 women who underwent ASC with Burch were included in this study. The Burch group showed statistically significantly lower rates of both subjectively (63.3% vs. 94.7%) and objectively (76.3% vs. 94.7% for cough stress test and 60.7% vs. 89.5% for MUDS) measured preoperative SUI (Table 1). All patients included in this study had SUI as defined by self-reported symptoms of SUI or positive CST or MUDS.

**Table 1** Demographic statistics and clinical characteristics

| | TOT ($n = 57$) | Burch ($n = 60$) | $p$ value |
|---|---|---|---|
| Age | 54.9 ± 9.7 | 58.3 ± 10.5 | 0.074 |
| Body mass index | 26.1 (17.5–39) | 26.7 (19.3–61) | 0.768 |
| Parity | 3 (0–5) | 2 (0–7) | 0.117 |
| Prior abdominal surgery | 46% (26/57) | 50% (30/60) | 0.712 |
| Preoperative SUI, patient reported | 94.7% (54/57) | 63.3% (38/60) | < 0.0001* |
| Preoperative SUI, positive cough stress test | 94.7% (54/57) | 76.3% (51/59) | 0.007* |
| Preoperative SUI, MUDS | 89.5% (48/54) | 60.7% (34/56) | 0.001* |
| VLPP $cmH_20$ | 89.5 (9–550) | 109 (65–518) | 0.105 |

Comparison of women undergoing TOT (transobturator) sling vs. Burch colposuspension. $p < 0.05$ denotes that the two groups were significantly statistically different, and this is highlighted with an asterisk

MUDS, multichannel urodynamic studies; SUI, stress urinary incontinence; VLPP, Valsalva leak point pressure

*Differences are statistically significant

More specifically, in the Burch group 63.3% (38/60) reported symptoms of SUI. Of these 38 patients, 10.5% (4/38) were negative only on CST, 36.8% (14/38) were negative only on MUDS, and 2.6% (1/38) were negative on both measures. In addition, in the Burch group 36.7% (22/60) did not report symptoms of SUI. Of these 22 patients, 45.4% (10/22) were positive only on CST, 36.3% (8/22) were positive only on MUDS, while 18.2% (4/22) were positive on both measures.

Regarding the TOT group, 94.7% (54/57) reported symptoms of SUI. Of these 54 patients, 5.5% (3/54) were negative only on CST, 11% (6/54) were negative only on MUDS, and 0% were negative on both measures. In addition, 5.3% (3/57) were not symptomatic. Of these patients, 33.3% (1/3) were positive only on CST, 0% were positive only on MUDS, while 66.7% (2/3) were positive for both of these measures.

As summarized in Table 1, the two groups were similar with respect to age ($p = 0.074$), BMI ($p = 0.768$), history of prior abdominal surgery ($p = 0.712$), preoperative VLPP ($p = 0.105$), and parity ($p = 0.117$). The two groups were found to be significantly different with respect to their rates of subjective (self-reported) and objective (positive CST and/or MUDS) SUI.

The postoperative rates of SUI were determined for both groups at each of three follow-up time points (weeks 2–4, 6–8, and 12). Patients who self-reported symptoms of SUI were further evaluated by cough stress test and MUDS. Again, patients who were considered incontinent were found to be positive on at least one of these measures. Patients who underwent ASC with a TOT sling had significantly lower rates of SUI up to 12 weeks of follow-up. Their odds ratios (OR) were calculated and adjusted for baseline preoperative SUI rates (Table 2). At 4 weeks, 15% ($N = 6/40$) of the TOT group was determined to have postoperative SUI compared with 32.5% of the Burch group ($N = 13/40$; OR = 0.26, 95% CI 0.08, 0.88). At the 6–8-week follow-up, 16% of the TOT group ($N = 9/55$) were determined to have SUI compared with 38% of the Burch group (19/50; OR = 0.21, 95% CI 0.08, 0.6). Lastly, the 12-week follow-up revealed that 12.5% of the TOT group ($N = 4/32$) presented with SUI compared with 30% of the Burch group ($N = 9/30$; OR = 0.15, 95% CI 0.04, 0.62).

The relative risk reduction (RRR) in postoperative SUI for the TOT group compared with the Burch group was determined to be 79–86% when taking all three follow-up points into account. In addition, there was no significant difference between postoperatively continent and incontinent patients at any of the three follow-up visits regarding mean VLPP on preoperative MUDS ($p > 0.05$) (Table 3).

Regarding secondary outcomes, intraoperative complications and other postoperative measures, no statistically significant differences were observed (Table 4). However, the Burch group did have a higher rate of repeat surgical procedures. This was attributed to persistent/recurrent SUI (Burch 25% vs. TOT 12%, $p = 0.078$). Repeat surgery in the Burch group consisted of mid-urethral sling placement (retropubic or transobturator), while in the TOT group it consisted mostly of the retropubic sling procedure. One patient in the TOT group had repeat surgery as the sling had to be revised because of urinary retention. Postoperative urinary urgency was not significantly different between the two groups (Table 5).

## Discussion

The use of Burch colposuspension as a concomitant anti-incontinence procedure at the time of ASC for POP repair has been extensively studied. Burgio et al., in a paper discussing the prospective analysis of outcomes at 1 year after the CARE Study, reported that Burch colposuspension with ASC showed significant reductions in urge and stress incontinence compared with not performing any anti-incontinence procedure at all [9]. In addition, 2-year outcomes of the CARE study demonstrated that women with POP only developed fewer symptoms of incontinence when they underwent a

**Table 2** Rates of postoperative SUI reported over time

| Weeks of follow-up | TOT ($n = 57$) | Burch ($n = 60$) | Odds ratio (95% CI) |
|---|---|---|---|
| 4 | 15% (6/40) | 32.5% (13/40) | 0.26 (0.08, 0.88) |
| 6–8 | 16% (9/55) | 38% (19/50) | 0.21 (0.08, 0.6) |
| 12 | 12.5% (4/32) | 30% (9/30) | 0.15 (0.04, 0.62) |

The effectiveness of surgery examined by recurrence of stress urinary continence (self-reported, which was then further investigated by cough stress test, which if positive was then confirmed on MUDS) at weeks 4, 6–8, and 12. Odds ratios were adjusted for baseline preoperative SUI rates. Odds ratios denote the odds of SUI recurrence following either a TOT (transobturator) or Burch surgical intervention

prophylactic Burch procedure at the time of ASC [10]. However, the extended CARE study (7-year follow-up) showed that the combination of ASC with Burch colposuspension, while resulting in a longer time to treatment failure compared with ASC with no anti-SUI treatment, did not offer any significant clinical benefits [19]. Cosson et al. found that 7 years after undergoing a Burch with ASC combination, only 34% of patients remained continent [7]. Costantini et al. carried out a series of studies showing no benefits regarding incontinence following a Burch concomitantly with ASC [11, 12]. In a recent study, a concomitant Burch and ASC procedure was compared with ASC combined with the mid-urethral sling according to Ulmsten. No significant differences were found at 6-month follow-up regarding overall incontinence and stress-specific incontinence. In addition, patient satisfaction was higher in the midurethral sling group [20]. However, a follow-up study on these same patients at 1 and 2 years postoperatively showed TVT to be superior to the Burch regarding continence. More specifically, the TVT group had higher rates of overall continence at 1 year postoperatively vs. the Burch group (49% vs. 29% $p = 0.03$) as well as higher rates of stress continence at 1 year (70% vs. 46%, $p = 0.01$) and 2 years (70% vs. 45%, $p = 0.006$) postoperatively [16].

It has now been suggested that the TOT sling has the potential to become the gold standard in SUI surgery for women [21]. Multiple studies have shown that TOT is a viable treatment option with good long-term efficacy [22, 23]. Cure rates, either subjective or objective, have been shown to decrease over long term-follow-up, but this decrease in many cases has not been statistically significant [23]. Compared with TVT, the data have been conflicting, as some report higher long-term cure rates in favor of TVT, while not being able to demonstrate these benefits to be significant [24]. In addition, a recent Cochrane review by Ford et al. showed no significant difference in objective and subjective cure rates between TVT and TOT. In addition, rates of organ perforation were reduced with the TOT method, as were operating time and length of hospitalization [15]. Similar objective and subjective long-term cure rates between the two methods have also been found in a recent metaanalysis of clinical trials [25]. This may not be the case concerning concomitant ASC, which in moving the vaginal apex superiorly and posteriorly may move the transverse TOT tape in a better position [26], forming a preferable angle and giving a less obstructive result than the TVT, which may result in greater periurethral pressure.

Law et al. found that the long-term outcomes of TOT when combined with vaginal hysterectomy and anterior or posterior colporrhaphy were equivalent or improved compared with TOT only [27]. In addition, a 2-year follow-up study by Jeon et al. on women who received abdominal sacrocolpopexy with or without TOT showed the combined procedure to be beneficial regarding postoperative SUI, as 28.6% of women who did not receive TOT presented with SUI or underwent repeat urinary incontinence procedures (versus 5.4% of women in the TOT group, $p < 0.01$) [28].

A cost analysis by Richardson et al. found the mid-urethral sling to be the most advantageous regarding cost-effectiveness and prophylactic treatment of occult SUI in women undergoing ASC [29]. Tubre et al. studied the outcomes of three sling procedures at the time of ASC: autologous rectus fascia bladder neck sling, retropubic midurethral sling, and TOT. They reported no significant differences in SUI cure rates among the three groups [30]. Once again, considering the results of Ghoniem's study on IUGA member practice patterns, we believe it would be beneficial to have more data on the efficacy, safety, and patient satisfaction of TOT when done at the time of ASC [4, 5].

To our knowledge, Moon et al. have published the only study investigating the use of the TOT sling or Burch with

**Table 3** Preoperative VLPP (Valsalva leak point pressure) on MUDS. Continent vs. incontinent patients postoperatively, median (range)

| VLPP | Continent | Incontinent | $p$ value |
|---|---|---|---|
| 4 Weeks postoperatively | 89.5 (20–550) $cmH_20$ | 92 (50–223) $cmH_20$ | 0.953 |
| 6–8 Weeks postoperatively | 104.5 (9–550) $cmH_20$ | 87 (20–223) $cmH_20$ | 0.712 |
| 12 Weeks postoperatively | 118 (9–550) $cmH_20$ | 79 (20–518) $cmH_20$ | 0.704 |

**Table 4** Secondary outcomes

| | TOT ($n = 57$) | Burch ($n = 60$) | $p$ value |
|---|---|---|---|
| Estimated blood loss (ml) | 100 (50–250) | 100 (50–350) | 0.829 |
| Duration of procedure (min) | 130 (79–306) | 122.5 (55–288) | 0.098 |
| Length of hospital stay (days) | 2 (1–30) | 2 (1–8) | 0.706 |
| Duration of indwelling Foley (days) | 1 (1–21) | 1 (1–3) | 0.319 |
| Rate of home discharge with Foley | 9% (5/57) | 2% (1/60) | 0.108 |
| Rate of postoperative fever | 9% (5/57) | 18% (11/60) | 0.132 |
| Rate of reoperation for SUI | 12% (7/57) | 25% (15/60) | 0.078 |

Comparison of surgical outcomes after either TOT (transobturator) sling or Burch colposuspension. $p < 0.05$ denotes a statistically significant difference in outcomes

SUI, stress urinary incontinence

ASC in women with SUI [26]. Their study showed the combination of Burch with ASC to be inferior to TOT with ASC. Their TOT group had lower rates of recurrent SUI (1.7% vs. 18.4% in the Burch group, $p = 0.003$) and a higher cure rate (98.3% vs. 69.7% in the Burch group, $p < 0.001$). In this retrospective study, Burch was carried out until 2004 when it was completely replaced by TOT. In addition, rates of preoperative SUI were similar between the two groups. In comparison, our study offers data in a North American population with shorter hospital stays, shorter duration of procedures, fewer days of indwelling catheters, and less urinary retention as shown by low percentages of patients discharged with Foley catheters. Although all patients included in this study were diagnosed with preoperative SUI, rates of preoperative SUI, as defined by self-reported symptoms of SUI or positive CST or MUDS, differed significantly between the two groups, while some patients required repeat surgery, which was not the case in the Korean study.

All in all, the fact that fewer patients who underwent placement of the TOT sling required repeat surgery is also important, as long-term continence and improved quality of life are the ultimate goals of incontinence surgery.

When considering previous studies, it is important to consider that various studies report rates of subjective or objective SUI based on different measures (self-reported symptoms of SUI, questionnaires, cough stress test, MUDS). It is therefore often difficult to compare outcomes between studies.

**Table 5** Postoperative urinary urgency/frequency rates over time

| Weeks of follow-up | TOT ($n = 57$) | Burch ($n = 60$) | $p$ value |
|---|---|---|---|
| 4 | 10% (4/40) | 16% (7/44) | 0.330 |
| 6–8 | 18% (10/55) | 22.4% (11/49) | 0.588 |
| 12 | 32% (10/31) | 27.6% (8/29) | 0.693 |

Patients reported occurrence of postoperative urinary urgency at weeks 4, 6–8, and 12. $p < 0.05$ denotes a significantly statistically difference in outcomes

TOT, transobturator

The present study adds to prior research by showing that a TOT sling may benefit patients more than a Burch colposuspension when undergoing concomitant ASC. We found that ASC combined with a TOT sling did not differ significantly with respect to safety and postoperative complications compared with ASC with Burch. However, differences between the two groups regarding preoperative SUI, as defined by self-reported symptoms of SUI or positive CST or MUDS, reached statistical significance. The patients who ultimately received a TOT sling had higher preoperative stress urinary incontinence rates, both subjectively and objectively. This may indicate increased effectiveness of the TOT sling as a concomitant procedure at the time of ASC.

Our conclusions are strengthened by limiting the data collection to one center and to two surgeons, experienced in the techniques of the ASC, Burch colposuspension, and TOT sling procedures, thereby diminishing confounding factors that could arise in a multicenter study. However, the fact that only two surgeons contributed to this study could also be seen as a weakness as this may make our results less generalizable.

Our findings, while insightful, are not without limitations. The study was retrospective, and a longer follow-up period would provide greater insight regarding patient satisfaction as well as outcomes such as recurrence of SUI, rates of reoperation, and occurrence of other complications. The follow-up consisted of patient reports of symptoms of SUI, which were then further investigated by CST and MUDS. Further evaluation with MUDS on all patients as well as validated questionnaires would provide additional objective outcomes. Certainly, larger prospective studies with longer follow-up and measurable subjective outcomes are needed to determine the safest, most efficacious surgical techniques when treating women with POP and SUI.

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## Compliance with ethical standards

**Conflicts of interest** None.

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