Filling pelvic gaps with muscular flaps: CT and MR imaging appearances and complications of myocutaneous flap reconstructions of the pelvic floor following perineal excision

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Filling pelvic gaps with muscular flaps: CT and MR imaging appearances and complications of myocutaneous flap reconstructions of the pelvic floor following perineal excision


Fig.

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

1. To discuss the indications for myocutaneous flap reconstruction of the pelvic floor.
2. To describe the surgical techniques involved in the commonest types of myocutaneous flaps used to reconstruct the pelvic floor.
3. To demonstrate the normal imaging features of myocutaneous flap reconstructions on post-operative CT and MR imaging.
4. To demonstrate the imaging features of complications arising at the flap graft and donor sites.
Background

Radical pelvi-perineal resections are performed for locally advanced rectal and anal carcinomas and for advanced gynaecological cancers. In the case of locally advanced rectal adenocarcinomas, neoadjuvant chemoradiotherapy followed by surgical resection has now become the treatment of choice, with studies showing reduced local recurrence rates with this approach [1].

Surgical resection for lower third rectal tumours has traditionally consisted of abdominoperineal excision (APE), involving en-bloc resection of the ano-rectum and posterior vaginal wall with the aim of complete tumour excision and negative resection margins. This procedure may be combined with vaginectomy, sacrectomy or exenteration of pelvic organs. However, APE leaves a large cavity, with the inherent complications and high morbidity of direct wound closure due to tension on the wound and post-operative collections filling the pelvic dead space [2].

The use of pre-operative radiotherapy exacerbates the problems of wound healing in primary closure of the perineum and is associated with an increase in the rates of perineal wound complications. These include chronic non-healing wounds, haemorrhage, collections or abscesses, perineal sinus or fistulation and herniation of pelvic contents through the perineum.

Strategies to reduce this considerable morbidity include the use of myocutaneous or fasciocutaneous flaps to reconstruct the pelvic floor and perineum. This is best performed immediately following APE, during the same surgical procedure. The benefits of using a myocutaneous flap in conjunction with APE are many:

- Firstly they provide tissue bulk to obliterate the dead space formed in the pelvis by the surgical excision. This serves to reduce the frequency of post-operative collections forming, and also separates the abdominal and pelvic cavities. Thus small bowel can be kept out the pelvis, safely away from the post-operative radiotherapy field (if subsequent radiotherapy is indicated), and reducing the incidence of radiation enteritis. The flap also provides a barrier to herniation of pelvic contents through the perineal defect.

- The flap brings with it well perfused tissue, which has not been irradiated pre-operatively. This serves to re-vascularise the irradiated pelvic side wall and perineal tissues, thus reducing the incidence of delayed healing or wound breakdown.
• Fresh skin can be transposed from the donor site and used to fill the perineal skin defect, or to reconstruct the vagina and vulva after partial or total vaginectomy/vulvectomy.

**Types of flap reconstruction of the pelvic floor:**

There are a variety of flaps that have been described for this purpose, with the vertical rectus abdominis myocutaneous (VRAM) and gracilis myocutaneous flap being the best described techniques. Other techniques include the inferior gluteal artery perforator (IGAP) fasciocutaneous flap, posterior thigh myocutaneous flap, split gluteus maximus myocutaneous flap, and flaps utilising other thigh muscles [3].

Our institution has considerable surgical expertise with the VRAM, gracilis, and IGAP flaps, comprising of a series of 60 patients [4]. This educational exhibit will present a description of these procedures with the normal post-operative findings on CT and MR imaging. We also present a review of the imaging findings of surgical complications at the donor and graft insertion sites.

**Imaging findings OR Procedure details**

**The vertical rectus abdominis myocutaneous (VRAM) flap**

*Anatomy:*

The VRAM flap is comprised of either of the paired rectus abdominis muscles of the anterior abdominal wall and the overlying subcutaneous fat and skin. The primary blood supply to this flap is derived from the deep inferior epigastric artery (from the external iliac artery). There is an additional supply from the superficial inferior epigastric artery, thus the flap is very well perfused. *(Figure 1)*
**Fig.**: 3D anatomical model showing the right rectus abdominis (RA) muscle (anterior fascia excised), and the left deep inferior epigastric artery (IEgA) with the left rectus abdominis excised.

**References:** Primal Pictures

The flap is well suited to perineal reconstruction because of all the flaps available, it delivers the largest volume of well vascularised tissue into the pelvis. It has a reliable and versatile skin paddle that can be utilised for perineal defect cover or for vaginal reconstruction - indeed it was initially developed for this purpose. Skin paddle size can be up to 25 x 11 cm, and can be orientated vertically, transversely or obliquely [5,6].

Only a unilateral VRAM flap is usually required for perineal reconstruction (compared to gracilis and IGAP flaps where bilateral flaps are often needed to provide sufficient tissue). The flap donor incision is incorporated into the APE abdominal wound, and can be closed primarily, removing the need for a second incision or skin grafts.

One problem with the VRAM flap is morbidity from abdominal wall herniation through the defect in the rectus sheath.
Surgical technique:

The donor site in APE is usually the right rectus abdominis muscle, as a left sided colostomy is performed; however if a right sided ileostomy is necessary or there is previous scarring on this side, then the left rectus abdominis muscle can be used instead. (Figure 2)

**Fig.**: VRAM surgical technique. A: Vertical skin paddle incision B: Elevation of rectus abdominis flap C: Transposition of VRAM flap to fill perineal defect D: Closure of incisions and formation of left colostomy


The abdominoperineal excision is performed first and then the construction of the flap can go ahead. The skin paddle and underlying island of anterior rectus sheath is incised,
and the muscle is detached from the lower costal margin, dividing the superior epigastric vessels in the process.

The muscle is elevated from the posterior rectus sheath, which is left intact, apart from a transverse incision inferiorly. The muscle flap is then delivered posteriorly into the pelvic cavity through this incision in the fascia, rotating on the pubic insertion (Figure 3). The skin paddle is brought to the perineal defect by twisting the flap medially 180 degrees, and the skin is cut to the required size. The excess skin paddle is de-epithelialised which serves to provide well vascularised tissue to the pelvic side wall and supports healing [7].

Fig.: Schematic of VRAM flap in position

Normal imaging appearances:
Of the three flaps described, the VRAM flap is the most easily recognisable on CT and MR imaging. This is partly because both the donor site and graft locations lie within the scope of follow up investigations performed to examine for local or distant recurrence, and also because of the tissue volume of the graft and the size of the vascular pedicle.

The donor site can be recognised by the absence of the ipsilateral rectus abdominis muscle compared to the contralateral remaining muscle (Figure 4). A contralateral stoma is invariably present. Coronal imaging will demonstrate the absent rectus muscle along its length (Figure 5).

Fig.: Normal VRAM flap donor site appearances. Axial CT images.

References: J. S. Rabouhans; Department of Radiology, Guy’s & St Thomas’ Hospitals, London, UNITED KINGDOM
The flap is seen as a band of soft tissue density extending posterio-inferiorly from the pubic tubercle, passing across the dome of the bladder and posterior to the uterus (in females). *(Figure 6)* This is the muscle component and contrast administration will opacify the accompanying inferior epigastric artery pedicle on the deep (now lateral) muscle surface. Medial to the muscle component there is fat density within the pelvis and perineum, which is the subcutaneous anterior abdominal wall fat. The findings are well demonstrated on axial/multi-planar MDCT *(Figures 7-8)* and on sagittal MR *(Figures 9-10).*
**Fig.** Normal VRAM flap appearances. Thick slab volume rendered MDCT image

**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
Fig.: Normal VRAM flap appearances. Sagittal thick slab volume rendered MDCT image

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
**Fig.**: Normal VRAM flap appearances. Multiplanar reformatted MDCT image

**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
**Fig.** Normal VRAM flap appearances. Sagittal T2w MR images.

**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
Initially post-operatively there is mild oedema of the flap and surrounding soft tissues, and some fluid in the pelvis. However on subsequent imaging there is resolution of these inflammatory appearances and the muscular component of the flap becomes atrophic (Figure 11). The persistence or appearance of new soft tissue density surrounding the flap should be investigated to exclude local disease recurrence or chronic infection such as perineal sinus (see below).
**Fig.**: VRAM flap maturation. A to D: Series of axial CT images showing serial maturation of a right VRAM Flap. Upper images demonstrate the muscle and vascular pedicle. Lower images demonstrate the muscle and fat components in the pelvic cavity. The muscular component is shown to atrophy over time, due to denervation.

**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

**The gracilis myocutaneous flap**

**Anatomy:**

The gracilis flap was the original workhorse flap for pelvic reconstruction before the development of the VRAM flap and is still utilised as it has the classic features of a favourable muscle flap; there is no functional loss in removing it from the medial thigh, it gives a considerable skin paddle (22 x 8 cm) but the donor site can be closed primarily with an inconspicuous scar. It has a consistent vascular pedicle on the anterior deep surface, 8-10 cm below the pubic tubercle, which is derived from a branch of the medial
femoral circumflex artery (from the profunda femoris artery) (Figure 12). The flap can be transferred with both an intact motor and sensory nerve supply [8].

As well as reconstructing the pelvic floor and perineum, it can be used for vaginal and anal sphincter reconstruction.

![Anatomy of the gracilis flap](image)

**Fig.**: Anatomy of the gracilis flap. A: 3D anatomical model of the medial femoral circumflex artery (MCFA, a branch of which supplies the gracilis muscle. B & C: Coronal and axial images showing normal position of the gracilis muscle.

**References:** Primal Pictures

**Surgical technique:**

The abdominoperineal excision is performed first and then the construction of the flap can go ahead. Bilateral gracilis flaps are usually required. The skin paddle is incised using only the proximal two thirds of the overlying skin, as the skin paddle reliability reduces as distance from the pedicle increases. The gracilis tendon is divided distally and the
flap is dissected proximally to the vascular pedicle. The flaps are rotated medially about their pedicles and tunnelled through perineal skin if required to fill the pelvic cavity and perineal defect. Excess skin is de-epithelialised as with the VRAM flap (Figure 13) [9].

![Gracilis flap: Surgical technique](image)

**Fig.**: Gracilis flap: Surgical technique. A: Incision over muscle. B: Transposition of flap into pelvic cavity. C: Closure of incisions.


**Normal imaging appearances:**

The gracilis flap can be difficult to detect on routine post-operative CT and MR imaging. The donor site in the medial thigh is not routinely included within follow-up abdominal and pelvic examinations but the absence of the gracilis muscle, and/or post-operative oedema at the donor site can be seen (Figure 14).
The gracilis muscle components can be seen passing superiorly and medially from the medial thigh into the perineum. If bilateral flaps were performed, one may pass anteriorly and the other posteriorly. The exact configuration is less consistent than with the VRAM flap, but subcutaneous fat is generally demonstrated surrounding the muscle component in the pelvis and perineum (*Figures 15-16*). The vascular pedicle is not usually as clearly depicted as with the VRAM flap due to its smaller calibre.
**Fig.**: Normal gracilis flap appearances. A & B: Axial/sagittal MR images. C: Axial CT image.

**References:** J. S. Rabouhans; Department of Radiology, Guy’s & St Thomas’ Hospitals, London, UNITED KINGDOM
The inferior gluteal artery perforator (IGAP) fasciocutaneous flap

Anatomy:

The IGAP fasciocutaneous flap is a more recent development and is based on the established inferior gluteal (or posterior thigh) myocutaneous flap. This has as its arterial supply the inferior gluteal artery (a terminal branch of the dorsal division of the internal iliac artery) (Figure 17). The posterior thigh flap has the disadvantage that the donor site is often included in the pre-operative radiation field, and the IGAP flap avoids this [10,11].

Like the other two flaps, the IGAP flap can also be used for vaginal reconstruction and to fill perineal defects.
**Fig.**: Anatomy of the IGAP flap. 3D anatomical model (right gluteus maximus muscle excised) showing the inferior gluteal artery and perforators which supply the IGAP flap.  
**References**: Primal Pictures

**Surgical technique**:  
Pre-operative imaging has been performed at one centre to map the positions of the inferior gluteal artery perforators, either with CT angiography or Doppler US, to aid in creation of a reliable skin paddle.

As with the other flaps, the APE is performed first and then the flaps are constructed; usually bilateral IGAP flaps are required. Skin paddles are incised on the buttock/posterior thigh, and the fascia containing the perforators is dissected from the underlying gluteus maximus muscle, or some muscle fibres can be included. The flaps are rotated medially about the perforator pedicle to fill the perineal defect (Figure 18) [12].
**Fig.** IGAP flap: Surgical technique. A: Pre-operative CT angiogram showing sites of perforators for the inferior gluteal artery (white arrows) and superior gluteal artery (black arrows). B: Perineal defect and IGAP skin flap design. C: IGAP flap raised. D: Closure of wounds.

**References:** Wagstaff et al, (2009) Microsurgery 29:626-9 [Ref 12]

**Normal imaging appearances:**

Like the gracilis flap it is difficult to detect the IGAP flap on post-operative CT and MR imaging, more so because there is not usually a significant muscular component. Defects in the gluteus maximus muscle may be observed (**Figure 19**). The fat of the flap is difficult to distinguish between the native fat of the buttock and ischio-rectal fossa. Also the axial images acquired are in the same plane of the donor site incision in the buttock, and it is therefore often only identified by a narrow plane of stranding in the subcutaneous fat. If there is surrounding fluid or gas from flap breakdown, the tissue planes around the flaps are much more readily identifiable (**Figure 20**), and see below.
**Fig.**: Normal IGAP flap appearances. Axial CT image.

**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
Complications of myocutaneous flap reconstructions of the pelvic floor:

There are complications which may arise that are specific to either the donor site or the graft site of the flaps.

**Donor site complications:**

- **Seroma.** Fluid can collect in the space once occupied by the muscle flap. Several cases of seroma formation occurred in our series in the rectus sheath after VRAM flap translocation *(Figure 21).*
Fig.: Seroma in VRAM donor site. Axial CT images from different patients.

**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

- **Wound breakdown.** This may occur if the excised flap area is too large to close, with increased tension on the wound edges. Alternatively wound infection, or post operative seroma/abscess can delay healing and cause wound break down (*Figure 22*).
**Fig.**: VRAM donor site wound breakdown & flap necrosis. Axial CT image.

**References**: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

- **Hernia.** Failure to provide support to the anterior abdominal wall after VRAM flap harvest, or tissue weakening from wound break down can result in hernia formation *(Figure 23).* By leaving the posterior rectus sheath intact and suturing the incised edges of the anterior rectus sheath this can be avoided. Para-stomal herniation may also occur *(Figure 24).*
Fig.: VRAM donor site incisional hernia. Axial CT images from two different patients.

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

**Graft site complications:**

- **Flap breakdown.** This may be total or partial. Total failure results from arterial or venous thrombosis, or poor arterial inflow due to excess traction or kinking of the pedicle. The flap becomes ischaemic and oedematous *(Figure 25)*, poor healing results and may lead to flap necrosis *(Figure 26)*, requiring debridement or flap revision.
Fig.: Early oedema & ischaemia of VRAM flap. Axial CT images from different patients showing various degrees of oedematous flap and peri-flap fluid.

References: J. S. Rabouhans; Department of Radiology, Guy’s & St Thomas' Hospitals, London, UNITED KINGDOM
Fig.: Gracilis and IGAP flap ischaemia and necrosis. Axial CT images. A: Total failure of left gracilis flap. B to D: Degrees of failure of IGAP flaps.

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

- Chronic perineal sinuses from necrotic flaps or non healing wounds may result (Figure 27). Pre-existing arterial disease may also result in poor perfusion of the graft. Partial failure may occur from fluid collection, infection, or venous insufficiency. The latter may result if venous collaterals are not included in the transposed pedicle. This will lead to venous engorgement of the graft, which can be successfully treated with leech therapy.
**Fig.** Chronic non-healing gracilis flap necrosis. Axial CT image.

**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

- **Collection.** Blood or fluid may initially collect in the pelvic/perineal dead space as a haematoma or seroma and become secondarily infected, or primary contamination of the operative site during colorectal resection and flap necrosis from ischaemia may result in abscess formation (*Figure 28*). Post operative drains are routinely placed to remove accumulated fluid.
Fig.: Collections around flap grafts. Axial CT images from different patients. A: Simple pelvic collection after VRAM flap. B: Perineal collection surrounding VRAM flap. C: Pelvic abscess from necrotic IGAP flap. D: Chronic pelvic seroma after 2 years.

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

- **Fistulae.** These may result from chronic poor wound healing, or breakdown of adjacent structures due to infection or iatrogenic injury. Entero-perineal (Figures 29-30) and entero-vaginal fistulae, and peritono-perineal sinuses (Figure 31-32) can occur. These may be treated conservatively or by surgical resection.
**Fig.**: Enteral-perineal-cutaneous fistula from necrotic IGAP flap. Axial CT image. Iatrogenic injury to the bowel occurred at flap debridement and revision.

*References:* J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
Fig.: Entero-perineal fistula around gracilis flap. A: Sagittal STIR MR B: Coronal STIR MR. The patient had recurrent rectal carcinoma which was excised and reconstructed with a left gracilis flap, but developed a fistula despite a healthy flap.

References: J. S. Rabouhans; Department of Radiology, Guy’s & St Thomas' Hospitals, London, UNITED KINGDOM
**Fig.:** Development of soft tissue around graft: cause? A: Early post op axial CT image shows pre-sacral fluid. One year later there is abnormal soft tissue around the flap seen on axial CT (B & C), coronal CT (D) and axial MR (E). Inflammatory change or local recurrence?

**References:** J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
Fig.: Soft tissue around graft: Peritono-perineal sinus. Same patient as previous image. A to C: sequential sagittal MR images from midline to lateral. Axial (D & E), and coronal (F) MR images. Fluid is seen collecting around the flap and within a sinus tract to the perineum (white arrows).

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

Recurrent disease:

On initial post-operative CT or MR examinations it may be difficult to determine between normal post-operative changes, flap maturation and recurrent disease, but for subsequent examinations, comparisons with previous imaging will be of benefit.

Locally recurrent disease should be suspected by the appearance of new soft tissue, persistent soft tissue, or increase in size of soft tissue in the surgical bed on follow up imaging. A review area should always be the pre-sacral space (Figure 33) and pelvic side walls (Figures 34-35) as these are common sites of local recurrence and persistent soft tissue density in this area should be considered suspicious for disease recurrence and not interpreted as post-surgical change.
**Fig.**: Soft tissue around IGAP: sacral osteomyelitis. Axial CT images. Same patient as in figure 29 with entero-perineal fistula. Soft tissue inflammatory mass in pre-sacral space may represent local recurrence, but actually was sacral osteomyelitis.

**References**: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
Fig.: Local disease recurrence with VRAM flaps. Axial CT images. Pelvic side wall recurrence after right VRAM flap is resulting in small bowel obstruction.

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM
Fig.: Disease recurrence around a gracilis flap. Axial MR image.

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

Depending on the time period since surgery $^{18}$FDG PET-CT may be of benefit in determining between metabolically active disease recurrence and post operative fibrosis.

The presence of a disease positive resection margin greatly increases the probability of developing disease recurrence, so extra attention should be made to review the appearances of the surgical bed and flap in these patients.

Images for this section:
Fig. 1: 3D anatomical model showing the right rectus abdominis (RA) muscle (anterior fascia excised), and the left deep inferior epigastric artery (IEgA) with the left rectus abdominis excised.
**Fig. 2:** VRAM surgical technique. A: Vertical skin paddle incision B: Elevation of rectus abdominis flap C: Transposition of VRAM flap to fill perineal defect D: Closure of incisions and formation of left colostomy
Fig. 3: Schematic of VRAM flap in position
Fig. 4: Normal VRAM flap donor site appearances. Axial CT images.
**Fig. 5:** Normal VRAM flap donor site appearances. Coronal CT image.
Fig. 6: Normal VRAM flap appearances. Thick slab volume rendered MDCT image
Fig. 7: Normal VRAM flap appearances. Sagittal thick slab volume rendered MDCT image
Fig. 8: Normal VRAM flap appearances. Multiplanar reformatted MDCT image
Fig. 9: Normal VRAM flap appearances. Sagittal T2w MR images.
Fig. 10: Normal VRAM flap appearances. Sagittal T2w MR images with schematic diagram.
**Fig. 11:** VRAM flap maturation. A to D: Series of axial CT images showing serial maturation of a right VRAM Flap. Upper images demonstrate the muscle and vascular pedicle. Lower images demonstrate the muscle and fat components in the pelvic cavity. The muscular component is shown to atrophy over time, due to denervation.
**Fig. 12**: Anatomy of the gracilis flap. A: 3D anatomical model of the medial femoral circumflex artery (MCFA, a branch of which supplies the gracilis muscle. B & C: Coronal and axial images showing normal position of the gracilis muscle.
Fig. 13: Gracilis flap: Surgical technique. A: Incision over muscle. B: Transposition of flap into pelvic cavity. C: Closure of incisions.
Fig. 14: Normal gracilis flap donor site appearances. A & B: Axial/coronal CT images. C: Axial STIR MR image
**Fig. 15:** Normal gracilis flap appearances. A & B: Axial/sagittal MR images. C: Axial CT image.
Fig. 16: Normal gracilis flap appearances. A to D: Anterior to posterior coronal MR images of bilateral gracilis flaps.
Fig. 17: Anatomy of the IGAP flap. 3D anatomical model (right gluteus maximus muscle excised) showing the inferior gluteal artery and perforators which supply the IGAP flap.
**Fig. 18:** IGAP flap: Surgical technique. A: Pre-operative CT angiogram showing sites of perforators for the inferior gluteal artery (white arrows) and superior gluteal artery (black arrows). B: Perineal defect and IGAP skin flap design. C: IGAP flap raised. D: Closure of wounds.
Fig. 19: Normal IGAP flap appearances. Axial CT image.
**Fig. 20:** IGAP tissue planes shown by surrounding gas. Axial CT image.
**Fig. 21:** Seroma in VRAM donor site. Axial CT images from different patients.
Fig. 22: VRAM donor site wound breakdown & flap necrosis. Axial CT image.
Fig. 23: VRAM donor site incisional hernia. Axial CT images from two different patients.
Fig. 24: VRAM para-stoma hernia & donor site seroma. Axial CT image.
Fig. 25: Early oedema & ischaemia of VRAM flap. Axial CT images from different patients showing various degrees of oedematous flap and peri-flap fluid.
Fig. 26: Gracilis and IGAP flap ischaemia and necrosis. Axial CT images. A: Total failure of left gracilis flap. B to D: Degrees of failure of IGAP flaps.
Fig. 27: Chronic non-healing gracilis flap necrosis. Axial CT image.
**Fig. 28:** Collections around flap grafts. Axial CT images from different patients. A: Simple pelvic collection after VRAM flap. B: Perineal collection surrounding VRAM flap. C: Pelvic abscess from necrotic IGAP flap. D: Chronic pelvic seroma after 2 years.
**Fig. 29:** Enteral-perineal-cutaneous fistula from necrotic IGAP flap. Axial CT image. Iatrogenic injury to the bowel occurred at flap debridement and revision.
**Fig. 30:** Entero-perineal fistula around gracilis flap. A: Sagittal STIR MR B: Coronal STIR MR. The patient had recurrent rectal carcinoma which was excised and reconstructed with a left gracilis flap, but developed a fistula despite a healthy flap.
Fig. 31: Development of soft tissue around graft: cause? A: Early post op axial CT image shows pre-sacral fluid. One year later there is abnormal soft tissue around the flap seen on axial CT (B & C), coronal CT (D) and axial MR (E). Inflammatory change or local recurrence?
Fig. 32: Soft tissue around graft: Peritono-perineal sinus. Same patient as previous image. A to C: sequential sagittal MR images from midline to lateral. Axial (D & E), and coronal (F) MR images. Fluid is seen collecting around the flap and within a sinus tract to the perineum (white arrows).
Fig. 33: Soft tissue around IGAP: sacral osteomyelitis. Axial CT images. Same patient as in figure 29 with entero-perineal fistula. Soft tissue inflammatory mass in pre-sacral space may represent local recurrence, but actually was sacral osteomyelitis.
Fig. 34: Local disease recurrence with VRAM flaps. Axial CT images. Pelvic side wall recurrence after right VRAM flap is resulting in small bowel obstruction.
Fig. 35: Disease recurrence around a gracilis flap. Axial MR image.
Conclusion

There are several myocutaneous flaps used for pelvic floor reconstruction that have characteristic appearances on post-operative CT and MR imaging. The radiologist should be aware of normal post-operative anatomy and imaging appearances of such flaps. Radiological review of the perineum should be routinely performed to facilitate detection of flap related complications and recurrent disease.

Personal Information

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Fig.: View of Big Ben from St Thomas' Hospital gardens

References: J. S. Rabouhans; Department of Radiology, Guy's & St Thomas' Hospitals, London, UNITED KINGDOM

Images for this section:
Fig. 1: View of Big Ben from St Thomas’ Hospital gardens
References


