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ORIGINAL ARTICLE

# The uses and outcomes of the Martius fat pad in female urology

Sachin Malde[1] · Marco Spilotros[1] · Ailsa Wilson[1] · Mahreen Pakzad[1] ·
Rizwan Hamid[1] · Jeremy Ockrim[1] · P. Julian Shah[1] · Tamsin Greenwell[1]

## Abstract

*Purpose* To assess the indications, morbidity, efficacy and outcomes of Martius fat pad (MFP) interposition in reconstructive female urology.

*Materials and methods* Data on 159 women with MFP interposition as part of their primary procedure between 2 September 2005 and 2 July 2015 were prospectively collected. Patient demographics and the indications for MFP interposition along with the outcomes of their primary procedures and short- and long-term complications related to the MFP, along with patient reported perception of postoperative appearance, were noted.

*Results* The main indications for MFP interposition were urethral diverticulum excision (74), vaginal repair of vesicovaginal fistula (VVF) (43), removal and repair of urethral erosion of mid-urethral tape (MUT) (24), female urethroplasty for stricture (12), vaginal closure of bladder neck for complex end-stage stress urinary incontinence (USUI) (4) and as a MUT wrap for protection of urethra and vagina in women with fragile urethras (2). The majority of patients (127 or 79 %) rated the post-operative appearance of their labia as good or excellent. Only 1 patient (0.6 %) felt the post-operative appearance was unsatisfactory. There were 2 post-harvest labial haematoma (1.25 %), 1 labial wound infection in an overweight diabetic patient (0.6 %) and no other significant short- or long-term complications.

*Conclusions* MFP interposition is associated with good cosmesis and a very low complication rate (<2 %). It appears to lower new onset post-procedure USUI, prevent erosion in the 'fragile' urethra and improve outcomes following repair of post-surgery VVF/UVF. MFP is a versatile and effective tool in the female urologists' armamentarium.

**Keywords** Martius fat pad · Incontinence · Fistula · Diverticulum

## Introduction

The harvesting of a fibrofatty labial flap and the concept of using it as an interposition flap were first described in 1928 by Martius [1] and later modified to exclude the bulbocavernosus muscle [2]. Vesicovaginal fistula (VVF) repair is the most common indication for MFP interposition [3, 4], but it has also been regularly utilised in urethrolysis [5] and repair of colovesical fistulae [6]. Recently, it has been suggested that the use of MFP interposition adds no benefit to VVF repair and additional morbidity [7]. In the light of this, we have reviewed the use of MFP interposition in our practice and the outcomes and morbidity associated with its use to evaluate indications and possible benefits or contra-indications.

## Materials and methods

We retrospectively reviewed and prospectively collected data on a total of 159 women [median age 48 (range 22–72) years] who had had MFP interposition as part of their primary urological procedure between 2 September 2005 and 2 July 2015. Mean follow-up was 3.2 years

✉ Sachin Malde
 sachmalde@gmail.com

 Tamsin Greenwell
 Tamsin.greenwell@uclh.nhs.uk

[1] Department of Urology, University College Hospital,
 London NW1 2PG, UK

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(range 3 months–6 years). One patient was lost to follow up at 12 months. The primary procedures associated with MFP interposition were: urethral diverticulectomy ($n = 74$), vaginal repair of VVF ($n = 43$), female urethroplasty ($n = 12$), excision of urethral erosion of mid-urethral tape ($n = 9$), vaginal closure of urethra ($n = 4$) and protection of the urethra and vagina from mid-urethral tape complications in women with fragile urethras ($n = 2$).

Patient demographics and indications for the primary procedure, as well as all short- and long-term complications related to the MFP were noted. In all, there were three routine follow-up appointments at 6, 12 and 52 weeks. Longer follow-up is available because of the nature of the National Health Service and compliance of patients with a request to attend for follow-up at 2 and 5 years for completeness of data. Success rates of the primary procedure and patient satisfaction with cosmesis of the MFP graft site were also documented.

## Surgical technique

The labial skin and superficial fascia are incised along the most dependent line of the labia majora and the bright yellow of the fibrofatty pad identified and formally dissected. The pad receives two main blood supplies at 11 and 8 o'clock from the external and internal pudendal arteries, respectively (Fig. 1). The margins of this dissection are:



**Fig. 1** Site of incision over right labia majora is marked. Also marked is the dual blood supply to the MFP at 8 and 11 o'clock

laterally the labiocrural fold, medially bulbocavernosus muscle (Fig. 2) and posteriorly the external surface of the pubic bone (Fig. 3).

The flap is divided at either its superior or inferior margin—most commonly at its superior margin leaving the flap
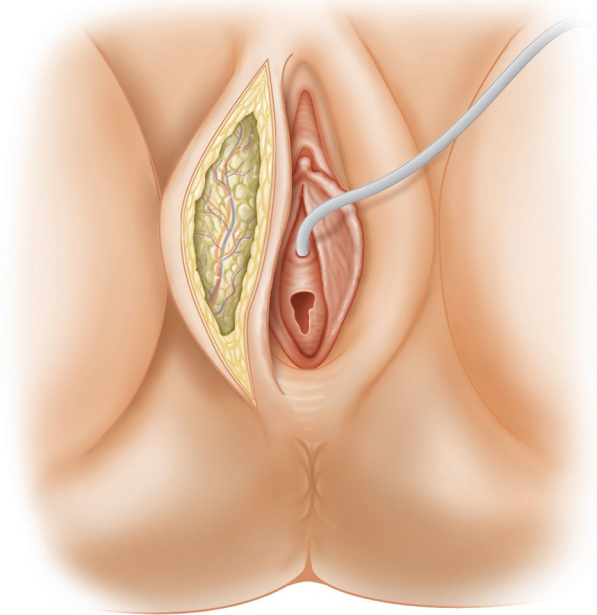


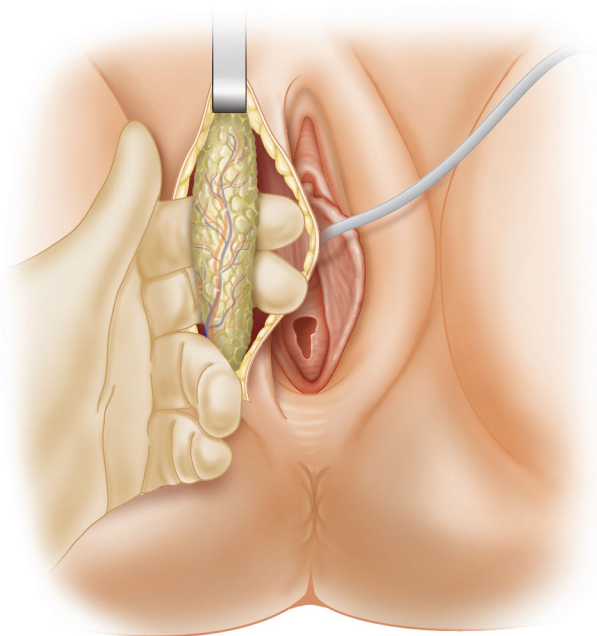**Fig. 2** Labial incision is made and the MFP delineated superolaterally



**Fig. 3** MFP is mobilised inferiorly leaving it attached to its superior and inferior pedicles
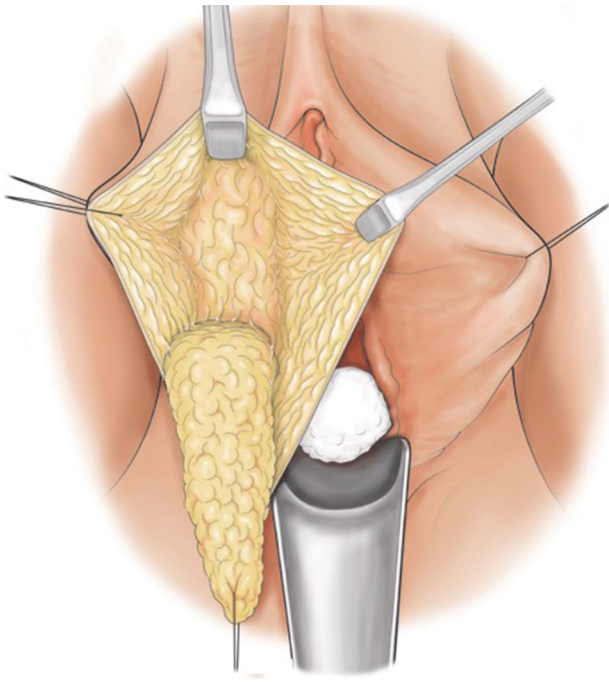
**Fig. 4** MFP is harvested here on its inferior pedicle. The superior pedicle is ligated so that the MFP can be swung medially to provide interposition
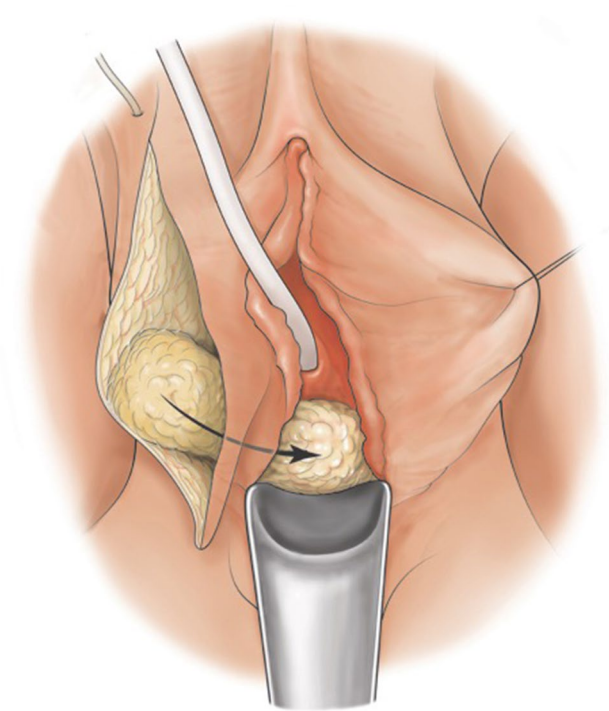


**Fig. 5** MFP is tunnelled under the lateral wall of the vagina and transposed into the vaginal wound

supplied by its inferior pedicle (Fig. 4). A tunnel is made deep to the lateral vaginal wall superficial to the bulbocavernosus muscle, and the flap transferred from the harvest site through this tunnel (Fig. 5). Closure is achieved subcutaneously with 2/0 absorbable suture, and the skin is closed with 3/0 undyed absorbable suture and tissue glue over a Minivac drain. A pressure dressing is applied to the labial wound. Other routine post-operative care is determined by the primary procedure.

## Results

Patient satisfaction regarding labial cosmesis was assessed at each of the three follow-up visits. Figure 6 demonstrates the typical appearance 6 weeks post-harvest. Seven-nine percentage (127) of the women rated the post-operative appearance of their labia as good or excellent. Only 1 (0.6 %) rated the appearance of their labia unsatisfactory post-harvest.

Table 1 highlights the outcomes from each primary procedure, and also any short- and long-term complications related to the MFP interposition.

There were 2 (1.25 %) labial haematomas post-surgery. Both patients underwent uneventful urethral diverticulectomy and were discharged as per routine on day 3 post-surgery. One represented on day 4 after active mobilisation
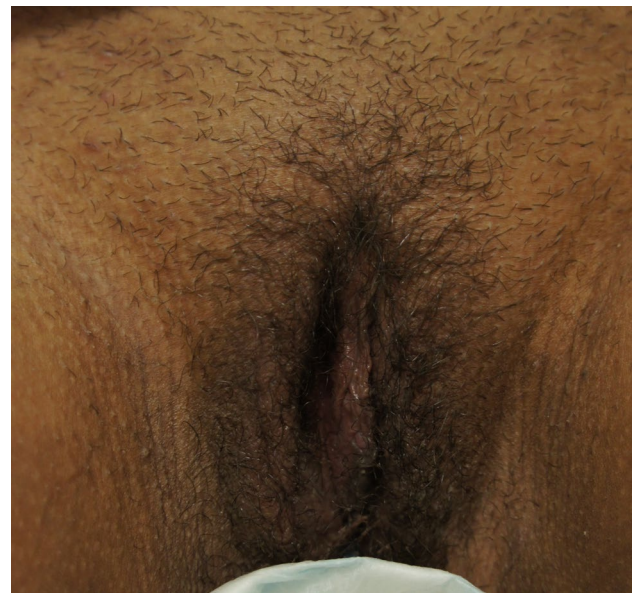


**Fig. 6** Typical appearance 6 weeks post-MFP harvest

with swollen, painful, bruised labia. A clinical diagnosis of labial haematoma was made, and the haematoma evacuated on the ward with complete resolution. The other patient represented with what was probably a secondary bleed following activity on day 10 post-surgery. The haematoma

**Table 1** Outcomes from primary urological procedure and complications of the MFP

| Indication | Number (%) | Mean age | Complication related to MFP | Primary procedure outcome |
|---|---|---|---|---|
| Urethral diverticulectomy | 74 (47) | 42 | 1 labial haematoma | 100 % cure ($n = 74$)<br>16 % new onset USUI ($n = 12$)<br>Falling to 8 % at 12 months post-surgery ($n = 6$) |
| Vaginal VVF repair | 43 (27) | 59 | None | 95 % cure ($n = 41$)** |
| Urethral erosion of tape | 24 (15) | 50 | None | 100 % cure ($n = 24$)<br>42 % recurrent USUI ($n = 10$) |
| Mid-urethral tape wrap | 2 (1) | 45 | None | 100 % cure USUI ($n = 5$)<br>No erosion of tape ($n = 0$) |
| Vaginal closure of bladder neck | 4 (3) | 46 | None | 100 % cure ($n = 4$) |
| Female urethroplasty | 12 (8) | 43 | None | 100 % cure ($n = 12$)<br>0 % new onset USUI |

was evacuated on the ward following admission with resolution of the patient's pain and symptoms. One insulin-dependent diabetic with a BMI of 28 underwent uneventful excision of urethral diverticulum for recurrent UTIs and again was discharged home on day 3. She represented on day 10 with a diagnosis of wound infection from her GP. On examination, she clearly had a labial abscess, which was incised and drained, in theatre—with resolution of her symptoms. These were the only complications of MFP interposition reported, both in the short- and long-term, giving a complication rate of 1.9 %.

All 74 patients having urethral diverticulectomy were cured of their diverticula; however, 12 (16 %) had new onset urodynamically confirmed stress urinary incontinence (USUI) immediately following removal of catheter. All 12 women had complex horseshoe or circumferential diverticula. All were reviewed by our continence nurse specialists and performed supervised pelvic floor muscle training (PFMT) for a minimum of 3 months—with resolution of SUI in 50 % such that at 12 months only 6 patients (8 %) had SUI.

Forty-three patients had vaginal repair of vesicovaginal fistulae (VVF) repair with MFP interposition. The causes of VVF were iatrogenic following hysterectomy for benign and malignant indications, colectomy for benign and malignant indications, nephroureterectomy for TCC ureter or radiotherapy for gynaecological malignancy. There were two failures both in post-radiotherapy VVF patients, making the overall success rate 95 %.

In 24 women, a urethral erosion of a mid-urethral tape was excised with primary repair of the urethral defect and MFP interposition. Cure (defined as removal of all eroded tape and all vaginal aspect of tape) was achieved in all 24 women with recurrent USUI in 10 (42 %), 2 of whom were managed with Burch colposuspension, 6 with rectus fascia sling and 2 with PFMT.

Two patients with previous pelvic radiotherapy and USUI underwent TVT-O insertion where a MFP wrap—in which the MFP was split distally into 2 and placed both between the urethra and the tape and the tape and the vagina, with successful cure of USUI in both patients and no erosion or extrusions to date.

Four patients with neurogenic disorders (multiple sclerosis $n = 2$; spinal cord injury $n = 1$; spina bifida $n = 1$), long-term suprapubic catheters and USUI secondary to capacious and incompetent urethra following previous prolonged urethral catheterisation underwent vaginal closure of the urethra with MFP interposition with success in all cases.

Twelve patients underwent urethroplasty for recurrent ISC/dilatation resistant severely symptomatic urethral stricture with ventral BMG urethroplasty supported by MFP interposition. All 12 had successful treatment of their stricture—with 1 recurrence to date at 24 months post-surgery and no new onset USUI.

## Discussion

MFP interposition has been used successfully in 159 female patients undergoing: urethral diverticulectomy, vaginal repair of VVF, excision of urethral erosion of mid-urethral tape, mid-urethral tape insertion in a field of significant radiotherapy damage, vaginal closure of urethra and urethroplasty. The morbidity of MFP interposition was minimal and the cosmesis excellent. However, there is a paucity of data regarding the outcomes of Martius fat pad use in the literature. Kasyan et al. [8] reported on 37 women operated on with Martius flaps with overall higher complication rates of bleeding (19 %), haematoma (5.4 %) and infection (5.4 %). Cosmetic problems were reported in 4 of the 24 women who were contactable for follow-up and periodic mild pain in 2 women. More recently, Lee et al. [9] assessed the morbidity of the Martius labial fat pad interposition in 97 women. In their series, 19 % had reduced sensation, 5 % reported pain and 14 % had numbness.

The commonest indication for MFP use in general is in vaginal VVF repair. A recent study of obstetric VVF suggested that its use for this indication be abandoned because of morbidity and lack of benefit [7] with a higher rate of residual incontinence in those with MFP interposition (44.9 vs. 16.5 %).

These poorer continence outcomes in the obstetric VVF patients with MFP interposition [7, 10, 11] are likely a result of the inclusion of more Goh type 1i and 1ii [>3.5 cm from external urethral meatus (EUM)] fistula [12] in the non-MFP group which are both easier to repair than Goh types 2–4 and have lower rates of incontinence following repair. Our success rate for VVF (Goh type 1i, 1ii and 1iii fistula) repair was 95 % with no post-repair urinary incontinence, and this compares favourably with other published series [3–5]. The MFP appears to have contributed to the success by improving local vascularity, preventing overlapping suture lines and aiding recovery of continence by providing urethral wall support [13–15].

In this series, we successfully excised 100 % of urethral diverticula with a new onset persistent USUI rate of 8 %. In our previous series [16], the new onset USUI rate following urethral diverticulum excision was similar at 7 %; however, rates of up to 49 % have been reported in other series [17]. It may be that MFP interposition is protective in terms of developing SUI post-excision of diverticulum.

Urethral erosion following synthetic mid-urethral tapes has been reported in 0.2–22 % [18–20]. We have successfully managed this by vaginal excision of the eroded tape and urethral repair with MFP interposition. This is followed at a later with a TVT-O or an autologous sling external to the MFP if necessary.

Multiply operated tissues, those rendered ischaemic from prior radiotherapy and patients in whom previous tape placement had resulted in urethral erosion are high risk of urethral erosion/vaginal extrusion of a synthetic mid-urethral tape and yet are also high risk of more invasive open procedures and obliteration of surgical planes renders pelvic access for rectus fascial sling problematic. In this group, we opted for the novel technique of TVT-O with a MFP wrap to reduce the risk of both erosion and extrusion.

Neuropathic patients with urethral cleavage or erosion secondary to prolonged urethral catheterisation have been successfully managed by vaginal closure of bladder neck with MFP interposition and suprapubic catheterisation. Whilst other options such as ileal conduit or intra-abdominal bladder neck closure exist, many are not fit for major surgery [21]. Previous reports of vaginal closure alone without MFP interposition indicate success rates in the order of 74 % [22], and usage of MFP in this group had allowed us to successfully close all 5 urethras from the vagina.

In 12 women with resistant urethral stricture, we utilised a ventral onlay BMG technique—with MFP interposition to provide vascular and physical support. All are currently dry, and 11 are stricture-free. This technique has previously been used successfully in 2 patients [23] and may avoid the recurrent stricturing seen with vaginal mucosal flap repairs as women become post-menopausal [24].

There was high patient acceptability—with 79 % of patients rating the final cosmetic appearance as good or excellent and only 1 (0.6 %) rating it as unsatisfactory. There was minimal morbidity associated with the fat pad harvest with 2 haematomas and 1 significant labial wound infection requiring re-admission and re-intervention. There is a lack of data regarding patient assessment of appearance, but Petrou et al. [25] documented outcomes in 8 patients only with a 12.5 % poor outcome rating. In this study, permanently decreased sensation or numbness at the harvest site was reported in 62.5 %, which may have been related to suprameatal transvaginal urethrolysis which was performed in all of the patients concomitantly with the Martius flap procedure in that study. Of the 8 patients, only one woman (12.5 %) complained of dyspareunia and 3 (37.5 %) had intermittent discomfort in the harvest area 1 year after the operation [25].

This is one of the largest reported series of MFP uses and results in the literature to our knowledge to date. As there are no specific validated questionnaires available for this particular procedure, patient outcomes in terms of cosmesis were subjective. This latter issue should be addressed in the future by using patient-related outcome measures (PROMS) to more objectively document how the surgery impacts directly on the patient. Continued follow-up should answer questions such as the durability of success, both of the primary procedure and post-operative long-term outcome of the MFP harvest itself. As our experience with the MFP improves, it is not difficult to imagine increasingly novel uses for this versatile graft.

## Conclusions

In developed countries, the Martius fat pad is an extremely useful addition to the female urologists' armamentarium and should be made use of in the appropriate scenario. The complication rate of harvest is very low and the cosmetic outcome excellent.

project development, data collection and data analysis and wrote and edited the manuscript.

**Compliance with ethical standards**

**Conflict of interest** The authors declare that they have no conflict of interest.

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