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REVIEW ARTICLE

Autologous Slings in Female Stress Urinary Incontinence Treatment: Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Abstract

Introduction and hypothesis The aim of this study is to evaluate the efficacy and safety of autologous fascial slings (AFS) compared with other surgical methods for female stress urinary incontinence (SUI) treatment.

Methods The search was performed on studies published before September 2023 to identify articles assessing the effectiveness and safety of AFS compared with other surgical methods in female SUI. Inclusion criteria were randomized controlled trials (RCTs) and adult women with SUI. Exclusion criteria were other urinary incontinence types, combined pharmacological treatment, pregnancy, and lactation. This systematic review was conducted according to the Population, Intervention, Comparison, and Outcome framework, Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 checklist, and was registered in the Prospective Register of Systematic Reviews.

Results Twenty RCTs were included in the systematic review and 10 RCTs in the meta-analysis. Comparison between AFS and synthetic midurethral slings (SMUS) did not show any statistically significant differences in the cure rate, frequency of urinary retention, or self-catheterization. SMUS showed more long-term postoperative complications (RR = 0.12, 95% CI: 0.03 to 0.50, $p = 0.004$), AFS had more in de novo urgency cases: (RR = 2.84, 95% CI: 1.13 to 7.10, $p = 0.03$). Operation time of SMUS was lower: (RR = 2.87, 95% CI: 2.56 to 3.19, $p < 0.00001$, $I^2 = 97\%$). SMUS showed significantly lower hospital stay duration: (RR = 1.92, 95% CI: 1.44 to 2.41, $p < 0.00001$).

Conclusions In this systematic review and meta-analysis, autologous slings demonstrated the same efficacy in comparison with SMUS in the management of SUI in women. AFS showed lower incidence of long-term postoperative complications. SMUS demonstrated lower operation time, hospital stay and de novo urgency.

Keywords Stress urinary incontinence · Autologous fascial sling · Pubovaginal sling · TVT

Introduction

Stress urinary incontinence (SUI) is a common problem that occurs in women who complain of involuntary urine release during physical activity, coughing, or sneezing. Such patients report a significant reduction in quality of life and health [1]. This disease is treated by a wide range of therapy options, including physical therapy, pessaries, urethral bulking injections, and surgery. The surgical treatments are represented by various types of interventions such as Burch colposuspension, pubovaginal sling, synthetic midurethral slings (SMUS), and single-incision mini-slings [2]. Midurethral slings are currently considered the standard and preferred surgical treatment for SUI in women.

Synthetic midurethral slings are presented with retropubic and transobturator approaches and demonstrate comparable efficacy [3]. However, synthetic slings are a controversial issue regarding the safety of these methods. There are known court actions in the UK, USA, Australia, Canada, and some European countries against the use of slings and tapes [4, 5]. In this regard, in recent years, there has been renewed interest

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in the use of autologous pubovaginal or fascial sling as an alternative surgical option for SUI treatment [6].

Autologous fascial sling (AFS) is one of the longest used methods of surgical treatment of SUI. In this method, lata fascia or rectus fascia is used to create support for the urethra and the neck of the bladder [7]. The advantages of AFS include the low incidence of adverse effects such as vaginal erosions, infections, and urethral injury associated with the use of synthetic mesh. AFS can be used to manage patients in situations where a synthetic mesh sling is contraindicated, such as prior pelvic radiation therapy and repair of urethrovaginal fistulas [8]. In the international literature, pubovaginal fascial sling has been shown to be a safe and effective procedure for patients with SUI, adequately correcting both urethral hypermobility and intrinsic sphincter insufficiency [9]. The aim of this study is to evaluate the efficacy and safety of AFS compared with other surgical methods for the female SUI treatment.

Materials and Methods

This systematic review included all published scientific articles that evaluated the effectiveness of slings in comparison with other surgical methods used to treat patients with SUI. The primary purpose was to evaluate the effectiveness of achieving better continence and quality of life for women with diagnosed SUI. Efficacy was assessed based on the cure rate (objectively and subjectively, including pad test, cough test, and patient satisfaction). Secondary outcome was to assess the safety and intervention complications.

The systematic review was conducted in accordance with the Population, Intervention, Comparison, and Outcome framework and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 checklist [10]. The systematic review registration number Prospective Register of Systematic Reviews 2023 CRD42023412868 was obtained from the PROSPERO international prospective register of systematic reviews by the National Institute for Health Research [11]. The approval of the institutional review board was not requested, as this study is a review of published studies. Relevant trials were identified through searches in PubMed, Cochrane Library, and MEDLINE databases up to September 2023 using key words: "autologous," "incontinence."

An electronic search of the above databases was independently conducted by the two researchers. All articles were screened following the search based on their titles and abstracts. The full texts of the studies that seemed to be appropriate according to their titles and abstracts were then reviewed. To identify additional potential studies, the reference lists of eligible trials were also manually searched. The eligibility of the articles based on the presence of inclusion criteria was verified by two investigators independently

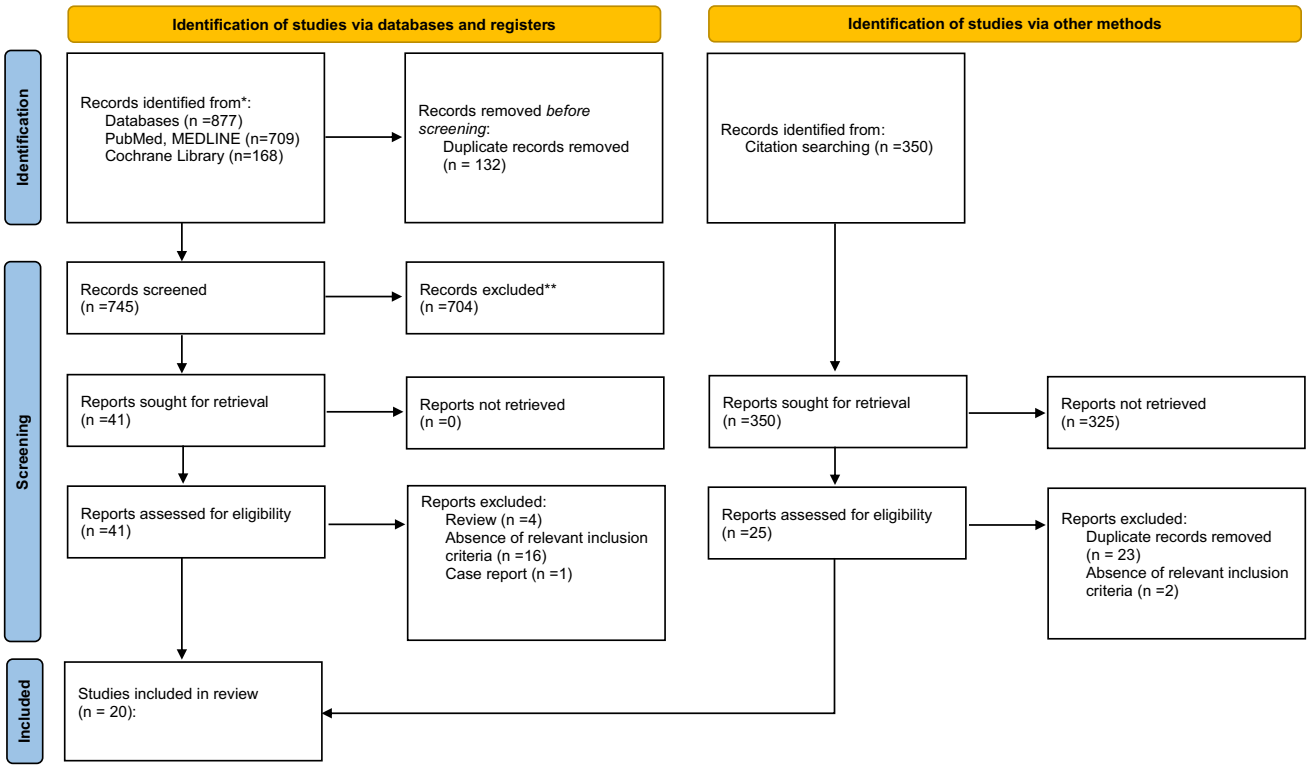


Fig. 1 Flow diagram

Table 1 Description of the randomized controlled trials included in the systematic review

Reference	Year	Sample size (patients)	Patients	Intervention	Comparison	Results	Follow-up
Al-Azzawi [17]	2014	80	Mean age for RFS 42.8 years and 39.2 for TOT	AFS ($n=40$)	TOT ($n=40$)	The mean operative duration was 80 min for AFS vs 20 min for TOT. Early cure rate was 98% for AFS and 95% for TOT. Early complications were mainly abdominal wound problems (20%) for RFS, and groin and upper thigh pain (13%) for TOT. The late complications were the development of postvoid residual urine (8% in AFS vs 5% in TOT) and de novo detrusor overactivity (5% in each group)	1 week, 1, 3, 6, 12 months
Albo et al. [39]	2007	655	Mean age for RFS 51.6 ± 10.1 years and 52.2 ± 10.5 for Burch procedure	Autologous rectus fascia ($n=326$)	Burch colposuspension ($n=329$)	Success rates were higher for women who underwent the sling procedure than for those who underwent the Burch procedure, for both the overall category of success (47% vs 38%, $p=0.01$) and the category specific to stress incontinence (66% vs 49%, $p<0.001$)	24 months
Amaro et al. [18]	2009	41	Mean age for AFS was 49 years and 52 for TVT	AFS ($n=21$)	TVT ($n=20$)	TVT operative time was shorter than AFS. Cure rates were 71% at 1 month, 57% at 6, and 12 months in the AFS group. In TVT group cure rates were 75% at 1 month, 70% at 6 months, and 65% at 12 months. There was no significant difference between the two groups	1, 6, 12, and 36 months
Chai et al. [40]	2009	655	Not stated	Autologous rectus fascial sling ($n=326$)	Burch colposuspension ($n=329$)	Blood loss ($p=0.0002$) and operative time ($p<0.0001$) were significantly associated with an adverse event. Patients who underwent concomitant surgery had a significantly higher serious adverse event rate (14.2% vs 7.3%, $p=0.01$) and adverse event rate (60.5% vs 48%, $p<0.01$) than patients who underwent continence surgery alone. Cystitis rates were higher in the sling vs the Burch group up to 6 weeks postoperatively regardless of concomitant surgery status ($p<0.01$). Intermittent self-catheterization increased the cystitis rate by 17% and 23% in the Burch and sling groups respectively	6 weeks

Table 1 (continued)

Reference	Year	Sample size (patients)	Patients	Intervention	Comparison	Results	Follow-up
Guerrero et al. [19]	2007	165	Mean age for long sling was 51.64 years and 52.1 for short sling	Full-length autologous slings (long sling; $n=81$)	Modified "sling-on-a-string" (short sling) ($n=84$)	The IIQ-7 scores decrease from 1.91/1.85 at baseline to 0.65/0.72 at 12 months and 0.85/0.92 at + 5 years. The UDI-6 scores decrease from 1.85/1.61 at baseline to 0.66/0.62 at 12 months and 1.22/1.08 at + 5 years. The incidence of SUI is 13% at 3 months but averages 53% at + 5 years. Both techniques offer similar improvements. The shorter sling is quicker, less painful and with fewer hospital readmissions	3, 6, 12 months; medium-term: 25–60 months (average 42 months/3.5 years); long-term: ranged between 61 and 89 months (average 74 months/6.2 years)
Guerrero et al. [20]	2010	201	Mean age for AFS was 52.1 years; 54.3 for TVT, and 52.4 years for Pelvicol™	AFS ($n=79$)	TVT ($n=72$); porcine dermis Pelvicol™ ($n=50$)	At 1 year only 61% of the Pelvicol slings remained improved, versus 93% of TVTs and 90% of AFS ($p<0.001$). Pelvicol has poorer dry rates (22%) than TVT (55%)/AFS (48%; $p=0.001$) at 1 year; hence, the Pelvicol arm was suspended following interim analysis. There is no difference in the success rates between TVT™ and AFS. One in five women in the Pelvicol arm had further surgery for SUI by 1 year, but none required further surgery in the other arms. AFS took longer to do (54 min versus 35 min for TVT/36 min for Pelvicol) and had higher ISC rates (9.9 versus 0% Pelvicol/TVT 1.5%). Hospital stay was shortest for TVT (2 days)	6 weeks, 6 and 12 months
Khan et al. [21]	2014	162 patients	Mean age for AFS was 59.4 years; 61.2 for TVT and 62 years for Pelvicol™	AFS ($n=61$)	TVT ($n=63$); Pelvicol graft ($n=38$)	Success rates for TVT, AFS, and Pelvicol were 73%, 75.4%, and 58% respectively. Comparing the 1- and 10-year "success" rates, there was deterioration from 93 to 73% ($p<0.05$) in the TVT arm and 90% to 75.4% ($p<0.05$) in the AFS arm; "dry" rates were 31.7%, 50.8%, and 15.7% respectively. Overall, the "dry" rates favored AFS when compared with Pelvicol ($p<0.001$) and TVT ($p=0.036$). The re-operation rate for persistent SUI was 3.2% (2 patients) in the TVT arm, 13.1% (5) in the Pelvicol arm, whereas none of the patients in the AFS arm required further intervention	1 and 10 years

Table 1 (continued)

Reference	Year	Sample size (patients)	Patients	Intervention	Comparison	Results	Follow-up
Sharifiaghdas et al. [22]	2008	100	Mean age for AFS was 55 years and 49.1 for TVT	AFS ($n=52$)	TVT ($n=48$)	Objective cure was achieved in 22 of the TVT group (88%) and in 30 (83%) of the sling group ($p=0.78$) using a cough-induced stress test, and in 76 and 75% of the women in the TVT versus sling group ($p=0.83$) respectively, using a 1-h pad test. Postoperative mean IIQ-7 scores were 44.3 (range 35.5–61.5) and 48.5 (range 38.5–69.7) in the TVT vs sling group ($p=0.46$). Five (20%) and 11 (30%) of the TVT and sling group respectively reported some changes in the voiding pattern or posture at more than 1 year's follow-up	6 and 12 months
Sharifiaghdas et al. [16]	2015	70	Mean age for AFS was 52.2 ± 9.3 years and 55.6 ± 9.8 for Ophira	AFS ($n=35$)	Mid-urethral mini sling (Ophira; $n=35$)	Objective cure rate, according to cough-induced stress test was recorded in 88.6% and 89.2% of the minisling (Ophira) and the rectus facia sling group respectively ($p=1.0$). Postoperative mean IIQ-7 score decreased to 42.7 ± 11.4 and 50.2 ± 11.1 in the minisling (Ophira)group	1, 3, 6, and 12 months
Sharma et al. [23]	2020	30	Mean age for AFS was 42.33 ± 5.80 years and 46.80 ± 9.12 for TVT	AFS ($n=15$)	TVT ($n=15$)	Mean operative time was significantly longer (55.60 ± 5.77 vs 25.27 ± 4.32 min, $p=0.001$) in the AFS group. Mean hospital stay of 7.1 ± 1.2 vs 1.2 ± 0.4 days, mean duration of catheterization 5.8 vs 1.2 days ($p<0.01$), and postoperative urinary retention requiring recatheterization were all significantly higher in the AFS group. Wound infection was greater in the AFS group ($p=0.01$) whereas groin pain was significantly greater in the TVT group ($p=0.01$). One patient developed vesicovaginal fistula, whereas one patient required cutting of the tape in the AFS group	1 and 6 weeks, 6 months

Table 1 (continued)

Reference	Year	Sample size (patients)	Patients	Intervention	Comparison	Results	Follow-up
Silva-Filho et al. [24]	2005	20	Mean age for AFS was 49.8 ± 9.1 years and 55.2 ± 13.4 for TOT	Autologous pubovaginal sling ($n = 10$)	TOT Safyre ($n = 10$)	There were no differences in patients' mean age, parity, body mass index, rate of postmenopausal state, pelvic floor defects and mean Valsalva leak point pressure in the preoperative urodynamic study. Mean operating time (21.1 ± 3.8 vs. 69.5 ± 23.7 min; $p < 0.001$) and hospital stay (28.8 ± 8.4 vs 44.4 ± 5.8 h; $p < 0.001$) was shorter in the TOT than in the autologous group. The postoperative pad test (39.4 ± 12.5 vs 8.4 ± 5.2 g; $p = 0.01$) and the absence in the improvement in the quality of life were significantly higher in the TOT group	6 months
Wadie et al. [25]	2005	53	Mean age for AFS was 45.32 ± 6.3 years and 44.9 ± 9 for TVT	AFS ($n = 25$)	TVT ($n = 28$)	No statistically significant difference was found between the two groups at baseline. Cure was accomplished in 23 out of 25 (92%) with a sling and in 26 out of 28 (92.9%) with TVT at first follow-up visit (1 week). There were 7 patients who needed at least 1 extra week of catheterization in the sling group and 3 in the TVT group. No significant difference was detected in terms of post-void residual urine, symptom score, and filling and voiding parameters. At 6 months 1 patient had de novo detrusor overactivity and 7 had wound pain. Compared with those with TVT, 2 cases of sling were considered treatment failures, none had de novo overactivity, and 2 had wound pain. None of the patients had symptoms suggestive of urethral erosion	6 months

Table 1 (continued)

Reference	Year	Sample size (patients)	Patients	Intervention	Comparison	Results	Follow-up
Zyczynski et al. [41]	2015	578	Mean age for AFS 51.9 ± 10.0 years and 52 ± 10.3 for Burch procedure	AFS ($n=294$)	Burch colposuspension ($n=284$)	Significant improvements in Urinary Distress Inventory–Irritative scores were reported by each surgical group 1 year after surgery ($p = 0.001$). Most women (50–71%) reported improvement in OAB symptoms. Improvements were similar in the midurethral sling groups at 1 year (65.5% compared with 70.7%, $P=0.32$; OR 0.83, 95% CI] 0.57– 1.20 for retropubic compared with transobturator sling) and throughout the 5-year follow-up period. More women reported OAB symptom improvement after Burch compared with pubovaginal sling (67.9% compared with 56.6%, $P=0.01$; OR 1.59, 95% CI 1.10–2.31 for Burch compared with sling); this group difference at 1 year persisted throughout the 5-year follow-up. At 1 year, 50.0–64.3% of patients reported 70% greater improvement in UI. This proportion declined to 36.5–54.1% at 5 years ($p = 0.001$)	5 years
Dogan [26]	2022	62	The mean age was found to be 54.74 ± 0.87 in group I and 55.58 ± 0.76 in group II	Autologous rectus fascia with midurethral sling (group I; $n=31$)	Mid-urethral synthetic multilaminar propylene sling (group II) ($n=31$)	There was no significant difference between the groups in terms of the preoperative and postoperative UDI-6 results ($p=0.258$, $p=0.349$). Similarly, the preoperative and postoperative IIQ-7 results did not show a significant difference between the groups ($p=0.483$, $p=0.367$). There was also no significant difference in demographic characteristics and complications between the groups. Only the mean operational time was significantly longer in group I ($p=0.029$)	1, 2, 6 weeks, and 3 months

Table 1 (continued)

Reference	Year	Sample size (patients)	Patients	Intervention	Comparison	Results	Follow-up
Kilinc et al. [27]	2022	120	Mean age for AFS was 58.242 ± 7.45 years and 55.48 ± 7.56 for TVT-O	AFS ($n=60$)	TVT-O ($n=60$)	The dryness rate at 24 months was 92.4% (49 out of 53) for patients with transobturator autologous rectus fascial sling AFS and 94.6% (53out of 56) for those with TVT-O ($p=0.47$). No difference was determined between the AFS and TVT-O groups in respect of the ICIQ-SF and QoL scores at 2 years postoperatively ($p=0.87$). There were five postoperative complications in the AFS group (one urinary retention, one hematoma at the suprapubic incision line, three intermittent groin pains) and four in the TVT-O group (four persistent groin pain) ($p=0.98$)	3, 6, 12, and 24 months
Tcherniakovsky et al. [28]	2009	41	Mean age for AFS was 52.1 ± 10.5 years and 46.5 ± 10.9 for TOT	AFS ($n=20$)	TOT Safyre ($n=21$)	Healing rate was 90.5% (19/21) and 95% (19/20) respectively after 12 months. The transobturator group presented a lower complication rate than the retropubic group	12 months
Elsersy [29]	2017	80	Mean age for AFS was 46.2 ± 3.4 years and 45.2 ± 3.5 for TVT-O	Autologous rectus fascia transobturator vaginal sling ($n=41$)	TVT-O ($n=39$)	Objective and subjective cure rates were comparable in the two groups, but patients in the TVT-O group had shorter operative time and shorter duration of post-operative catheterization. Patients in the TVT-O group were statistically more satisfied than patients in the AFS group	1, 12, and 24 weeks
Wadie et al. [30]	2010	63	Mean age for AFS was 50.291 years and 46.083 for TVT	AFS ($n=39$)	TVT ($n=24$)	Cure was defined as a significant decrease in UDI-6 and a negative stress test at 200 ml, which was found to be 93.65% and 95.2% respectively. Overall, UDI-6 decreased from a mean preoperative value of 68.1 ± 16.9 to 27.6 ± 18.3 ($p<0.0001$). IIQ-7 decreased from 70 ± 19 to 24 ± 20.8 ($p<0.0001$). The difference between pre- and postoperative values was not significant	24 months

Table 1 (continued)

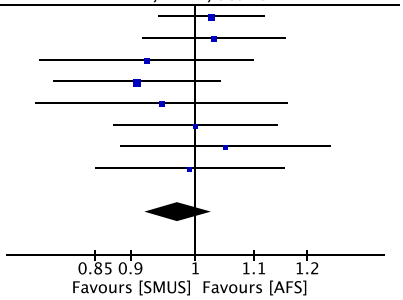
Reference	Year	Sample size (patients)	Patients	Intervention	Comparison	Results	Follow-up
Brubaker et al. [42]	2012	482	Mean age for AFS 52.3 ± 9.7 years and 53.3 ± 10.5 for the Burch procedure	AFS ($n=243$)	Burch colposuspension ($n=239$)	Incontinent participants were more likely to enroll in the follow-up study than continent patients (85.5% vs 52.2%) regardless of surgical group ($p<0.0001$). Overall, the continence rates were lower in the Burch urethropexy group than in the fascial sling group ($p=0.002$). The continence rates at 5 years were 24.1% (95% CI 18.5 to 29.7) vs 30.8% (95% CI 24.7 to 36.9) respectively. Satisfaction at 5 years was related to continence status and was higher in women undergoing sling surgery (83% vs 73%, $p=0.04$). Satisfaction decreased with time ($p=0.001$) and remained higher in the sling group ($p=0.03$). The two groups had similar adverse event rates (Burch 10% vs sling 9%) and similar numbers of participants with adverse events (Burch 23 vs sling 22)	5 years
Bai et al. [31]	2005	92	Mean age for AFS 56.3 ± 2.1 years and 56.5 ± 3.1 for the Burch procedure, 58.2 ± 3.3 for TVT	AFS ($n=28$)	Burch ($n=33$); TVT ($n=31$)	There were no statistically significant differences in the cure rates initially, but after 12 months the cure rate of the pubovaginal sling procedure was found to be significantly higher than those of the tension-free vaginal tape or Burch colposuspension procedures	3, 6, and 12 months

AFS autologous fascial sling, *ICIQ-SF* International Consultation on Incontinence Questionnaire–Urinary Incontinence Short Form, *IIQ-7* Incontinence Impact Questionnaire, *ISC* intermittent self-catheterization, *QoL* quality of life, *RFS* rectus fascia sling, *SUI* stress urinary incontinence, *TOT* transobturator tape, *TVT* tension-free vaginal tape, *TVT-O* tension-free vaginal tape-obturator, *UI* urinary incontinence, *UDI-6* Urinary Distress Inventory short form

A

Study or Subgroup	AFS Events	AFS Total	SMUS Events	SMUS Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Al-Azzawi 2014	39	40	38	40	15.8%	1.03 [0.94, 1.12]
Bai 2005	27	28	29	31	11.5%	1.03 [0.92, 1.16]
Elsersy 2017	34	41	35	39	15.0%	0.92 [0.78, 1.10]
Kilinc 2022	50	60	55	60	22.9%	0.91 [0.79, 1.04]
Sharifiaghdas 2008	30	36	22	25	10.8%	0.95 [0.77, 1.16]
Sharma 2020	13	13	15	15	6.0%	1.00 [0.87, 1.14]
Tcherniakovsky 2009	19	20	19	21	7.7%	1.05 [0.88, 1.25]
Wadie 2005	23	25	26	28	10.2%	0.99 [0.85, 1.16]
Total (95% CI)		**263**		**259**	**100.0%**	**0.97 [0.92, 1.03]**
Total events	235		239			

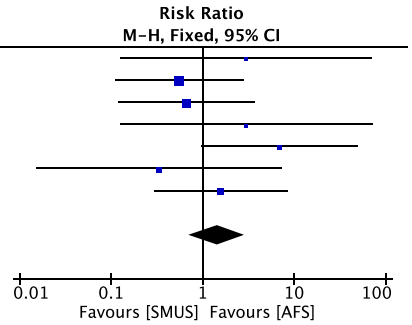
Heterogeneity: $Chi^2 = 4.74$, df = 7 (P = 0.69); $I^2 = 0\%$
Test for overall effect: Z = 1.00 (P = 0.32)



B

Study or Subgroup	AFS Events	AFS Total	SMUS Events	SMUS Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Al-Azzawi 2014	1	40	0	40	4.1%	3.00 [0.13, 71.51]
Bai 2005	2	28	4	31	31.0%	0.55 [0.11, 2.79]
Dogan 2022	2	31	3	31	24.5%	0.67 [0.12, 3.72]
Kilinc 2022	1	60	0	60	4.1%	3.00 [0.12, 72.20]
Sharma 2020	7	15	1	15	8.2%	7.00 [0.98, 50.16]
Silva-Filho 2005	0	10	1	10	12.2%	0.33 [0.02, 7.32]
Tcherniakovsky 2009	3	20	2	21	15.9%	1.57 [0.29, 8.46]
Total (95% CI)		**204**		**208**	**100.0%**	**1.44 [0.72, 2.90]**
Total events	16		11			

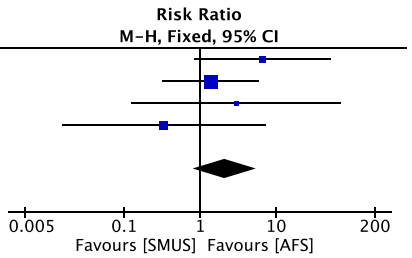
Heterogeneity: $Chi^2 = 5.87$, df = 6 (P = 0.44); $I^2 = 0\%$
Test for overall effect: Z = 1.03 (P = 0.30)



C

Study or Subgroup	AFS Events	AFS Total	SMUS Events	SMUS Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Guerrero 2010	7	71	1	67	17.2%	6.61 [0.83, 52.27]
Khan 2014	4	61	3	63	49.4%	1.38 [0.32, 5.90]
Kilinc 2022	1	60	0	60	8.4%	3.00 [0.12, 72.20]
Silva-Filho 2005	0	10	1	10	25.1%	0.33 [0.02, 7.32]
Total (95% CI)		**202**		**200**	**100.0%**	**2.15 [0.83, 5.59]**
Total events	12		5			

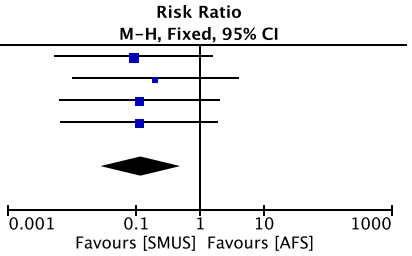
Heterogeneity: $Chi^2 = 2.93$, df = 3 (P = 0.40); $I^2 = 0\%$
Test for overall effect: Z = 1.57 (P = 0.12)



D

Study or Subgroup	AFS Events	AFS Total	SMUS Events	SMUS Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Al-Azzawi 2014	0	40	5	40	32.4%	0.09 [0.01, 1.59]
Dogan 2022	0	31	2	31	14.7%	0.20 [0.01, 4.00]
Kilinc 2022	0	60	4	60	26.5%	0.11 [0.01, 2.02]
Sharma 2020	0	15	4	15	26.5%	0.11 [0.01, 1.90]
Total (95% CI)		**146**		**146**	**100.0%**	**0.12 [0.03, 0.50]**
Total events	0		15			

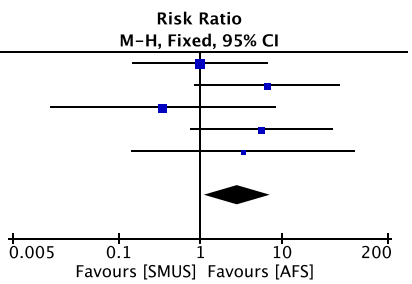
Heterogeneity: $Chi^2 = 0.15$, df = 3 (P = 0.98); $I^2 = 0\%$
Test for overall effect: Z = 2.91 (P = 0.004)



E

Study or Subgroup	AFS Events	AFS Total	SMUS Events	SMUS Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Al-Azzawi 2014	2	40	2	40	32.5%	1.00 [0.15, 6.76]
Elsersy 2017	7	41	1	39	16.7%	6.66 [0.86, 51.67]
Khan 2014	0	61	1	63	24.0%	0.34 [0.01, 8.29]
Sharifiaghdas 2008	8	36	1	25	19.2%	5.56 [0.74, 41.68]
Wadie 2005	1	25	0	28	7.7%	3.35 [0.14, 78.60]
Total (95% CI)		**203**		**195**	**100.0%**	**2.84 [1.13, 7.10]**
Total events	18		5			

Heterogeneity: $Chi^2 = 3.94$, df = 4 (P = 0.41); $I^2 = 0\%$
Test for overall effect: Z = 2.23 (P = 0.03)



◂**Fig. 2** Meta-analyses. **A** Cure rate in autologous fascial slings (*AFS*) vs. synthetic midurethral slings (*SMUS*). **B** Urinary retention in AFS vs. SMUS. **C** Self-catheterization in AFS vs. SMUS **D** Long-term postoperative complications in AFS vs. SMUS. **E** AFS vs. SMUS in de novo urgency

reading the full text of the preselected articles. Studies with duplicate datasets were excluded. All disagreements regarding the inclusion or exclusion of a preselected study as well as other disagreements during the review process were resolved by a third author. Studies were collected independently using a standardized data extraction procedure (authors, year of publication, study design, patient characteristics, intervention, and results).

Only randomized controlled trials (RCTs) including a minimum of 10 adult women with clinically confirmed SUI were considered for inclusion in the systematic review. Studies involving patients with other urinary incontinence types, combined pharmacological treatment, and articles with pregnant and lactating patients, were excluded. The data were pooled in a meta-analysis using RevMan (Review Manager version 5.4, The Cochrane Collaboration, 2011). Two investigators independently assessed the quality of the selected studies using risk-of-bias assessment based on the Cochrane Handbook for Systematic Reviews of Interventions, and the third investigator was consulted when disagreements occurred [12]. TheRoB2tool was used to assess the risk of bias in randomized controlled studies following the Cochrane Handbook for Systematic Reviews of Interventions [13].

Results

The electronic search of PubMed, Cochrane Library, and MEDLINE databases retrieved 877 articles (Fig. 1). After the removal of duplicates and the search for the title and abstract of the articles, 41 publications were selected. After reading the full-text articles, 21 of them were excluded. Four of these studies were reviews and 17 articles were not eligible owing to noncompliance with the inclusion criteria. These studies included 10 articles without comparison or inappropriate patients and interventions, 6 articles were not RCTs, 1 article was a case report [14], and 1 article was a cost-effectiveness article [15]. The references of the selected articles were checked for acceptable studies ($n=350$). Twenty-five publications matched the title, but 23 were duplicates and 2 were excluded owing to noncompliance with the inclusion criteria. In conclusion, 20 randomized clinical trials were included in the systematic review and 10 in the meta-analysis (Table 1).

The study by Sharifiaghdas et al. [16] compared AFS and a mid-urethral minisling (Ophira). Based on a cough-induced stress test, the rectus facia sling group had an objective cure rate of 89.2%, whereas the minisling group had an objective cure rate of 88.6% ($p=1.0$). The postoperative mean IIQ-7 score decreased to 42.7 ± 11.4 and 50.2 ± 11.1 in the minisling group.

Fifteen studies compared AFS with SMUS [17–31]. The follow-up duration ranged from 1 week to 10 years among the studies. Two of them additionally provide a comparison with porcine dermis (Pelvicol) [20, 21].

Five studies compared AFS with Burch colposuspension. Bai et al. [31] included a comparison of AFS, colposuspension and tension-free vaginal tape (TVT). Initially, the cure rates showed no statistically significant changes. After 12 months, the pubovaginal sling procedure was found to be significantly more efficient than the tension-free vaginal tape or Burch colposuspension surgeries.

The first meta-analysis assessed a cure rate after operation of between AFS and standard midurethral slings in 8 studies with 522 patients. There was no statistically significant difference between the two methods (RR = 0.97, 95% CI: 0.92 to 1.03, $p=0.32$, $I^2=0\%$; Fig. 2A).

The second meta-analysis including 7 studies with 412 participants compared the frequency of urinary retention in AFS and SMUS. There was no statistically significant difference (RR = 1.44, 95% CI: 0.72 to 2.90, $p=0.30$, $I^2=0\%$; Fig. 2B).

The frequency of self-catheterization for AFS compared with SMUS was assessed in the third meta-analysis. Four studies with 402 patients were included. There was no statistically significant difference (RR = 2.15, 95% CI: 0.83 to 5.59, $p=0.12$, $I^2=0\%$; Fig. 2C).

The fourth meta-analysis including 4 studies that evaluated 292 patients compared long-term postoperative complications in AFS and SMUS (RR = 0.12, 95% CI: 0.03 to 0.50, $p=0.004$, $I^2=0\%$). There was a statistically significant difference: SMUS showed more long-term postoperative complications (Fig. 2D).

The next meta-analysis compared AFS and SMUS in de novo urgency and included 5 studies with 398 patients. There was a statistically significant difference: AFS showed more de novo urgency cases (RR = 2.84, 95% CI: 1.13 to 7.10, $p=0.03$, $I^2=0\%$; Fig. 2E).

The sixth meta-analysis assessed the operation time of AFS compared with SMUS, including 7 studies with 427 patients. The operation time of SMUS was lower and there was a statistically significant difference (RR = 2.87, 95% CI: 2.56 to 3.19, $p<0.00001$, $I^2=97\%$; Fig. 3A).

The seventh meta-analysis was aimed at comparing AFS and SMUS with regard to hospital stay duration. It included 2 studies assessing 110 patients. There was a statistically significant difference: SMUS showed a shorter hospital stay duration (RR = 1.92, 95% CI: 1.44 to 2.41, $p<0.00001$, $I^2=96\%$; Fig. 3B).

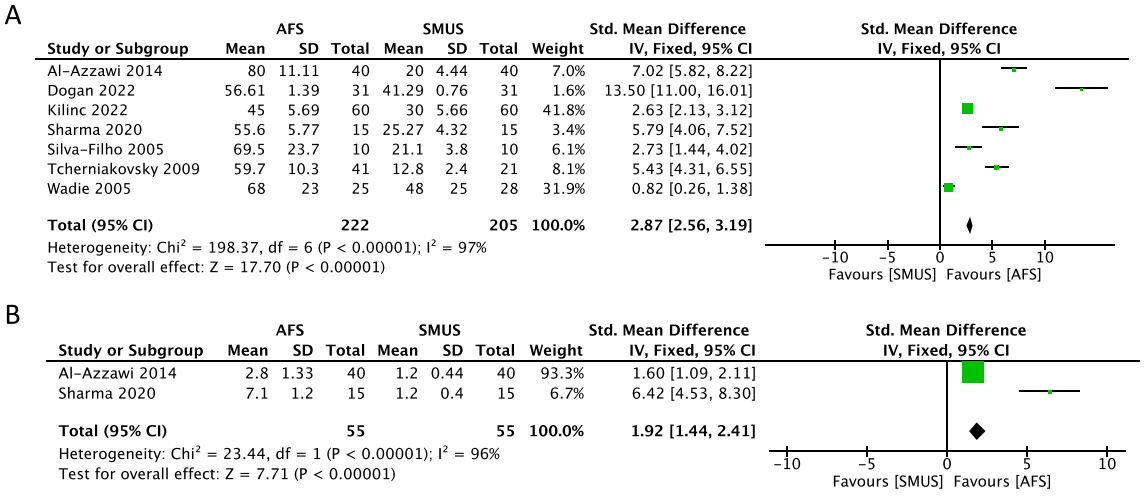


Fig. 3 Meta-analyses. **A** Operation time of autologous fascial slings (*AFS*) versus synthetic midurethral slings (*SMUS*). **B** Hospital stay duration in AFS vs. SMUS

The risk of bias in each of the included studies was independently evaluated by two reviewers in accordance with the Cochrane Handbook using RoB2.0 for randomized controlled trials. All disagreements were resolved by a third author. The visualization tools were created using the ROBVIS application [32]. This application generated "traffic light" plots of the domain-level judgments for each result and weighted bar plots of the distribution of risk-of-bias judgments within each bias domain. Based on RoB instrument 2 for randomized trials (Figs. 4 and 5) two trials showed a high risk of bias, 10 trials showed some concerns, and 8 trials showed a low risk of bias.

Discussion

This systematic review and meta-analysis was conducted to evaluate the efficacy and safety of AFS compared with other surgical treatments for female SUI. All available information from the 20 included RCTs were analyzed and summarized. According to the results of this study, the effectiveness of AFS and SMUS was similar. AFS showed a lower incidence of long-term postoperative complications. Despite the statistical significance, it is excessively low. SMUS demonstrated shorter operation time, shorter hospital stay, and lower de novo urgency.

According to International Continence Society Standards 2023, the development of voiding dysfunction is the most common complication of AFS [33]. Athanasopoulos et al. [34] performed a retrospective analysis of 264 patients who underwent AFS surgery. The authors reported a de novo urgency rate of 49 (18.5%) patients, whereas 224 patients (85%) reported significant improvement. In a systematic review and meta-analysis in 2017, Fusco et al. [2] evaluated SMUS and other surgical treatments for SUI. The efficacy in objective cure rate of SMUS and AFS was similar but showed superiority over Burch colposuspension. In another systematic review and meta-analysis by Schimpf et al. [35], AFS showed lower rates of wound infection, bowel injury and bladder or vaginal perforation compared with Burch's colposuspension. In a 2020 prospective study [36] the autologous transobturator tape showed similar objective and subjective cure rates and overall complication rates, as well as better outcomes for postoperative voiding dysfunction and de novo filling phase symptoms compared with the standard transobutrator tape.

A prospective cohort study by Parker et al. [37] reported results of AFS surgery in 229 patients with primary AFS and in 59 patients with primary SMUS. Of 59 patients, 34 had a failed sling with recurrent SUI, 20 had sling extrusion, and 5 patients suffered from obstruction requiring sling lysis or excision. At a median follow-up of 14 months, prior MUS placement was not associated with a significant difference in objective (55.9% vs 62.4%, $p=0.37$) or subjective cure (66.1% vs 69.0%, $p=0.75$) compared with patients undergoing placement of an initial AFS. Patients undergoing AFS after prior SMUS did have a significantly higher rate of urinary retention requiring intermittent catheterization (8.5% vs 3.1%, $p<0.001$) and re-operation (13.6% vs 3.5%, $p=0.01$) for persistent incontinence.

Furthermore, a randomized controlled trial by Maher et al. [38] was not included in the systematic review but is worth considering in the context of the question of the effectiveness of AFS. Autologous pubovaginal sling and transurethral bulking Macroplastique were compared in the treatment of female SUI and intrinsic sphincter deficiency. At 62 months' follow-up, the response rate was 60% in both

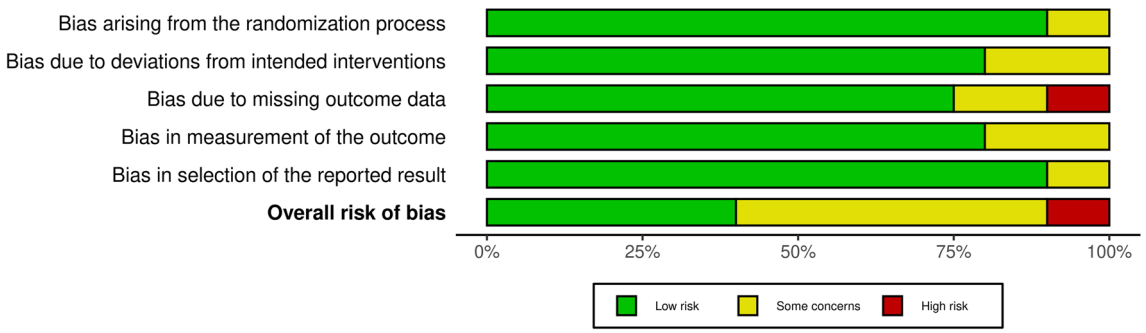


Fig. 4 RoB2.0 tool for randomized controlled trials (traffic light plot)

Fig. 5 RoB2.0 tool for randomized controlled trials (summary plot)

groups, with the sling group reporting better continence success (69% vs 21%) and satisfaction rates (69% vs 29%, $p = 0.057$).

The AFS is considered a reasonable primary treatment option for uncomplicated SUI in women. This surgical intervention can be used following the removal of a synthetic MUS. Moreover, given the current status of slings in some countries and possible contraindications to the use of synthetic slings, AFS has emerged as an option in the treatment of SUI.

The limitations of this systematic review and meta-analysis include a small sample size and low quality of some old studies. At the same time, there is a limited amount of research conducted with a high-quality rate. The short follow-up duration is also noteworthy in some studies. In addition, studies with a high risk of bias (critical or high risk of bias) were included. In some articles and in the primary outcome there was no clear division of the cure rate into objective and subjective, which would have been more informative. Owing to different outcomes and follow-up periods, it was not possible to conduct a quantitative synthesis comparing AFS and Burch colposuspension. Moreover, 4 studies were the same trial (SISTER trial) [39–42]. Concerning implications for future research, more well-conducted prospective and randomized trials with long-term follow-up and large sample size are required to assess the advantages and disadvantages of autologous slings in female SUI management. In order to ensure the objectiveness of the results, studies should have common standardized measures for continence surgery.

Conclusion

In this systematic review and meta-analysis, autologous slings demonstrated the same efficacy in comparison with SMUS in the management of SUI in women. AFS showed lower incidence of long-term postoperative complications. SMUS demonstrated lower operation time, hospital stay and de novo urgency. However, more well conducted studies with long-term follow-up and standard outcome measures will be useful in the further study of this issue and the surgical method choice for the female SUI treatment.

Authors' contributions Bagrat Grigoryan: data collection, manuscript writing; George Kasyan: data collection, manuscript writing, manuscript editing; Dmitry Pushkar: project development, manuscript editing.

Declarations

Conflicts of interest None.

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