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Fixation of uterosacral ligaments to anterior vaginal wall during modified McCall culdoplasty after vaginal hysterectomy

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ABSTRACT

Objectives: McCall culdoplasty is a commonly performed procedure for pelvic organ prolapse surgical repair; despite its good efficacy, however, anterior prolapse recurrence frequently occurs. The aim of our study was to verify whether fixation of utero-sacral ligaments (USLs) to anterior vaginal wall during a modified McCall culdoplasty (MMC) could reduce the rate of anterior recurrence of prolapse.
Study design: This was a retrospective study on women submitted to MMC after vaginal hysterectomy and anterior colporraphy for prolapse repair. Patients undergoing concurrent anterior fixation of USLs (AF) were compared to cases treated with MMC alone, evaluating potential differences in anatomic result of prolapse repair at 12 months, rate of anterior recurrence over time, operative data and post-operative morbidity.
Results: Women undergoing MMC with AF (n = 45), compared with patients treated with MMC alone (n = 77), showed better results in terms of anatomic support in the anterior compartment at 12 months, assessed by means of POP-Q system parameters Aa (-1.8 cm vs −1.2 cm, p 0.0025) and Ba (-2.0 cm vs −1.3 cm, p 0.00015), and a lower rate of anterior recurrence (11.1% vs 29.9%, p 0.025); the other parameters of prolapse anatomic staging did not differ significantly, nor did operative data or post-operative morbidity. Follow up confirmed a longer disease-free survival over time for women treated with MMC with AF (p 0.028)
Conclusions: Fixation of USLs to anterior vaginal wall at time of post-hysterectomy MMC appears to improve anatomic outcomes of the procedure reducing the risk of anterior prolapse, without implying a reduced safety, nor a greater surgical complexity.

Introduction

Pelvic organ prolapse (POP) is defined as the descent of one or more aspects of the vagina and uterus [1]. This condition is frequently reported in postmenopausal women, with a prevalence as high as 50% when assessed at vaginal examination, and the lifetime risk for undergoing surgical repair has been estimated in 6–18% [2]. A wide variety of surgical techniques have been described in Literature, addressing the repair of anterior, central or posterior prolapse: these procedures encompass the use of either native tissue or synthetic mesh for the repair, performed through the vaginal or abdominal route [3].

A widely performed technique is vaginal hysterectomy (VH), associated with fixation of the vaginal apex to pelvic structures such as the uterosacral ligaments (USLs): this procedure can imply either suspension to the ipsilateral ligament or midline plication of the USLs, with the aim of preventing vaginal vault prolapse [3]. A longstanding technique is McCall culdoplasty, which consists in the obliteration of the pouch of Douglas by means of sutures transfixing the posterior vaginal wall, the USLs and the pre-rectal peritoneum [4]; this procedure, which was originally developed for enterocele prevention, has undergone several proposals of modification over decades, and its variations are currently considered a highly effective procedure for preventing post-hysterectomy POP [5].

Despite surgical innovations, recurrence of POP after vaginal surgical repair still remains a bothersome issue, due to the high prevalence reported at follow up [6,7]; recurrences are most commonly found in the anterior compartment [7]. Though apical repair

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has been demonstrated to contribute partly to anterior vaginal support [8,9], anterior colporraphy is frequently performed concurrently at the time of VH. Over time new procedures have been proposed, implying a concurrent fixation of the anterior vaginal wall to the USLs during vault suspension after VH, such as in the technique described by Shull et al. for tranvaginal high USLs suspension [10]. In a modified version of McCall culdoplasty, the tail of the suspending suture is transfixed through bladder peritoneum, vesico-vaginal fascia and anterior vaginal wall before closing the cuff [11,12]; though this additional surgical step is likely to improve anterior support in the view of reducing the rate of POP recurrence after VH, no data exist regarding its possible advantages when compared to original McCall culdoplasty.

The aim of our study was to determine the efficacy and safety of the fixation of USLs to anterior vaginal wall during McCall culdoplasty carried out after vaginal hysterectomy with concurrent anterior colporraphy, through a comparison of cases with controls were this additional surgical step was not performed. Our primary outcomes were the anatomical results and the rate of recurrence at 12 months, and the duration of the period without relapse; secondary outcomes were surgical and postoperative results including duration of surgery, rates of complications and time needed for recovery.

Materials and methods

This was a single centre retrospective study on women submitted to surgical treatment of POP including McCall culdoplasty, at the Obstetrics and Gynecology Universitary Department of Mauriziano Umberto I Hospital in Turin, during the period from January 2004 to January 2020. Data were retrieved through retrospective review of hospital medical records; we searched the database including all surgical operations performed during that period in our centre, identifying patients who had undergone vaginal hysterectomy and verifying whether inclusion and exclusion criteria applied.

The inclusion criteria were: women with POP affecting the anterior and central compartments, treated with VH followed by McCall culdoplasty and anterior colporraphy, followed up for a minimum of 12 months.

The exclusion criteria were: use of grafts for POP repair; concomitant surgical procedures for stress urinary incontinence (SUI); re-operation for POP recurrence during the first 12 months after the procedure.

All of the women included in the study underwent VH with concomitant anterior colporraphy through midline plication of Halban's pubocervical fascia; additional surgical procedures included, when indicated, posterior repair consisting in colpoperineorrhaphy and levator ani muscle plication [3]; the choice for performing salpingectomy and oophorectomy relied on the patient's menopausal status and preferences after counseling. VH was followed by a modified McCall culdoplasty (MMC), which could subsequently include the fixation of the USLs to the anterior vaginal wall previously repaired through colporraphy. This procedure, which was reffered as anterior fixation (AF), was performed according to operating surgeon's choice. The women included in the study population were then divided in two groups, consisting in cases treated with AF after MMC, and controls who underwent MMC alone.

MMC consisted in a midline plication of the USLs through two consecutive sutures in polydioxanone absorbable monofilament. Each suture was passed firstly through the epithelium and fibromuscular layers of the posterior vaginal cuff on the left side, and then through the ipsilateral USL and the cardinal ligament stump; pre-rectal peritoneum was subsequently transfixed on the midline and the suture was passed on the right side through the cardinal ligament, the USL and the posterior vaginal cuff. This procedure was repeated a second time, transfixing more cranially the pre-rectal peritoneum. In women who underwent AF together with MMC, a single suture was placed through the left USL, the ipsilateral anterior edge of the vaginal cuff after colporraphy – transfixing the vagina and the plicated vesico-vaginal fascia – and then controlaterally through the same structures in the opposite direction (Fig. 1). Eventually, in both groups the vaginal cuff was closed with an interrupted suture on the transversal axis, and the MMC sutures were tensioned with midline USLs plication and obliteration of the pouch of Douglas.

All procedures were performed under spinal anesthesia with indwelling urinary catheter. After surgery, the vaginal cuff was packed with a gauze soaked in povidone iodine, which was removed at 24 h. Urinary catheter was maintained for 48 h; after removal, the patient was asked to empty her bladder, and the post-voiding residual (PVR) was evaluated. The patient was discharged after two consecutive measurements of a < 100 ml PVR; in cases of persistently abnormal voiding, the woman was treated with oral corticosteroids to reduce potential tissue edema in the urethral region, instructed to perform intermittent self-catheterization at home with daily recording, and checked after 7 days.

All patients underwent preoperative evaluation included medical interview and clinical examination with urogynecological assessment. After surgery, they were followed up at 1 month, 3 months, 6 months and 12 months after surgery, and then once a year. Both preoperative assessment and follow up visits included a pelvic examination with evaluation of prolapse through the POP Quantification System (POP-Q) [13], the measurement of PVR and an interview to enquire about clinical symptoms of SUI. Recurrence

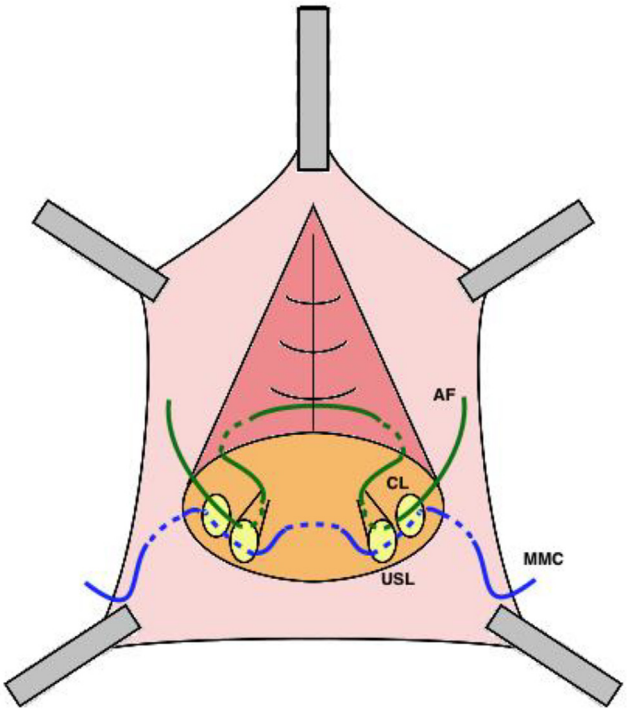

Fig. 1. A simplified diagram of the surgical procedure is shown. Sutures of modified McCall culdoplasty (MMC) are represented in blue; the sutures are passed through the posterior vaginal cuff, the utero-sacral (USL) and cardinal ligament (CL) stumps and the pre-rectal peritoneum, and then passed on the controlateral side. Sutures of anterior fixation (AF) are represented in green; the sutures are passed through the USL, the anterior edge of the vaginal cuff after colporraphy and then controlaterally.

of prolapse after surgery was defined as a descent equal or greater than stage II according to the POP-Q system.

We collected anamnestic data about age, body mass index (BMI), parity and menopausal status, and the features of the POP at preoperative evaluation, including PVR and prevalence of SUI; surgical data including procedures performed, duration of the operation, rate of intra- or post-operative complications including fever, urinary tract infections (UTI), hematoma, blood transfusions, ureteral and bowel injuries, vaginal cuff dehiscence; post-operative data including duration of bladder catheterization after surgery, duration of hospital stay, PVR, rate of clinical SUI and anatomical outcomes during follow up. During the follow up period, the patients were assessed through POP-Q system: the primary outcome was the difference in POP staging between the two groups at 12 months, considering POP-Q points location and prevalence of recurrence for each compartment, defined by means of POP-Q staging as previously stated. We then collected data about subsequent follow up visits to study the incidence of anterior prolapse recurrence over time, in order to build a Kaplan-Meier estimator for each group and analyze whether the two curves significantly differ.

Table 1
Characteristics of the two groups.

Variables	MMC with AF (N = 45)	MMC without AF (N = 77)	p §
Age (years) *	64.9 +/− 1.0	64.8 +/− 0.9	0.91
BMI (kg/m^2) *	26.2 +/− 0.6	25.4 +/− 0.4	0.31
Postmenopausal status (%)	43 (95.6%)	73 (94.8%)	0.97
Number of vaginal deliveries *	2.0 +/− 0.1	1.8 +/− 0.1	0.52
PVR (ml) *	29.8 +/− 7.8	50.6 +/− 8.2	0.086
SUI (%)	8 (17.8)	11 (14.3)	0.61
Adnexal surgery (%)	24 (53.3)	26 (34.8)	0.038
Posterior repair (%)	15 (33.3)	25 (32.5)	0.95

MMC modified McCall culdoplasty; AF anterior fixation of USLs; BMI body mass index; PVR post-voiding residual; SUI stress urinary incontinence.
* Data are reported as mean +/− standard error.
§ Analysis was carried out with a two-tailed *t*-test for independent samples with unequal variances for continuous variables, and with Fisher's test for categorical variables.

Table 2
Grading of prolapse at preoperative assessment.

POP-Q system	MMC with AF (N = 45)	MMC without AF (N = 77)	p §
Aa (cm)	1.9 +/− 0.2	1.8 +/− 0.1	0.66
Ba (cm)	2.9 +/− 0.2	2.5 +/− 0.2	0.16
C (cm)	1.7 +/− 0.5	1.4 +/− 0.4	0.66
D (cm)	−2.6 +/− 0.4	−2.5 +/− 0.4	0.90
TVL (cm)	7.5 +/− 0.2	7.5 +/− 0.2	0.83
Ap (cm)	−1.2 +/− 0.2	−1.1 +/− 0.2	0.69
Bp (cm)	−1.3 +/− 0.2	−1.5 +/− 0.2	0.72
Gh (cm)	4.6 +/− 0.1	4.7 +/− 0.1	0.89
Pb (cm)	2.8 +/− 0.1	2.8 +/− 0.1	0.87

POP-Q Pelvic Organ Prolapse Quantification; MMC modified McCall culdoplasty; AF anterior fixation of USLs.
Data are reported as mean +/− standard error.
§ Analysis was carried out with a two-tailed *t*-test for independent samples with unequal variances.

Statistical analysis

Continuous variables were expressed as mean +/- standard error; categorical variables were expressed as n (%). We divided our population in two groups, consisting in cases treated with AF after MMC, and controls who underwent MMC alone. These groups were then compared for the variables collected, to evaluate potential differences. Univariate analysis was performed for continuos variables with a two-tailed *t*-test for independent samples with unequal variances, and for categorical variables with a Fisher's test, after checking with Kolmogorov-Smirnov test that the distribution of our samples did not differ from the normal one. Follow up data about anterior prolapse recurrence were used to build for each group a Kaplan-Meier estimator, describing disease-free survival after surgery; the two survival distributions were compared by means of a Mantel-Cox log-rank test. A difference was considered statistically significant when it was associated with a two-tailed $p < 0.05$.

Statistical analyses were performed using SPSS 22.0 (Statistical Package for the Social Sciences) software (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp).

Results

During the study interval, 122 women were submitted to VH with MMC and anterior colporraphy in our Center, and followed

Table 3
Grading of prolapse at postoperative assessment at 12 months.

POP-Q system	MMC with AF (N = 45)	MMC without AF (N = 77)	p §
Aa (cm) *	−1.8 +/− 0.1	−1.2 +/− 0.1	**0.0025**
Ba (cm) *	−2.0 +/− 0.1	−1.3 +/− 0.1	**0.00015**
C (cm) *	−5.2 +/− 0.1	−4.9 +/− 0.2	0.24
TVL (cm) *	6.6 +/− 0.2	6.6 +/− 0.1	0.99
Ap (cm) *	−2.1 +/− 0.1	−1.9 +/− 0.1	0.33
Bp (cm) *	−2.1 +/− 0.1	−2.0 +/− 0.1	0.55
Gh (cm) *	4.2 +/− 0.2	4.5 +/− 0.1	0.31
Pb (cm) *	2.6 +/− 0.2	2.8 +/− 0.1	0.29
Difference in Aa (cm) *	4.0 +/− 0.2	3 +/− 0.2	**0.0013**
Difference in Ba (cm) *	5.0 +/− 0.3	3.8 +/− 0.2	**0.0036**
Difference in C (cm) *	6.5 +/− 0.6	6.0 +/− 0.4	0.53
Difference in Ap (cm) *	−0.9 +/− 0.3	−0.8 +/− 0.2	0.84
Difference in Bp (cm) *	−0.9 +/− 0.3	−0.9 +/− 0.2	0.92
Anterior recurrence (%)	5 (11.1)	23 (29.9)	**0.025**
Central recurrence (%)	0 (0)	1 (1.3%)	0.98
Posterior recurrence (%)	4 (5.2%)	5 (6.5%)	0.72

POP-Q Pelvic Organ Prolapse Quantification; MMC modified McCall culdoplasty; AF anterior fixation of USLs.
Recurrence was defined as a prolapse equal or greater than stage II according to POP-Q system.
* Data are reported as mean +/− standard error.
§ Analysis was carried out with a two-tailed *t*-test for independent samples with unequal variances for continuous variables, and with Fisher's test for categorical variables; statistically significant results are highlighted in bold.

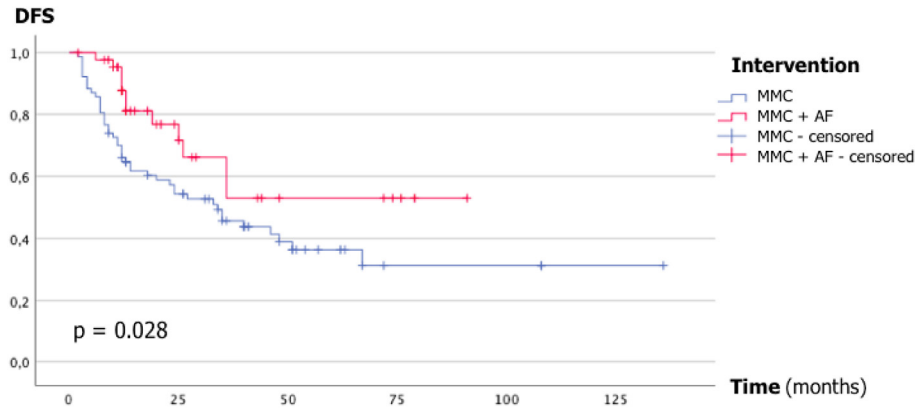

Fig. 2. Kaplan-Meier estimators for women submitted to modified McCall culdoplasty alone (MMC) or with fixation of utero-sacral ligaments to anterior vaginal wall after colporraphy (MMC + AF). Cumulative disease-free survival (DFS) in terms of time to anterior recurrence is significantly better for MMC + AF when the distributions of two groups are compared by means of a log-rank test (χ^2 4.84, p 0.028).

up subsequently for a minimum of 12 months. Among them, in 45 cases AF was performed during MMC, whereas 77 patients did not undergo this additional surgical step. Procedures were performed by 11 operating surgeons overall during the period of time considered in the study.

Table 1 summarizes the baseline characteristics of the two groups, in terms of anamnestic features and type or surgical procedures performed. These data highlight the fact that the two groups did not differ significantly of any of the features examined, except for a slightly higher prevalence of adnexal removal performed with VH among cases submitted to AF. The results of the preoperative assessment of the prolapse through POP-Q system are reported in Table 2; no significant difference was observed between the two groups, whose baseline POP grading was comparable.

Table 3 reports anatomical outcomes of MMC alone vs MMC with concurrent AF. At 12 months, a significantly better result was obtained from MMC with AF in terms of anterior support, expressed by the location of POP-Q system points Aa (p 0.0025) and Ba (p 0.00015), whereas the other measures showed no significant difference. The improvement in anterior support deriving from surgery, expressed as the difference between pre- and post-operative location of POP-Q points, also was significantly better for MMC with AF, for both Aa (p 0.0013) and Ba (0.0036). Secondly, women which underwent concurrent AF showed a significantly lower prevalence of anterior recurrence at 12 months: 11.1% of women submitted to the procedure were diagnosed with anatomic recurrence, whereas this condition was reported in 29.9% of patients for whom this surgical step was not performed (p 0.025).

The analysis of follow up data about anterior prolapse recurrence over time allowed us to build Kaplan-Meier estimators which are reported in Fig. 2. The rate of anterior recurrence over time appeared to be lower in women submitted to AF during McCall culdoplasty, with a significant difference in terms of disease-free survival after surgery, as shown by the log-rank test (χ^2 4.84, p 0.028).

Table 4 reports the data regarding the surgical and post-operative secondary outcomes. The two groups did not differ for duration, rates of complication, duration of hospital stay, prevalence of SUI or postoperative voiding problems; these data suggest that the addition of AF to MMC should not imply a longer operating time or a reduced safety of the procedure.

Table 4
Surgical and post-operative outcomes of the procedures performed.

	MMC with AF (N = 45)	MMC without AF (N = 77)	p §
Duration (minutes) *	89.3 +/− 4.1	87.4 +/− 3.2	0.73
Blood transfusion (%)	0 (0)	1 (1.3)	0.95
Ureteral injury (%)	0 (0)	0 (0)	–
Bowel injury (%)	0 (0)	0 (0)	–
Vaginal cuff dehiscence (%)	0 (0)	0 (0)	–
Pelvic/vaginal hematoma	1 (2.2%)	1 (1.3)	0.98
Fever (%)	0 (0)	0 (0)	–
UTI (%)	1 (2.2)	3 (3.9)	0.85
Time to normal PVR (days)	2.9 +/− 0.2	3.2 +/− 0.2	0.38
Duration of hospital stay (days)	4.7 +/− 0.3	4.3 +/− 0.2	0.40
PVR (ml) *†	7.1 +/− 2.8	9.9 +/− 2.1	0.44
SUI (%)†	7 (15.6)	12 (15.6)	0.98

MMC modified McCall culdoplasty; AF anterior fixation of USLs; UTI urinary tract infection; PVR post-voiding residual; SUI stress urinary incontinence.
* Data are reported as mean +/− standard error.
§ Analysis was carried out with a two-tailed *t*-test for independent samples with unequal variances for continuous variables, and with Fisher's test for categorical variables.
† Evaluation carried out at 12 months follow up visit.

Discussion

The presents study shows that the fixation of USLs to anterior vaginal wall during MMC, carried out after VH with anterior colporraphy, may imply a better anatomic result of surgery with a reduced rate of anterior prolapse recurrence.

In our population, women submitted to MMC with AF showed a significantly lower prevalence of anterior compartment prolapse at 12 months follow up visit; this corresponded to a significant difference in terms anatomic support, expressed by means of the location of vaginal points Aa and Ba at POP-Q system assessment. The efficacy of the procedure in restoring a normal anatomy of anterior vaginal wall, expressed by the mean difference between pre- and postoperative location of those points, was improved by the addition of AF, although the absolute difference between the two groups was actually small (about 1 cm). However, one of the main strenghts of the study lies in the analysis of a longer follow up period, which shows how women submitted to MMC with AF actually have a better disease-free survival in terms of time to anterior recurrence, as shown by Kaplan-Meier estimators. POP staging at 12 months had similar results for the other compartments between the two groups; it is noteworthy the fact that both women submitted to MMC with AF and MMC alone showed fairly good anatomic results for apical support at assessment of C point (-5.2 and −4.9 respectively, p 0.24), with negligible rates of central recurrence (0% and 1.3% respectively, p 0.98). Eventually, the addition of AF to MMC did not imply a significantly longer operating time, nor a difference in terms of complications or postoperative

course, with fairly good results for both groups in terms of surgical morbidity.

The results of the present study are similar to the data reported in Literature for procedures involving a anterior vaginal wall support obtained through some form of fixation to the USLs. Colombo et al. proposed a modified version of McCall culdoplasty in which the tail of the suspending suture transfixing the USLs was passed through the anterior vaginal wall on the ipsilateral side [11]; the procedure was compared to sacrospinous ligament fixation at the time of VH, showing better results in terms of operative time, blood loss and anatomic outcomes, with a 5% of patients subsequently diagnosed with vault prolapse and 6% of recurrent cystocele. Spelzini et al. compared such technique to USLs suspension by means of Shull's technique [10], showing similar results for the two procedures in terms of efficacy and safety [12]: in their study MMC was followed by anterior recurrence in 13% of cases and vault recurrence in 1.4%, and at POP-Q assessment the mean value of Aa and Ba points location was −2; on the other hand, the rate of total complications was quite 3.1%, with a 2.2% prevalence of ureteral injury. The results of the present study are consistent with these data from Literature altogether, supporting the evidence favouring a MMC including anterior vaginal wall fixation to USLs to improve anatomic support in this compartment.

In Literature, the anterior vaginal wall is considered the most common site where recurrence of prolapse may occur, affecting about 15–20% of women submitted to USL suspension after VH [7]; an unsatisfactory result is more common when the anterior prolapse presents at a higher grade preoperatively [7,14]. A possible explanation for these results may depend on the failure to correctly address the pathogenic mechanisms underlying cystocele. Traditionally, it was considered to depend on midline defects due to the stretching and thinning of the anterior pubocervical fascia, causing bladder descent into the vagina; surgical repair relied therefore on plication of this fascia through anterior colporraphy [15]. Nevertheless, several other mechanisms have been subsequently proposed for the development of anterior prolapse: paravaginal defects, due to fascial detachment from the arcus tendineus fasciae pelvis, and transverse defects, resulting from the separation of the pubocervical fascia from the pericervical connective tissue ring, are now known to play a crucial role [16,17]. Anterior colporraphy does not imply repair of these defects, and recurrence rates are actually high when it is performed alone; on the other hand, the association with procedures restoring a normal support for the vaginal apex has been shown to improve the rate of anterior recurrences [8]. This could be explained because of the relation observed between apical and anterior prolapse: loss of adequate support from defective cardinal and uterosacral ligaments has been proposed as a causal mechanisms for cystocele pathogenesis [18], which implies a significant effect of the repair of apex support in achieving a complete correction for anterior vaginal wall prolapse [9,19,20]. Fixation of the USLs to the anterior vaginal wall after colporraphy could contribute to improve the anatomic outcome, by offering a support based on apical structures and overcoming lateral and transverse defects; this could explain the better results obtained in the present study by this procedure in the comparison with MMC alone. Concurrent AF might therefore contribute to a reduced rate of recurrence of anterior vaginal wall prolapse after MMC through this mechanism.

The benefits deriving from the addition of the procedure to MMC may have relevant implications for the choice of surgical repair techniques after VH. Performing variations of McCall culdoplasty at the time of hysterectomy might be the most effective prophylactic surgical procedure for preventing subsequent pelvic organ prolapse [5]; this type of operation moreover has been extensively carried out for several decades, with a sound experience among most urogynecologist. The additional fixation of USLs to the anterior vaginal wall is a quite easily performed step, and the present study does not show and increased risk of complications, or a worsening of other postoperative outcomes either. This is in accordance with data from other studies showing the benefits of addressing the anterior vaginal wall when performing McCall culdoplasty [11,12]: this aim can be achieved through surgical steps meant to exploit USLs suspension not only for apical repair, but also to offer an additional support site to anterior vaginal wall besides colporraphy alone. Such mechanism is actually used by Shull's technique for transvaginal high USLs suspension [10], which on the other hand may be technically challenging for surgeons, since ligament transfixion is performed in its most distal segment; nevertheless, the use of a MMC technique does not seem to worsen postoperative outcomes [12,21]. The procedure described in the present study might be therefore considered among the possible choices for POP surgery performed through native tissue repair with a vaginal approach.

These techniques are still a mainstay of urogynecologic surgery: despite the more recent introduction of abdominal procedures such as sacral colpopexy, they are often preferred due to benefits such as a shorter operating time, a quicker return to activities of daily living, and reduced costs [22]. Moreover, recent data seems to suggest a lower risk of complications requiring readmission and reoperation [23,24].

The main limitations of the study depend on its retrospective nature. Firstly, the allocation to MMC alone or combined with AF depended on the surgeon's choice at the time of operation, and was retrieved retrospectively from the surgical reports; though the two groups were similar when compared for the main clinical variables – such as age, parity, BMI or pre-operative grading of the prolapse –, it is not possible to exclude that other factors not investigated presently might be related to the procedure performed and its outcomes. Notably, it should be acknowledged that the procedures were performed by several surgeons over a long period of time, so it is quite hard to understand whether different surgical skills might have influenced either the choice or the outcome of the operation through a retrospective study. This is the main limitation for our work, which should prompt further research with prospective studies relying on randomization to either a procedure or another. Secondly, symptoms were evaluated by means of a patient interview at each visit, nevertheless questionnaire forms were not administered during follow up; since an objective quantification was lacking, symptoms were not considered in our analysis, which relied on anatomical outcomes exclusively. Therefore, no data are available regarding quality of life or the impact on symptoms deriving from the procedure. Further research would be needed to confirm these data, with prospective studies carried out on a larger population and taking into account other outcomes such as quality of life measures.

Conclusions

The fixation of USLs to anterior vaginal wall at time of posthysterectomy MMC is an additional surgical step which appears to improve anatomic outcomes of the procedure in terms of recurrence of anterior prolapse, without implying a reduced safety, nor a greater surgical complexity.

Ethics approval

The study was conducted in accordance with the 1964 Declaration of Helsinki. Since this was a retrospective study with no experimental research on participants, being all the procedures performed part of the routine care, exemption from formal

approval was granted by the Ethics Committee of our institution when inquired.

Consent to participate and to publish

Informed consent was obtained from all individual participants included in the study. All patients gave their consent to the anonymous use and publication of their data for scientific purposes.

CRediT authorship contribution statement

Matteo Mancarella: Conceptualization, Methodology, Formal analysis, Writing - original draft. **Francesco Testa:** Data curation, Investigation. **Francesca Chiadò Piat:** Data curation, Investigation. **Lorenzo Novara:** Writing - review & editing. **Nicoletta Biglia:** Supervision, Project administration. **Luca Giuseppe Sgro:** Conceptualization, Investigation, Supervision, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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