

CHAPTER 8

PROBLEMS WITH VAGINAL CLOSURE AND FLAPS IN FISTULA SURGERY

Section 8.1: Flaps to close the vagina during fistula repair
Section 8.2: Managing vaginal stenosis
Section 8.3: To improve healing of the fistula: Martius flap
Section 8.4: To improve healing of the fistula: Gracilis flap

(8.1) FLAPS TO CLOSE THE VAGINA DURING FISTULA REPAIR

Not uncommonly, there is a problem obtaining sufficient vaginal skin to reform the vaginal wall if the fistula is large (> 3 cm) or there is a lot of scarring. There are a number of ways to overcome this problem:

- For large defects > 2 cm size: the Singapore flap is the best.
- For smaller defects < 2 cm size: the Labial flap is useful.

SINGAPORE FLAP

The Singapore flap has the great advantage of causing minimal or no disfiguration. It can be used for cover of the anterior, lateral or posterior vagina, or for all if necessary, by taking a flap from each side.

The blood supply is based on the posterior labial artery as it branches from the internal pudendal artery. To maintain the blood supply, the flap is based inferiorly just medial to the ischial tuberosity. To preserve the blood supply:

- (1) Cut down directly through the fascia at a width that corresponds to the maximum skin width. This width has to be maintained at the base of the flap. It is important not to undermine the skin. Elevate the flap in the subfascial plane since the blood supply runs just above the fascia.
- (2) The fascia and deep fat are left intact at the base of the flap (level with the posterior introitus) with the skin and superficial fat cut only to a depth of 1 cm.
- (3) You can cut laterally at the base of the flap to free the fascia as long as you do not go centrally and disturb the blood supply.

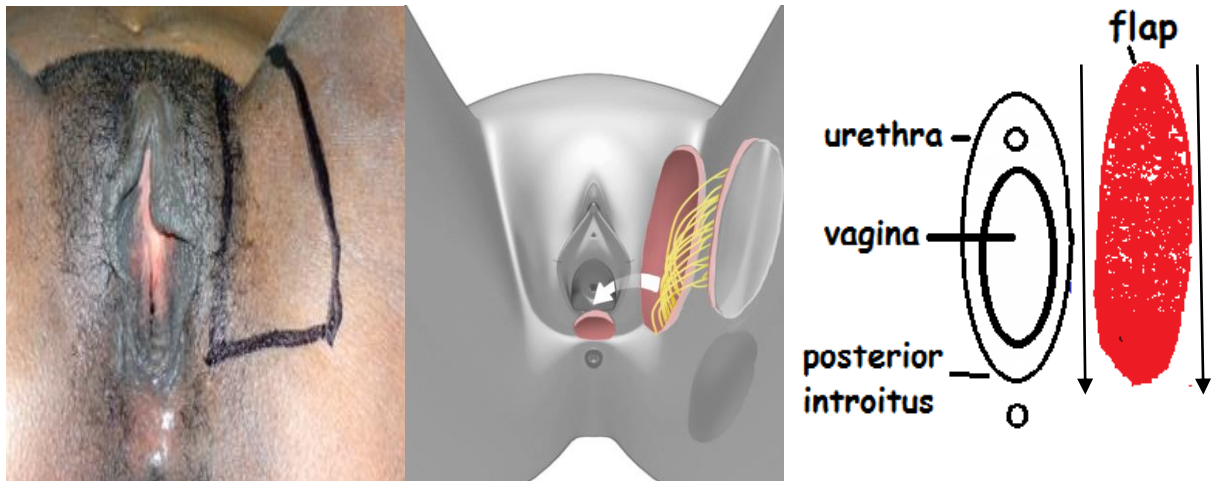


Fig. 8.1a1: Shows the flap area outline before the procedure.


Fig. 8.1a2: Shows how the flap will be swung (white arrow) into the vagina under the skin bridge of the labia.

Fig. 8.1a3: The incisions through the fat and fascia (arrows) come all the way down to the level of the posterior introitus without undermining the skin.

Dimensions: The size will vary according to the size of the defect.

- The *width* can vary depending on the size of the defect e.g. 3-6 cm.
- Adequate *length* is critical to pass through the tunnel and reach the other side. It is better to have the flap too long than too short. The typical *length* is 10-15 cm. One way of estimating the length of the graft is to measure from the base of the graft site (just medial to ischial tuberosity) to the most distal place in the vagina where the graft will have to reach. This can be done using a piece of gauze. Then add 1-2 cm to this estimate.

Diluted adrenaline can be injected along the line of the intended incision if cautery is not available.

	<p>It is better not to have too much flexion of the hip with the patient in the lithotomy position while marking out the flap area as otherwise the landmarks may be distorted and it is more difficult to extend the flap above the level of the adductor longus tendon.</p>
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(1) **INCISION FOR THE FLAP:** Outline the area to be cut with a pen or dye.

- **Medial border** is just lateral to the labia majora at the labio-crural fold to avoid the hair-bearing skin. However, some hair is usually included.
- **Lateral border** will vary depending on the width taken.
- **Upper margin** should extend to 2-3 cm above the adductor longus tendon. A good rule would be to keep the flap wide until you reach the adductor longus tendon and then taper the incision to an oval near the apex.
- **Lower margin** (base) is usually in line with the posterior introitus. Do not cut below this to avoid disturbing the blood supply.

Cut the skin, fat and then continue down to include the deep fascia of the underlying muscle. To complete the incision (see Fig. 8.1a2), the lower (inferior) skin margin is cut but only to a depth of 1 cm into the fat. This is to preserve the blood supply entering the deep surface of the flap. In cases where there is an episiotomy, the lower skin margin may be left intact (see Fig. 8.2c + d).

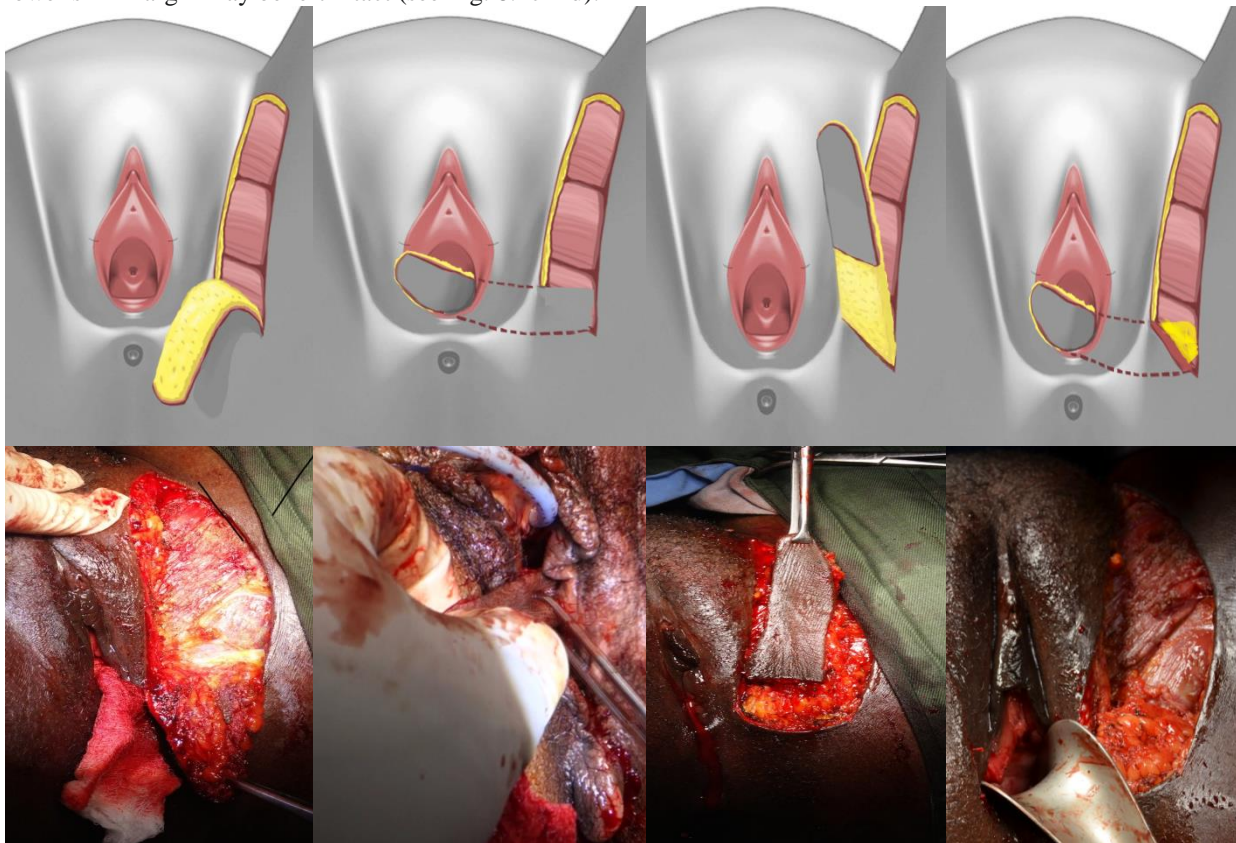


Fig. 8.1b: Shows the flap taken with the underlying fascia. You must see the underlying muscle exposed.

Fig. 8.1c: The flap is swung into the vagina. The point where it enters the vagina is marked on the skin with the Allis forceps.

Fig. 8.1d: Shows the flap with the lower skin excised.

Fig. 8.1e: The flap has been swung back into the vagina so that only the fat and pedicle are visible in the lower end of the donor site.

(2) **MOBILIZATION OF THE FLAP:** (Fig. 8.1b)

- Starting proximally, deepen the skin incision and cut the deep fascia so that you can see the underlying muscle. Cut down perpendicular on either side and avoid undermining the skin (see Fig. 8.1a3) to avoid

cutting the blood supply. Continue until the lower end is reached on both sides. Both the skin and the deep fascia are cut to the base of the flap on both sides.

- The skin at the base (inferior) of the flap is then undermined for several centimetres to improve mobilization and allow for donor site closure. Do this inferiorly and a bit at the sides as well.

Optional: To keep the skin and the fascia together, either apply a single absorbable stitch to the apex of the flap between the skin and the fascia or place an Allis forceps on the apex of both the subcutaneous tissue and the fascia.



Fig. 8.1f: Shows the donor site with the muscle exposed in the upper 2/3rds while the pedicle (fat and fascia) is seen in the lower 1/3rd.

Fig 8.1g: Shows the flap covering a defect in the vagina over the urethra and distal bladder.

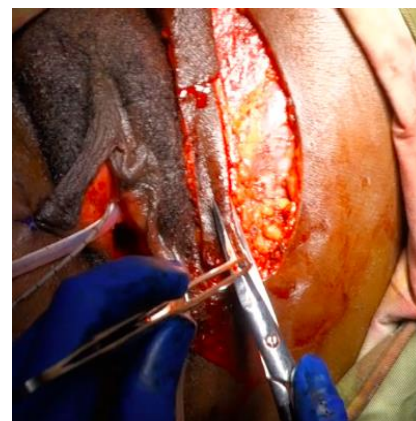
Fig. 8.1h: This is the same case as in Fig. 8.1f+g one week post-operatively showing a good cosmetic result.

Fig. 8.1i: In this case, the flap is used to cover a posterior defect in the vagina and perineum in a patient with a very stenosed vagina following the repair of a 4th degree perineal tear.

(3) TUNNEL FOR FLAP INTO VAGINA: (Fig. 8.1a2 and Fig. 8.1c) After mobilization, pull the flap into the vagina through a tunnel in the same way as the Martius flap. Make a tunnel subcutaneously under the labia majora and above the inferior pubic ramus initially with scissors or cautery. By staying close to the bone, you usually get less bleeding. Dissect the tunnel from both the vaginal and labial aspects. The size of the tunnel will vary with the size of the flap but a good rule is that the tunnel should allow the passage of two fingers. You may stretch the tunnel so there is no tension on the flap although it is better to sharply dissect the tunnel so that the flap goes through easily. There should be room for one finger to be inserted alongside the flap to allow for any swelling which will take place. There should be no tension either pulling the flap in or when suturing it in place.

Any excess skin is removed from either the vaginal or perineal side. With the flap pulled into the tunnel/ vagina, from the vaginal aspect mark on the skin where the flap exits the tunnel. Then pull the flap back into the groin and make a transverse incision at this mark. Then excise the skin superficially below this mark to remove the epidermis in the area that will be buried in the tunnel. This can be done using a knife or scissors as in Fig. 8.2a.

Fig. 8.2a: Shows the skin at the lower end of the flap being excised with scissors. The left hand is holding pickups/ dissecting forceps to steady the skin which is excised in strips longitudinally. Then any bleeders on the bare surface are cauterized.



! Top Tip! The flap should swing in easily. It should be more of a pushing motion from the outside rather than a pulling one from the inside to avoid injury to the flap. If the flap fails to come in easily, either (a) cut the fascia more on the lateral edge of the donor site or (b) undermine the skin more at the lower end.

! Tip! It is a good idea to inject adrenaline in the tunnel area to avoid bleeding which can be a problem in this vascular area.

Note: It is not usually necessary or a good idea to trim the fat of the flap as this could interfere with the blood supply. The only fat that could be trimmed would be the apical 2-3 cm as this would not interfere with the blood supply.

(4) **FIXATION OF THE FLAP IN VAGINA:** (Fig. 8.1g)

- Before the flap is pulled into the vagina, it is a good idea to place four separate sutures in the proximal and distal corners. These will be used to fix the flap.
- After being pulled through the tunnel, the flap must rotate sideways to reach the opposite side. By keeping the flap attached to its base, it can be rotated 90 degrees without compromising the blood supply.
- Fix the flap on the far side first. Pass the four sutures through the flap. Then fill in the gaps in between.
- A combination of continuous and interrupted sutures is used.

(5) **CLOSURE OF FLAP DONOR SITE:**



Because the defect is often large, taking the leg out of the stirrups and adducting the hip allows the skin edges to come together more easily. This makes closure much easier.

Overcoming discrepancy: The lateral edge of the wound is longer than the medial side. If you do not take this into consideration during closure, you will end up with too much skin (“dog’s ear”) on the lateral side. To overcome this problem, align the centre of each side of the wound by marking with a towel clamp (Fig. 8.2b). Then remove the towel clamp and place the first few deep sutures in the middle of the wound as previously marked. This is to align the middle of the lateral incision with the middle of the medial one. Then work from each end allowing the discrepancy to be distributed along the way and worked toward the middle.

Fig. 8.2b: Shows a towel clip being used to help align the closure. Note the presence of a drain.

The donor site is closed in three layers ie. fascia, deep dermis, subcuticular. Even in the thin patients, aim for this.

(a) *the fascial layer:* Close the deep fascia on the medial side to the superficial (Scarpa’s) fascia laterally. This places all the tension of the closure on the deep pelvic fascia which is very strong. At the lower end of the wound, it is not possible to access the deep fascia on the medial side, so suture the superficial fascia to the superficial fascia with interrupted sutures. *Note:* It is not possible to close the deep fascia to the deep fascia as the defect is too large.

(b) *Superficial layers:*

- a deep dermal layer: placing the sutures in the deep portion of the dermis will hold the tension and approximate the skin edges better. Aim to include some of the white layer of the dermis.
- a skin or subcuticular layer. However, if the closure seems tight (usually after taking a wide flap) or there is amononical dermatitis present, it may be wise to use interrupted external sutures with permanent 3-0 nylon or prolene, which can be removed after 2 weeks. This should give a stronger closure.

Drain: As there is a high risk of haematoma or seroma, a drain is inserted just above the muscle layer. It exits through the upper or lower end of the incision. It may be brought out either at one end of the wound or (preferably) through a separate stab incision. If standard drains are not available, a drain can be made from the sterile tubing of a urine bag. Another option is to use a straight plastic catheter as used for intermittent catheterization.

POST-OPERATIVE CARE:

Make sure to have the patient keep her legs in adduction to minimize tension on the closure during the healing period. Keep her on bed rest until Day 2 to avoid any pulling on the flap site. Ambulation is then allowed. She should not sit for 5 days to avoid any pressure on the blood supply which is close to the ischial tuberosity.

- *If the flap necroses or breaks down:* This may be due to (a) Poor blood supply (b) Tension (c) Infection. It can be partial or total. The treatment is to debride any dead tissue and irrigate the vagina with saline twice daily as there is often a profuse discharge.
- *If the flap retracts:* If you notice post-operatively that flaps are retracting back to the vaginal side-wall on the side from which they were taken, this indicates some tension. Make the flaps longer so they reach further and do not have to be pulled too much i.e. the tip should go 2-3 cm above the adductor longus tendon. When you harvest a flap with the fascia it should survive all the way to the tip.
- If utilizing a previous flap in a repeat operation, as long as you keep about 50% of it attached, the flap can be mobilized and brought back in over the repair.

If a flap is performed in the presence of an episiotomy:

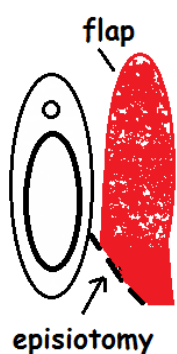


Fig. 8.2c: Shows the flap in relation to the episiotomy.

There are two important points in this situation:

- The episiotomy should form the lower medial border of the flap.
- Do not make the transverse incision across the lower end of the flap i.e. keep the lower end intact. Swing the flap directly into the vagina without tunneling it. Cosmetically this is not as neat compared to the tunneled flap but it is more practical in this situation.



Fig. 8.2d: Shows the flap mobilized with the lower end intact and about to be swung into the vagina through the gap created by the episiotomy.

SINGAPORE SLING



This is utilizing the fascia of the flap as a sling for stress incontinence. The Singapore flap is taken in the usual way with the skin, fat and fascia. Two sutures are applied to the fascia (Fig. 8.2e) and these are then fixed to the rectus sheath suprapubically on one or both sides.

- *Far suture:* This is placed near the apex of the flap which will reach to the opposite side.
- *Near suture:* A second (optional) suture is placed on the near side.

Fig. 8.2e: Shows two Prolene sutures inserted through the fascia of the flap. The far suture is on the right side of the photograph.

The far suture is the most important for adjusting the tension. In fact, the sling probably works just as well with this suture alone. The bladder may be filled with 100 ml of fluid and the suture is tied tight enough to stop any leakage. Both of these sutures are then pulled up with a Stamey needle through the rectus sheath on either side of the midline in the same way as for a rectus sling. They are not tied yet. The skin of the flap is first sutured to the vagina before the sling sutures are tied.

Note: While it is possible to take a skin flap (previously known as an Island flap) without including the deep fascia, it is better to take this for two reasons: (1) It is easier to get the graft to swing into the vagina. (2) Necrosis of the graft is less likely as the axial blood supply is better preserved for the entire length of the flap.

LABIAL FLAP

This flap is used to cover the anterior vagina but is only suitable for small defects (up to 2 cm). Two incisions are required (Fig. 8.2f):

- A horizontal incision is made either as an extension of one of the lateral incisions (made during dissection of the fistula) or of any episiotomy.
- A vertical incision is made in the groove just lateral to the labia majora (labia-crural fold) from the level of the urethral opening and continued down to meet the horizontal incision.

The grey area (the antero-lateral skin of the vagina and labia) shown between these incisions is then undermined and mobilized so that it can be swung medially to cover the anterior vagina. This results in:

- The pink vaginal skin (b in Fig. 8.2f) being rotated to end at point b'. This is sutured in place first.
- The pigmented labial skin (a in Fig. 8.2f) being rotated medially to end up at point a' on the left side of the vagina.

The incisions are closed usually without any difficulty or need for any further undermining at this stage.

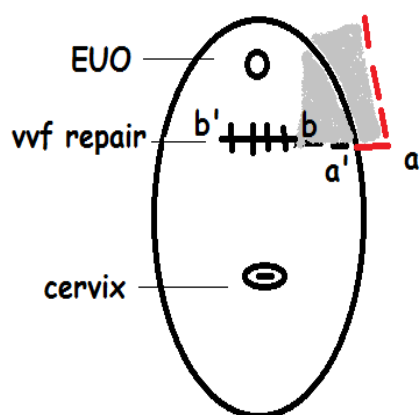


Fig. 8.2f: Labial Flap: This shows the two incisions with the grey area which will be mobilized.



Fig. 8.2g: Shows a vagina being re-formed with bilateral Singapore flaps which are being joined in the midline. The initial suturing is performed outside the vagina as in this photograph.

(8.2) MANAGING VAGINAL STENOSIS

During or following a VVF repair, the vagina may be so scarred that it is very short and narrow or almost closed. Usually, length is the main problem limiting coitus.

Open the vagina: Irrespective of which method is used, the vagina has to be opened up first. Make a transverse incision (3-4 cm wide) into the scar at the vault/proximal vagina, after identifying the urethra/bladder with a metal catheter in place, and the rectum with a dilator or your finger in the rectum. Dissect up high and remove as much scar at the vault as possible. Identify any cervix.

To keep the vagina open: there are several options:

- (1) **Bilateral Singapore flaps:** Two large Singapore flaps can be sutured together to create a complete neovagina. The flaps are sutured to each other along an anterior and a posterior suture line while still outside (Fig. 8.2g). Once the neovagina has been mostly created externally, then it is turned in on itself (inverted) and secured to the apex of the vagina.
- (2) **Bowel:** Use large bowel (sigmoid) as a neo-vagina. The danger of any surgery involving the lower colon is a 10-20% risk of a leak from the anastomosis.
- (3) **Kees Neovagina:** Dr Kees has described a novel technique where the vagina is enlarged by opening the pelvic peritoneum. If this is kept open, the peritoneal lining forming the upper neovagina is transformed into normal vaginal skin within three months. The following is based on his description of the operation.

KEES NEOVAGINA METHOD

- (A) **Incision:** Bilateral episiotomies; transverse incision in 'vaginal vault'. If the cervix is present, this will be a posterior colpotomy. Then by sharp and blunt dissection, tunnel up to the parietal peritoneum. The bladder

or rectum may be injured during this step. Widen the colpotomy out to the ischial spines in order to prevent stricture of the neovagina. *Complications:* If the bladder or the rectum are traumatized, they are repaired immediately and then covered by the thick posterior colpotomy peritoneum.

- (B) **To form the lower part of the neovagina:** Join the vagina to the peritoneum: (Interrupted Vicryl sutures are preferably used for all suturing.)
- *Anterior:* If the cervix is present, suture the anterior peritoneum from the cervix onto what is left of the anterior vaginal wall. (With repositioning of the cervix into the neovagina, patients can become pregnant.)
 - *Posterior:* The posterior peritoneum is sutured onto the posterior vaginal wall.
 - *Lateral:* Suture peritoneum into the deepest point of bilateral episiotomy/ widened colpotomy to prevent re-stenosis and for a broad neovagina.
- (C) **To form the vault of the neovagina:** Either with interrupted sutures or a separate continuous suture started laterally on each side, work from laterally to apically:
- *Laterally:* Identify the uterus and suture from:
 - (a) the posterolateral uterine peritoneum (serosa) 1-2 cm above the lower part of the uterus onto
 - (b) the posterolateral pelvis wall peritoneum about 2-3 cm from the cervix. If the uterosacral ligament is clearly identifiable, it can be stitched onto this although often it is not so clear.
 This closes the space between the uterus (up to) and the lateral pelvic wall. The ureter should not be at risk here since it is at a superior level within the parametrium above the ischial spine.
 - *Apically:* Suture the posterior uterine peritoneum (serosa) at 1-2 cm proximally from isthmus (inferior part of the uterus just above where it joins the cervix) onto anterior rectum serosa at 12-14 cm from anus.

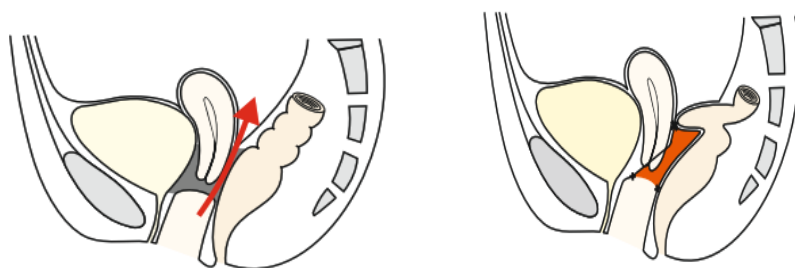



Fig. 8.3: Shows where the colpotomy is made and the plane of dissection. Fig. 8.4: Shows the completed neovagina. Diagrams courtesy of Kees Waaldijk from obstetric trauma surgery art and science: Kees neovagina reconstruction (2017).

Tip! It is a good idea to use this method at the time of (mid and high) RVF repair as there is no danger of creating a new fistula.

Post-operatively: The vagina is packed deeply with a Vaseline pack for 4-5 days. Leave in Foley catheter for 2 days. The vagina is re-packed every 4-5 days up to day 25 to keep it open during the healing process. From then, vaginal dilators can be used to keep the vagina open until intercourse starts 5-6 weeks after surgery. A dilator is passed twice a day and left in for ten minutes. Compliance is very important especially during the initial 5 weeks.

In congenital Mayer-Rokitansky-Küster-Hauser (MRKH) syndrome (where there is usually a very short vagina and absent cervix/ uterus), a similar procedure can be performed. In this case, to form the apex, the posterior bladder peritoneum is used instead of the uterine peritoneum. No episiotomies are required. It works well in this condition because there is no scarring.

	Vaginal stenosis is a difficult problem to solve and none of the surgeries is easy. It is much easier to deal with it at the initial fistula repair. If managed later, there is a high risk of opening the bladder or the rectum.
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Acquired stenosis (non-fistula): In some cases after childbirth or other trauma, the vagina has become hidden but can be opened up easily once you find it. These patients are usually menstruating normally. Look carefully before making any incision. It often helps to do a rectal examination and look for any air, blood or mucus coming out from the vagina. Once found, it is easy to pass a probe into the area and dilate it up. Remember that the vagina is closer to the urethral opening than to the rectum. In some patients, the stenosis recurs and it may be easier to place a Singapore flap laterally after incising the vagina.

(8.3) TO IMPROVE HEALING OF THE FISTULA: MARTIUS FLAP

This is a fibro-fatty flap (5-6 cm long and 2-3 cm wide) which is normally taken from the labia majora on one side. The flap is performed after the fistula repair and before closing the vagina. The purpose of a Martius flap is:

- To plug minor defects in the suture line and bring fresh blood supply to the area.
- To keep the healing bladder and vaginal walls apart.
- To fill any dead space lateral to the repair in the hope of stopping lateral scarring out towards the bones thereby reducing the risk of stress incontinence.

This procedure was commonly performed for most fistula repairs in the past i.e. those that were within reach of the graft. However, it is now only performed where the tissues are poor or there has been a failed repair before. It is especially used for fistulas involving the urethra (urethro-vaginal) and in these cases may be combined with a pubo-coccygeal sling.

Preparation for the flap

- Check that there are no bleeding areas in the vagina before performing the flap.
- Insert 2-3 stay sutures (mainly on the side opposite the graft) that will be used to hold the flap in place later (Fig 8.6). These are inserted but the ends are left long on a clip. These are inserted into the fascia between the bladder and cervix/ vagina. Hold the fascia that you want with an Allis forceps as you insert the stitch.

CAUTION! Make sure you identify the cervix before you pull the Martius flap through as the flap may cover over it later. It is a good idea to put a stay suture just above the cervix.

(Step 1) Incision: The operating table can be made level and the Auvard speculum is removed to avoid stretching the area of the flap site.

- Incise the medial aspect of the labia majora for 6 cm between two Allis forceps from above the level of the clitoris to mid-vagina (dotted line in Fig. 8.4). A longer graft can be made with an 8–10 cm long vertical incision from the level of the mons pubis to the level of the fourchette.
- The incision should be made in the bulk of the labia majora. The initial incision is deepened so that you go through Scarpa's fascia. Dissect between Scarpa's fascia and the fat pad to create a flap. Once the incision is made, move the Allis forceps to either side of the incision (Fig. 8.5 and 8.6).

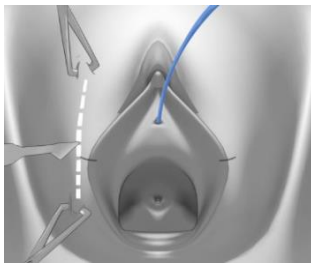


Fig. 8.4: Shows the line of incision for the Martius flap.

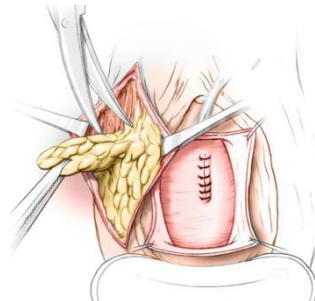


Fig. 8.5: Shows the flap being dissected out.

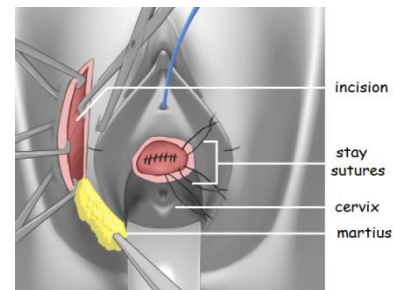


Fig. 8.6: Shows the stay sutures inserted to fix the Martius flap in the fascia on the opposite side.

(Step 2) Dissecting out the flap: The aim is to obtain a 2 cm wide fat flap. With scissors, separate the underlying fat from the skin taking care not to button-hole the skin. Place your finger behind the skin so that you can feel how close you are to the skin. Avoid being too close to the skin. The fibro-fatty tissue of the labia is dissected free from the underlying adductor fascia.

- It is important not to divide the graft until it has been determined that the length that has been developed is adequate. Measure using a piece of drain or gauze to see that it will reach from the upper graft to the vagina.
- The upper part of the flap is freed by cutting between two artery forceps and tying. Then hold the upper part of the flap with forceps (as shown in Fig. 8.6) to make the dissection easier. Dissect around the flap so that a pedicle is formed at the lower end. Alternatively, the pedicle can be formed at the upper end as in Fig. 8.7 b+c.
- Most bleeding occurs on the medial side as you dissect. Avoid cutting the lower medial part, as this will cause unnecessary bleeding. This part will be pulled through into the vagina anyway so dissection is unnecessary and contains the blood supply to the flap that you want to remain intact.

- Before pulling the flap through into the vagina, check that all bleeding is stopped from the flap donor site and the graft itself. Cautery can be used for haemostasis.

CAUTION! Good mobilization is important to prevent excessive tension and subsequent necrosis of the flap. Make sure the base of the flap is wide so that it retains a good blood supply (from the pudendal artery branches).

(Step 3) Pulling the flap through into the vagina: The flap is brought into the vagina via a tunnel under the labial and vaginal skin:

- Reinsert the Auvard speculum into the vagina.
- Using scissors or a curved artery forceps, make a tunnel from the donor site to the vagina. Keep the scissors closely against the bony surface of the inferior pubic ramus. However, stay lateral enough to avoid the bladder/ urethra repair.
- The tunnel is enlarged by opening and closing the scissors in several directions. The tunnel should be wide enough to eventually admit two fingers. Too narrow an opening may strangulate the flap.
- While the scissors are still open, pass an artery forceps from the vagina along the scissors and pull the flap through (Fig. 8.7a).

The flap is then fixed to the sutures previously inserted (Fig. 8.6). Use a free needle to pass both ends of the suture through the flap from posterior to anterior and tie the two ends together.

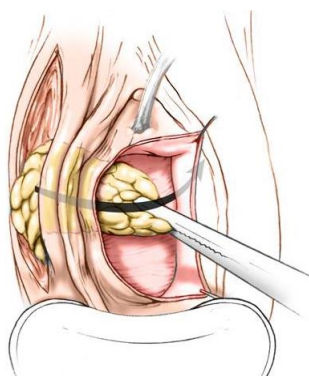


Fig. 8.7a: The flap is being pulled into the vagina to cover the repaired bladder. (Courtesy of Grace Chen)

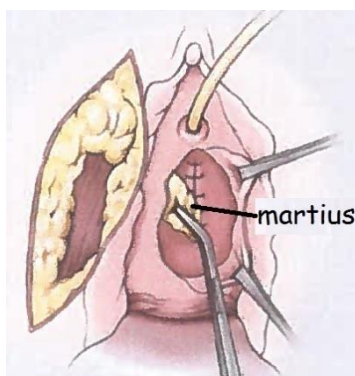


Fig. 8.7b: In this case, the flap with the pedicle is based superiorly/ anteriorly which gives a better approach for urethral fistulas.



Fig. 8.7c: With adequate dissection, a large flap can be obtained in most cases.

(Step 4) Closure of the flap donor site: This is usually done after the vagina has been closed. Do a continuous suture to close the deep layer. Start at the top (leaving the short end on a clip) and continue down. Then going more superficially, go back up to the top and tie. The skin can be closed with simple interrupted stitches or a subcuticular stitch.

(8.4) TO IMPROVE HEALING OF THE FISTULA: GRACILIS FLAP


Because muscle is so vascular, it tends to become adherent to any surrounding tissues and supply all the factors necessary for good wound healing. It is this property that makes it such a good intermediate layer.

Indications for Gracilis flap

RVF: (a) RVF after radiotherapy. In post-radiation fistulas, wait one year before attempting repair. However, all fistulas post-radiation have a very high failure rate so it may be simpler to leave the patient with a colostomy rather than attempt repair. If you are repairing, then a Gracilis flap greatly increases the chance of healing. (b) On several occasions, I have used it successfully for obstetric RVFs which were very scarred due to multiple previous repairs, and I felt that this was the last chance for healing. In a review of the use of a Gracilis flap in RVFs (all etiologies including obstetrical), it is suggested that it be considered as one of the first-line treatment options for recurrent RVF.

Reference: *Gracilis muscle interposition for recto-vaginal and ano-vagina fistula repair: A systematic literature review: A. Hotouras et al; Colorectal disease Volume 17, Issue 2, 1 February 2015, Pages 104-110.*

VVF: (i) Post-radiotherapy causes. (ii) It can be used in any difficult (scarred) or recurrent cases of obstetric VVFs or to support a neo-urethra especially if you think the chances of healing are small. (iii) If during a VVF repair, there are repeated positive dye tests, then consider a Gracilis flap.

	<p>Before performing the flap, there must be sutures placed to fix the flap. Either (a) During the fistula repair, make sure each angle suture is left long with both ends on an artery forceps. (b) If these have already been cut, place several stay stitches on both sides near the angles and in the midline. It is much more difficult to place sutures to fix the flap after harvesting the flap, as the position of the patient will often have changed.</p>
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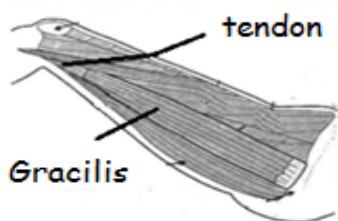


Fig. 8.8: The Gracilis muscle is long and thin. The Gracilis tendon is distinctively long and inserted on the medial tibial condyle.

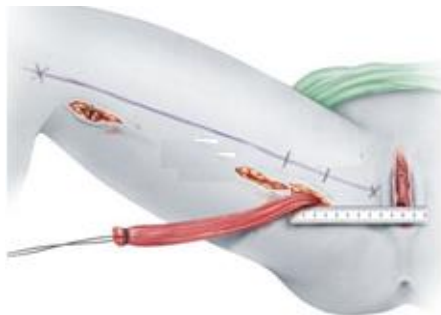


Fig. 8.9: Shows the line of incisions. In this case, traction with your fingers around the proximal muscle will help identify the more distal tendon before it is cut.

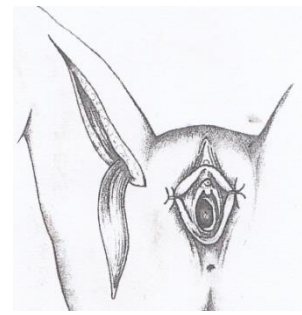


Fig. 8.10a: Alternatively, one long incision can be made. This is a simpler option but more morbid.

ANATOMY/ BLOOD SUPPLY

- The Gracilis muscle lies along the line between the pubic tubercle and the medial tibial condyle. It lies just posterior to the adductor longus muscle. An incision is made two finger-breadths posterior and parallel to the very palpable adductor longus tendon.
 - First mark out the line between the pubic tubercle and the medial tibial condyle which indicates the adductor longus muscle.
 - Then mark out a line made two finger-breadths posterior and parallel to this line (Fig. 8.9) which will be the line of the incision over the Gracilis muscle.



While the muscle can be harvested in the lithotomy position, you should reduce the flexion of the hip so the thigh is lower. This makes it easier to mark the muscle more accurately. Otherwise, you may end up too posteriorly.

- The main blood supply of the Gracilis enters the proximal third of the muscle from underneath the (antero-medial) adductor longus and then runs on its posterior aspect. This pedicle is about 8 to 10 cm from the pubic tubercle. The vessel is quite small although when clearly identified it can be seen pulsating. Bright yellow fat should alert you to the proximity of the vessels as you mobilize along the antero-medial border of the muscle. The obturator nerve to the muscle is also nearby so if this is stimulated by cautery (i.e. muscle contracts), this should also alert you to the proximity of the pedicle. Either:
 - (a) You can mobilize the muscle proximally until you identify the vessel. This has the advantage of allowing more mobilization of the muscle proximally. The fatty tissue is carefully teased apart by spreading with an artery forceps or scissors. If you do not find the vessels and you are already within 6-8 cm of the pubis, you can stop as you do not need more mobilization and the risk of injuring the vessels is high.
 - (b) You may avoid mobilizing the muscle (especially antero-medially) in the proximal 10 cm. This is safer if you are not confident in identifying the vessel.

(1) INCISIONS

Single-incision technique: This is much simpler to do but is not as good cosmetically. Make an incision in the lower two-thirds of the inner thigh starting 8 cm distal to the pubic tubercle (Fig. 8.10). The muscle is mobilized from distal to proximal after the tendon end is divided in the lower thigh. If you do not go sufficiently

distally, you may end up with a flap that is too short. However, there is no point mobilizing beyond where the muscle becomes a tendon. With the tendon transected, the muscle is freed up by blunt dissection.

Two-incision technique (see Fig. 8.9, 8.10b+c)

- *First (proximal) incision:* Incise 8 cm distal to the pubic bone for about 6 cm. This exposes the muscle. Mobilize the muscle all around by sharp and blunt dissection. Confirm that it is the Gracilis by the two tendon test:
 - Pulling up the muscle (Fig. 8.10b) and checking that the tendon of the adductor longus does not tighten.
 - Feel distally near the knee to see if the (distal) Gracilis tendon tightens. If it does not, you may have the adductor longus or another muscle.

Second (distal) incision: This is about 4 cm proximal to the knee. By pulling on the muscle proximally (Fig. 8.10b), feel distally for the tendon tightening. From the first incision, pass a long clamp on top of the muscle and make a small incision (about 4 cm) over the tendon. Find the tendon and place a drain around it. Free the tendon bluntly.

- From the distal part of the first incision, the muscle is freed up all around distally by a combination of blunt and sharp dissection. This requires the use of 1-2 retractors to lift the skin. Then look inside the incisions (headlight useful here) and cut any attachments. There are a few small pedicles which come from the adductor longus so look for these antero-medially. While a lot of mobilization can be performed bluntly, it is important not to rip or tear the tissues to avoid bleeding.
- Through the second incision, free the muscle proximally as much as you can. The muscle has to be completely free before you cut the tendon and pull the muscle through from the second to the first incision.
- By keeping some of the tendon on the lower end of the muscle, it is easier for the stitches to hold in tendon compared to muscle.

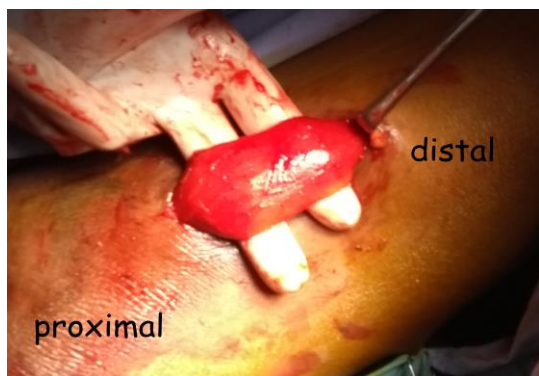


Fig. 8.10b: Shows the Gracilis muscle being pulled up through a proximal incision.



Fig. 8.10c: Shows the two incisions in the right thigh made to harvest the muscle flap.



Fig. 8.11a: Shows a single Deaver retractor (arrows x 2) being used to form the tunnel.

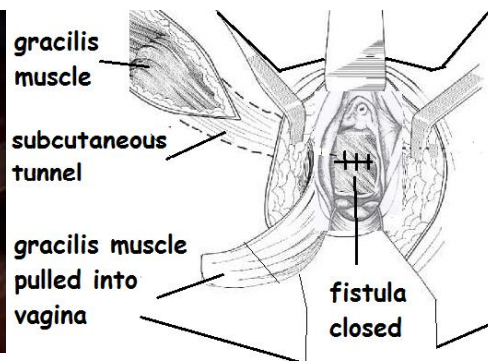


Fig. 8.11b: Shows the muscle being pulled through a subcutaneous tunnel and ready to be fixed into the vagina.



(2) TUNNEL FOR MUSCLE INTO THE VAGINA

- Make a subcutaneous tunnel from the medial end of the incision in the thigh to the vagina. You can start at either end and meet in the middle. Initially this is made by inserting a large clamp or a narrow Deaver retractor but eventually you should be able to get two fingers into the tunnel so there is no tension on the flap. You often have to cut bands of fascia with cautery to enlarge the tunnel.
- The muscle is pulled through this tunnel into the vagina (Fig. 8.11b). It should pass easily. If you find there is tension on the flap when it is in the vagina, the options are:
 - Mobilize the anterior border of the muscle proximally until you see the vascular pedicle. The (proximal) skin incision should be down to this level. Also mobilize the posterior border of the muscle.
 - Adduct the leg by removing it from the stirrups.

(3) FIXATION OF MUSCLE IN THE VAGINA

- Before pulling the muscle into the vagina, it is a good idea to place four stay sutures in the vagina i.e. in the four corners. These are usually placed in tissue between the bladder and the vagina.
- Fix the part of the graft closer to the thigh first (place two sutures first without tying and then tie both).
- Then fix the free end of the muscle to the opposite side of the vagina.
- If there is excess muscle, it can be cut off.

(4) CLOSURE OF INCISIONS: The thigh incision is closed:

- (a) A deep layer of deep fascia to deep fascia.
- (b) Deep dermis: this catches some of the white layer and holds the sutures (fat does not). It approximates the skin.
- (c) Skin layer.


- As it is a pretty dry dissection and you close all the layers, you could probably get away without a drain.
- Put a pressure bandage around the thigh, which can be removed the following day. The dressing should be changed on Day 1 if soaked. Otherwise, it can be kept on until Day 2.


Postoperative Care: The patient may have bed rest on Day 1 and be mobilized from Day 2.

Combined Gracilis and Singapore flap

- If a Gracilis and a Singapore flap are performed during the same operation, they should be done on the same side. This is because only one tunnel is required although it may have to be enlarged for the Singapore flap.
- It is a good idea to harvest the Singapore flap first as this is more difficult to do if you have already taken the Gracilis. It is important to leave at least a 3 cm bridge of skin between the Singapore donor site and the (proximal) Gracilis incision.
- It is time-consuming to do both flaps. If your main concern is the healing of the fistula, then do a Gracilis flap. If you do not get skin cover over the Gracilis flap, as long as you have good apposition of the muscle over the fistula repair site, this should not affect the fistula repair. Then cover the muscle with Vaseline gauze and pack the vagina.

Free skin graft: Another option would be to cover the exposed muscle with either a split (from the thigh) or full-thickness skin graft (from the lower abdomen). A split-thickness will take easier but has a little more risk of contracture. For full-thickness graft, the key is to get it thin enough so that all the fat is removed. Suture the graft to the muscle and then pack the vagina for five days. When you remove the pack, do it carefully under vision so as not to disrupt the graft.

 **Tip!** One option in cases where the fistula repair has already taken a long time or there has been significant blood loss is to stage the procedures over two days. The vagina can be packed at the end of the fistula repair. Blood can be transfused overnight if necessary. The patient is then returned to the operating room early the next day to place any flaps.

 **Tip!** If you have a lateral fistula which you need to cover with a Gracilis flap, it is a good idea to take it from the side opposite to the fistula. This is because it is easier to place the tendon end of the muscle over the fistula as it can be fitted in easily. If you take it from the same side as the fistula, it is difficult to get it into the corner.

 **Summary
of use of flaps in
fistula surgery**

- *Poor vagina + fistula* = Singapore flap. A Singapore flap should help with healing of the fistula as well as providing skin cover.
- *Good vagina + fistula with poor tissues* = Gracilis, Martius or Pubococcygeus flap. If you place a good size patch of muscle over any fistula repair, it will usually heal.
- *Poor vagina + poor fistula* = Do both Gracilis and Singapore flaps.