



# The gluteal fold flap: A versatile option for perineal reconstruction following anorectal cancer resection

N.M. Pantelides<sup>a</sup>, R.J. Davies<sup>b</sup>, N.S. Fearnhead<sup>b</sup>, C.M. Malata<sup>a,\*</sup>

<sup>a</sup> Department of Plastic and Reconstructive Surgery, Addenbrooke's Hospital, Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK

<sup>b</sup> Cambridge Colorectal Unit, Addenbrooke's Hospital, Cambridge University Hospitals NHS Foundation Trust, Cambridge, UK

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Anal cancer

**Summary** *Introduction:* Gluteal fold flaps (GFFs) have been extensively reported for vulvo-vaginal reconstruction but there are no published series of their use for perineal reconstruction following anorectal cancer excision. In this context, abdominal myocutaneous flaps remain the method of choice but may be unavailable because of pre-existing abdominal scars, or need for a colostomy/urostomy. In addition, their abdominal wall morbidity makes them less acceptable, especially given the increasing use of laparoscopic techniques for the extirpative surgery. We document our experience using GFFs following radical anorectal cancer excision.

*Methods:* Data were collected from a single surgeon's consecutive cases performed over a five-year period (October 2007–May 2012). The indication, surgical procedure, complications and follow-up were recorded, as was the incidence of neoadjuvant/adjuvant therapy.

*Results:* Ten gluteal fold fasciocutaneous flaps were performed in seven patients at the time of radical anorectal excision. The GFFs were performed alone (unilateral  $n = 3$ , bilateral  $n = 3$ ) or in combination with a contralateral anterolateral thigh (ALT) myocutaneous flap ( $n = 1$ ). The indications for anorectal excision were rectal adenocarcinoma ( $n = 3$ ), anal squamous cell carcinoma ( $n = 3$ ) and anal adenocarcinoma ( $n = 1$ ).

All flaps survived completely although two patients required further surgery, one for evacuation of a late donor site haematoma and another to close a small, persistent wound dehiscence. The mean follow-up period was 24 months (range 2–57).

*Conclusions:* The GFF is a reliable, versatile and robust option for perineal reconstruction after extended anorectal excision, despite local irradiation, and should be considered for medium and selected large defects in this context.

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\* Corresponding author. Tel.: +44 1223 586672; fax: +44 1223 257177.

E-mail addresses: [cmalata@hotmail.com](mailto:cmalata@hotmail.com), [charles.malata@addenbrookes.nhs.uk](mailto:charles.malata@addenbrookes.nhs.uk) (C.M. Malata).

## Introduction

Perineal defects following rectal and anal disease present a significant reconstructive challenge. They occur most commonly following abdominoperineal excision of the rectum (APER) or pelvic exenteration (PE) but may also arise after surgical management for congenital, traumatic or chronic inflammatory conditions.

Where a perineal defect remains following APER or PE, a wide variety of flaps have been described, predominantly using abdominal, pudendal, gluteal and thigh donor sites. Of these, abdominal myocutaneous flaps, such as the vertical rectus abdominis myocutaneous (VRAM) flap, are most commonly used and are widely reported in the literature.<sup>1–4</sup>

However, recent technical advancements have enabled a reduction in abdominal morbidity from both the resection and the reconstruction. The advent of total muscle-preserving (abdominal) flap harvest techniques, and the increasing use of laparoscopic APER has drastically reduced the abdominal wall sequelae. As a consequence, the standard use of a pedicled VRAM flap following APER or PE has been called into question, since the associated morbidity at the donor site is deemed less acceptable.<sup>4</sup> Surgeons are therefore required to consider different reconstructive strategies, using alternative donor sites.

The perineum itself receives a rich blood supply and represents a versatile donor for local perforator flaps. The gluteal fold flap (GFF), first described by Yii and Niranjani in

**Table 1** Summary of patients.

| Patient | Age | Sex | Pre-operative |       | Indication                      | Procedure   | Post-operative | Complications/<br>Outcomes  | Post-op<br>stay (days) |
|---------|-----|-----|---------------|-------|---------------------------------|---|----------------|---|------------------------|
|         |     |     | RT            | Chemo |                                 |   | RT             |   |                        |
| 1       | 64  | M   | N             | N     | Recurrent rectal adenocarcinoma | APER and posterior pelvic exenteration with right gluteal fold flap                             | N              | Debridement of perineal wound dehiscence and V-Y flap advancement (2 months post-operatively)   | 18                     |
| 2       | 38  | F   | N             | Y     | Recurrent anal SCC              | Wider perineal excision (previous salvage APER), coccygectomy with bilateral gluteal fold flaps | N              | Further local recurrence requiring excision of flaps, anterior vagina, urethra and bladder and bilateral gracilis myocutaneous flaps  | 7                      |
| 3       | 66  | M   | Y             | Y     | Recurrent anal SCC              | Salvage APER with right gluteal fold flap   | N              | Nil   | 18                     |
| 4       | 59  | F   | Y             | Y     | Anal SCC                        | Posterior pelvic exenteration with a left pedicled ALT flap and right gluteal fold flap         | Y              | Evacuation of haematoma at GFF donor site (16 days post-operatively)<br>Infected ALT donor site seroma (1 month post-operatively)<br>Post-operative DVT requiring anticoagulation | 25                     |
| 5       | 77  | M   | Y             | Y     | Anal adenocarcinoma             | APER with right gluteal fold flap   | N              | Nil   | 12                     |
| 6       | 46  | F   | Y             | Y     | Rectal adenocarcinoma           | Extralevator APER with bilateral gluteal fold flaps   | N              | Nil   | 13                     |
| 7       | 62  | F   | Y             | Y     | Rectal adenocarcinoma           | APER and posterior vaginectomy with bilateral gluteal fold flaps                                | N              | Nil   | 12                     |



**Figure 1** a. Intra-operative sequence, showing perineal reconstruction with a right GFF measuring 5 cm in width (Patient 3- 66 year-old male.). **Top** — Perineal defect following salvage APER for recurrent anal SCC, with bilateral flap design. Note that there is a relatively large skin deficit relative to the depth of the cavity. **Middle** — A right-sided GFF was raised and transposed into the defect anti-clockwise. The proximal part of the flap was de-epithelialised. **Bottom** — The flap was tacked in place at the start of flap inset to allow donor site closure. Two suction drains, one for the donor site and the other for the perineal defect are shown in situ. b. Patient 3. Appearance pre-operatively (**left**) and at 3 months post-operatively (**right**), showing the location of the donor site in the right gluteal fold with minimal distortion of the right buttock. The donor site scar deviates inferiorly from the gluteal fold laterally due to dog-ear excision.

1996,<sup>5</sup> is a pedicled fasciocutaneous flap based on perforators from the internal pudendal artery. Its use in vulval and vaginal reconstruction following tumour excision has been extensively described in the literature<sup>6,7</sup> but reports of its use following anorectal resection for malignancy are sparse.<sup>8–10</sup> This may reflect uncertainty about the residual blood supply following extensive pelvic dissection, or the volume of tissue that it can contribute to fill dead space in the pelvis.

The UK Department of Health-mandated centralisation of colorectal cancer services<sup>11</sup> and the involvement of plastic surgeons within the multi-disciplinary teams (MDTs), mean that plastic surgeons are being increasingly called upon to reconstruct perineal defects arising from anorectal tumour resection. This article presents our initial experience at a tertiary University Hospital cancer referral centre using the GFF in this context.

## Patients and methods

Ten GFFs were performed in seven patients for perineal reconstruction following resection of an anorectal malignancy. All reconstructions were performed by a single plastic surgeon (CMM) between October 2007 and May 2012. The extirpative surgery was carried out by specialist oncological colorectal surgeons (RJD and NSF).

The indications for anorectal excision were rectal adenocarcinoma ( $n = 3$ ), anal squamous cell carcinoma (SCC) ( $n = 3$ ), and anal adenocarcinoma ( $n = 1$ ). The tumour was recurrent in three of the seven cases. Three patients underwent unilateral GFF reconstruction whereas in three patients, bilateral GFF were used. In one case, a GFF was combined with a contralateral anterolateral thigh (ALT) flap.

Prior to surgery, five of the seven patients received combined neoadjuvant chemoradiation and one patient had neoadjuvant chemotherapy alone, having received radiotherapy to the perineum 3 years earlier. Post-operatively, one patient underwent palliative radiotherapy to a rapid tumour recurrence in the groin.

A summary of the patient demographics, previous treatments, procedures and outcomes is presented in Table 1.

## Surgical technique

### Flap selection

The GFF was selected for patients in whom the resultant defect was anticipated to be moderate in size,<sup>12</sup> in patients who had multiple scars on their abdomen, and in those who refused to accept the distortion and subsequent umbilical malpositioning caused by an abdominal myocutaneous (VRAM) flap harvest. In addition, two patients had pre-existing abdominal stomas, thereby precluding ipsilateral rectus abdominis harvest.

### Flap marking

With the patient in the standing position, the gluteal fold was marked. The flap was outlined, centred on the gluteal fold, and extending for 3–4 cm on either side of it, depending on the "pinch" (to determine what width would allow the donor site to be closed directly) and ensuring that

it has adequate size to cover the anticipated perineal defect (Figure 1a – top). The patient was then put in the lithotomy position and the sites of the medial arterial perforators were identified using a hand-held Doppler probe in the region of the ischial tuberosity. The flap markings were subsequently revised at surgery if necessary.

### Flap harvest

The flap harvest position was dictated by the most ideal position for the resection. Beginning laterally, the flap was raised along subfascial plane (Figure 1a – middle) and the perforators entering its base were identified, often with intra-operative Doppler assistance, and carefully preserved. The deep fascia was carefully teased in order to allow adequate flap mobility. The flap was then transposed into the defect (Figure 1a – bottom), inset without tension, and the donor site was closed primarily. Where two GFFs were used, the flap with better perfusion was selected for cutaneous coverage, whilst the other was de-epithelialized and buried.

### Flap inset

The flap inset was to the pelvic wall fascia with 2/0 PDS sutures. Deep dermal sutures with 3/0 monocryl and interrupted 4/0 nylon sutures were used to secure the flap skin into the recipient site. Suction drains were used at both the donor and recipient sites.

**Table 2** Advantages and disadvantages of the gluteal fold flap.

#### Advantages/Indications

- Consistent vascular anatomy
- Reliable flap vascularity
- Ease of dissection
- Can be raised in the lithotomy or Lloyd Davies position, with the patient prone, or in the jack-knife position
- Tissue lies outside the field of radiotherapy
- Usually has enough bulk
- Can be raised simultaneously as bilateral GFFs, or combined with another flap as needed
- Length of flap is adequate for most perineal resections
- Acceptable donor site scar and gluteal contour
- No muscle dissection so minimal functional sequelae
- No possibility of damage to major nerves (particularly sciatic)
- Avoids an abdominal incision
- Abdominal muscles are preserved for colostomy ± urostomy where needed

#### Disadvantages/Limitations

- Limited width (8 cm maximum)
- May be unreliable in the obese
- May have inadequate bulk for larger defects, predisposing to pelvic collections/perineal herniation
- Occasionally damaged during radical PE or extended APER
- Increased operative time when compared with mesh insertion
- Patients asked not to sit on the flap for 3 weeks post-operatively



### Post-operative care

The patients were asked to lie on their side, and avoid sitting on the flap for 3 weeks, to prevent direct pressure and compression of the vascular pedicle. This can cause discomfort, particularly in bilateral cases, and patients should be counselled about this pre-operatively. Negative pressure was maintained at the donor site until there was satisfactory healing, to reduce the risk of haematoma formation.

### Results

The study population consisted of four females and three males, with a mean age of 59 years (range 38–77). The mean post-operative hospital stay was 15 days and the mean follow-up period was 24 months (range 2–57).

All the flaps survived completely and there were no partial or total flap failures. Post-operative complications occurred in two patients however, requiring further surgery. In Patient 4, a late haematoma developed at the GFF donor site on day 15, requiring evacuation on day 16. The same patient also developed an infected seroma of her ALT donor site, requiring aspiration and inpatient intravenous antibiotic treatment. In Patient 1, persistent poor wound healing at the junction between distal end of the flap and the previously irradiated tissue necessitated debridement and V-Y advancement of the GFF two months post-operatively. This was attributed to inadequate resection of the surrounding irradiated areas.

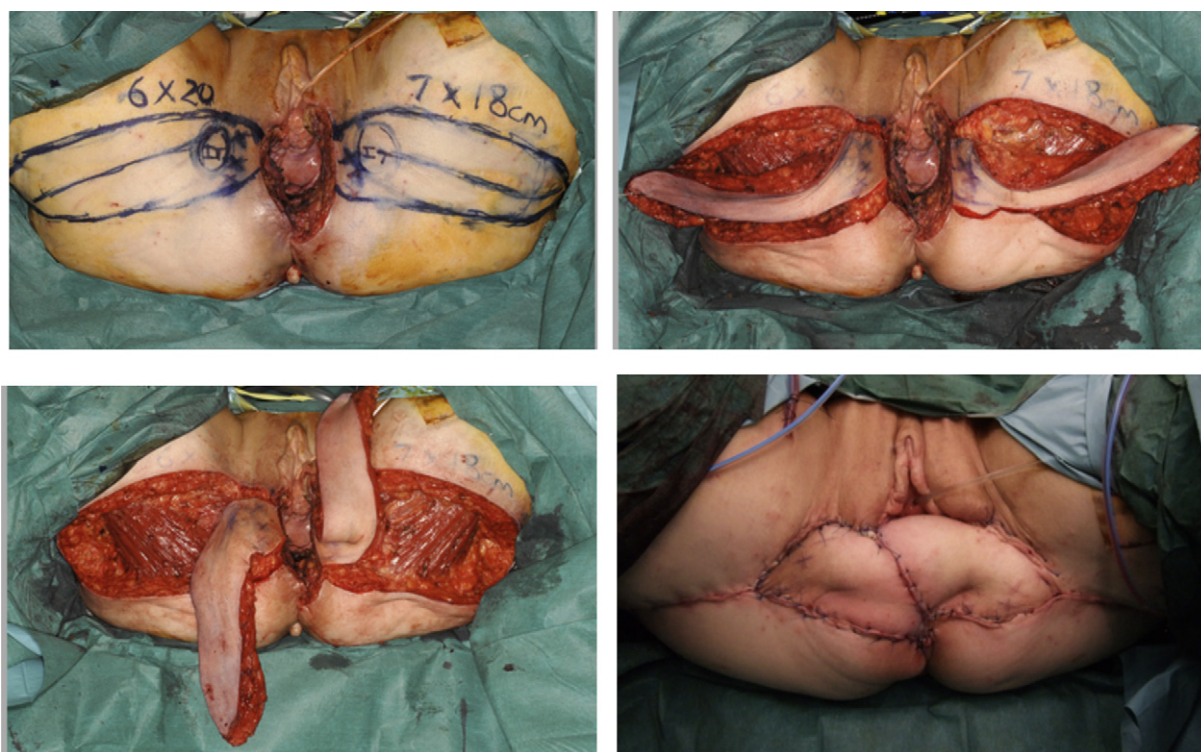
In one patient, tumour recurrence two years post-operatively culminated in further perineal excision, including the GFFs, and successful reconstruction with bilateral gracilis myocutaneous flaps (Patient 2 in Table 1). Despite all surgery being intended as curative, three patients who underwent tumour resection have subsequently died due to metastatic disease.

### Discussion

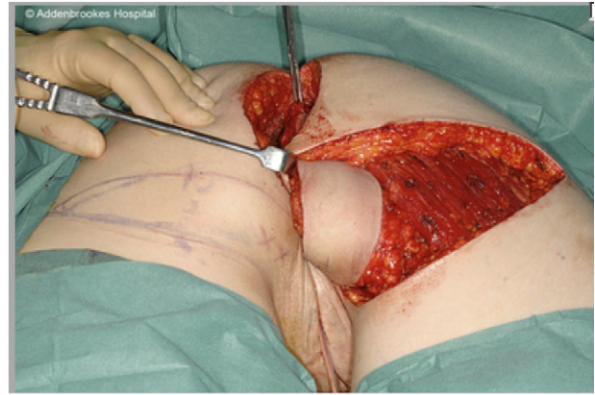
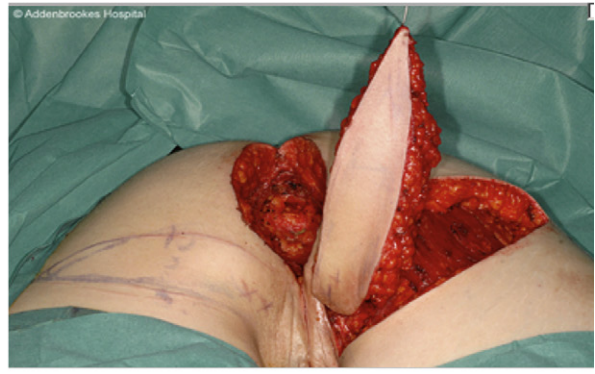
Abdominoperineal excision of the rectum (APER) remains the gold standard treatment for low rectal tumours,<sup>13</sup> and is also used as a salvage procedure for anal cancer. Recently, a more radical extra-levator abdominoperineal excision (ELAPE) technique has been described, which is thought to have superior oncological outcomes at the expense of a larger perineal/pelvic defect. In cases of local or recurrent pelvic malignancy, pelvic exenteration (PE) may be required.

In each case, primary closure of the perineal defect carries a significant risk of complications, such as infection, non-healing or secondary dehiscence.<sup>14</sup> Where this occurs, it causes substantial patient morbidity; in one study, where perineal dehiscence occurred following APER, the mean duration to healing was 278 days.<sup>15</sup>

Many factors co-exist that interfere with the healing process. Locally advanced and/or recurrent disease necessitates wide excision margins, creating large defects. Local tissues are often poor quality due to radiotherapy and previous surgery, whilst patients are often malnourished and



**Figure 2** Intra-operative sequence demonstrating the use of bilateral GFFs in perineal reconstruction (Patient 7 – 62 year-old female). **Top left** – bilateral GFFs were designed, with no skin bridges. Note the remnants of posterior vaginal mucosa in the centre of the photograph. **Top right** – flaps being raised during harvest. **Bottom left** – anti-clockwise transposition of both flaps; flap inset is facilitated by the absence of skin bridges/tunnels. **Bottom right** – appearance at the end of surgery.

**a****b**

**Figure 3** a. Intra-operative sequence showing flap harvest in the prone position to reconstruct a wider perineal excision and coccygectomy following salvage APER (Patient 2- 38 year-old female). Please note the skin bridges which can sometimes be left undivided. Care must be taken not to constrict the flap in the tunnel. b. Appearance 6 months post-operatively with excellent donor site scars and adequate bulk with bilateral GFFs. The bulk allowed her to function sexually.



may be immunocompromised as a result of chemotherapy. Flap reconstruction enables healthy, non-irradiated tissue to be brought into the defect and has been shown to reduce patient morbidity, when compared with primary closure.<sup>16,17</sup>

Following APER or PE, the vertical rectus abdominis myocutaneous (VRAM) flap has traditionally been the reconstructive method of choice.<sup>1–4</sup> Its major disadvantage is the abdominal sequelae, particularly hernias, parietal weakness, and distortion of the abdominal contour and umbilical position.

Recent advancements have led to the development of the laparoscopic APER, ELAPE and PE. The initial part of the procedure is performed laparoscopically, with patient supine, before the patient is turned prone for the perineal dissection. This obviates the need for the midline laparotomy incision so any abdominal morbidity resulting primarily from the reconstruction is less acceptable.

In 1996, Yui and Niranjan described a pattern of flaps based around the vaginal orifice, which resemble the petals of a lotus flower – the so-called “lotus petal flaps”.<sup>5</sup> They changed the orientation of the flap around the base according to reconstructive requirements, with the lowermost petal flap, designed around the gluteal fold on each side, being termed the “*gluteal fold flap*”. It is a fasciocutaneous flap based on 4–6 consistent perforators from the internal pudendal artery, arising near the midline of the perineum.

The flap has been extensively described in the literature for reconstruction following vulval and vaginal tumour resection.<sup>6,7</sup> However, its use in reconstructing other perineal defects is less well reported, although isolated case reports and small case series have alluded to the potential versatility of this technique. It has been used to cover defects following resection of stenosing anorectal scar tissue,<sup>18</sup> perianal Paget’s disease<sup>19</sup> and perineal hidradenitis suppurativa.<sup>20</sup> GFF’s have also been utilised in the repair of traumatic cloaca<sup>21</sup> and rectovaginal fistulae.<sup>22</sup> Noticeably, however, there is a scarcity in the literature regarding the

use of the GFF following APER or PE for anorectal malignancy, with no published series to date.

We believe that the GFF represents an excellent option for perineal reconstruction following anorectal excision (Table 2). It lies outside the field of pelvic or perineal radiotherapy and is robust, with a low rate of local complications. It has sufficient reach, and bilateral flaps are available if needed. The GFF can also be used when the abdominal muscles are not available due to previous operations, or when the rectus muscle is required for a colostomy, urostomy, or both.

Importantly, the flap can be raised with the patient in the lithotomy, Lloyd Davies or prone position (Figures 1a, 2, 3a), which avoids turning the patient intra-operatively. Where bilateral GFFs are required, both can be raised simultaneously, again minimising operative time.

Patients with anorectal cancer are increasingly diagnosed and treated at a younger age so body image and function are very important. The flap affords a good cosmetic result, since it utilises neighbouring tissue with similar appearance and texture (Figures 1b, 3b, 4). The scar from the donor site is hidden in the gluteal fold and concealed when the patient wears underwear. If bilateral flaps are used, the natal cleft can be re-created to improve the cosmetic outcome. In the long-term, patient mobility is not reduced, even in bilateral reconstruction.

Reluctance to use the GFF following anorectal resection may relate to concerns about the blood supply following extensive pelvic dissection. The flap is based on perforators from the internal pudendal artery, a terminal branch of the internal iliac artery. The internal iliac arteries are often ligated during PE (and occasionally during APER) and one might expect that this would compromise the arterial inflow. However, the region is supplied by a rich arterial anastomotic network and we did not experience a problem identifying perforating vessels in any of our cases and all of the flaps survived entirely.



**Figure 4** Appearances pre-operatively (left) and at 5 weeks post-operatively (right) following APER and right GFF reconstruction for anal adenocarcinoma (Patient 5 – 77 year-old male). The flap gives an excellent cosmetic result.

If there is a potential concern about flap perfusion (for example, in the elderly/obese) it is also possible to preserve part of the skin pedicle at the expense of a slightly reduced range of excursion and a dog ear (which can be excised as a secondary procedure).

A further potential concern is the volume of tissue that the GFF can contribute. Excision of the rectum in APER or PE creates a large volume of dead space in the pelvis and, in general, a unilateral GFF will be insufficient to fill such large defects. However, the flap can provide a considerable volume of subcutaneous tissue, particularly in patients who are not slim. Where substantial volume filling is required, bilateral GFFs can be used (Patients 2, 6, 7) or the reconstruction can be augmented by bringing omentum down into the pelvis or combining the GFF with a myocutaneous flap, such as the ALT flap (Patient 4).

Given the range of reconstructive options available following anorectal excision, algorithms have been proposed to simplify the decision making process. Our group recommends that a unilateral GFF should be used to reconstruct medium-sized cutaneous defects ( $<60\text{ cm}^2$ ) whereas for large defects ( $>60\text{ cm}^2$ ), or following a pelvic exenteration, a rectus abdominis myocutaneous flap is preferable to obliterate the dead-space created.<sup>12</sup> However, in some cases, the GFF will be appropriate for use in large cutaneous defects ( $>60\text{ cm}^2$ ), particularly in the absence of PE, where the defect is shallower. The GFF can also be used bilaterally or in combination with other flaps for large defects if required. Sinna et al. present a more complex algorithm for general perineal reconstruction, based upon the need for a midline laparotomy incision.<sup>4</sup> They recommend using internal pudendal perforator flaps where an abdominal incision is not required and where satisfactory local tissue is available.

## Conclusion

The GFF is a versatile option for perineal reconstruction following radical surgery for anorectal cancer. Its rich anastomotic blood supply means that it remains viable despite extensive pelvic dissection and ligation of the internal iliac arteries. The flap yields a reasonable volume of tissue to obliterate the pelvic dead space and can be used bilaterally or in combination with other flaps as necessary. It is robust, with 100% total flap survival in this series, and allows for primary healing even in previously irradiated areas. We contend that it should be seriously considered for reconstruction of all medium and some large perineal defects following anorectal excision, either individually or, if necessary, in combination with other flaps.

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## Conflict of interest

The authors declare that there are no conflicts of interest.

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