Management of 34 chronic heel sinuses in leprosy, using a modification of a local rotation flap in Kolkata, India

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Accepted for publication 16 April 2004

Summary We have seen 55 trophic ulcers of the heel in 2 years in our hospital, between March 2000 and February 2002. Thirty-four were chronic heel sinuses, six cases of multiple sinuses and 28 cases of single sinus of the plantar aspect of the heel. All these cases were treated by excision of the sinus, paring the prominence of the calcaneum, or excision of the cavity within the calcaneum and coverage by a rotation flap or a modification of this flap. Over the past 6 years, we have evolved a modification of a rotation flap that requires a fusiform incision to excise the sinus, and a curved incision for the flap extending through the instep and the non-weight bearing heel. The fusiform excision, rather than the traditional triangulation, causes the flap to partly transpose rather than rotate completely. The flap is raised superficial to the plantar aponeurosis, exposing the aponeurosis from mid-sole to the heel. It is a modification of a rotation flap. The scarring over the weight-bearing sole is minimal, restricted only to the incision necessary for the excision of the heel sinus and this is its main advantage. Twenty-one of the 34 cases healed without complications. Thirteen cases had complications, of which six were treated non-operatively and seven required either a redo of the flap or another flap cover.

Introduction

Chronic heel sinus is a frequently seen problem in anaesthetic feet in leprosy. These sinuses may occur singly or as multiple heel sinuses. Management of this chronic heel sinus has been very frustrating for the patients and for those involved in their treatment.

Many flaps have been described in the management of small defects of the heel. Fritschi\(^1\) has described a procedure by which an incision was made on the lateral aspect of the foot and deepened to raise skin and subcutaneous fibro-fatty tissue of the sole. Curtin\(^2\) presents many flaps, all of which leave secondary defects of the plantar surfaces that need to be covered by skin grafts. Shah and Pandit\(^3\) have described a myocutaneous flap, using the flexor digitorum brevis, which leaves a small secondary defect of the instep. Shanahan and Gingrass\(^4\) have described a long transposition flap for large heel defects. Baker et al.\(^5\) have described an

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island flap of the instep, based on the medial plantar artery, to cover heel defects. Thorne et al.\(^6\) have described flaps to cover different types of tissue defects of the heel. Hasegawa et al.\(^3\) have described a flap from the leg, based on the anastomosis between the peroneal artery and the sural artery.

We have seen 55 trophic ulcers of the heel in 2 years in our hospital, between March 2000 and February 2002. Thirty-four were chronic heel sinuses, including six cases of multiple sinuses and 28 cases of single sinus of the plantar aspect of the heel. All these cases were treated by excision of the sinus, paring the prominence of the calcaneum, or excision of the cavity within the calcaneum and coverage by a rotation flap or a modification of this flap.

The flap described below was originally designed as a rotation flap, in an attempt to minimize the scarring on the sole. Later, we improved upon the heel scar by reducing it further, excising the sinus as a fusiform defect, rather than the original triangulation which provided a long scar, continuous with the flap (Figures 1, 2, 3, 4 and 5). The flap incision also provided adequate exposure of the calcaneum to enable paring of the osteitic bone. The cover for the defect is the adjacent tissue and therefore native to the heel. It is also simple to raise.

The flap is raised superficial to the plantar aponeurosis, exposing the fascia over the abductor hallucis and the plantar aponeurosis from mid-sole to the heel. The procedure is explained in detail below.

**Materials and methods**

**INDICATIONS FOR THIS FLAP**

Single chronic heel sinus occurring in the weight bearing skin of the heel, leading down to the level of the calcaneum or plantar fascia attached to the calcaneum, with or without X-ray evidence of osteitis is ideally treated by this technique. The surrounding fibrosis should not extend more than 2.5 cm across transversely.

![Figure 1. Schematic representation of rotation flap.](image)
Defects larger than 2.5 cm across (transversely) after excising the sinus and the surrounding fibrosed skin are treated with a medial plantar artery island flap, or if the area is still larger, treated with distant flaps.

If there is evidence of the sinus extending within the calcaneum (determined clinically by using a probe and/or by X-ray), the procedure needs to be modified to eliminate this

Figure 2. Schematic representation of previously designed rotation flap (postoperative appearance).

Figure 3. Schematic representations of the incisions for the modified flap.
osteomyelitis by excising the infected bone and then continuing the procedure. The approach to the infected bone can, however, be made through the flap incision.

Multiple heel sinuses may be treated by this technique if the calcaneal damage is slight enough to allow salvaging the calcaneum and if all the sinuses can be approached and excised through the same flap incision.

PRE-OPERATIVE PREPARATION

The patient is admitted and taught to walk with crutches. All patients who come with infection of the heel sinus wound or other sites of infection are treated with a course of broad-spectrum antibiotics preoperatively.

PROCEDURE

The procedure is done under spinal anaesthesia, using a tourniquet. About 1 ml of gentian violet paint is first squirted, using a syringe, into the sinus. Then an incision is made to excise

Figure 4. Schematic representations of the incisions for the modified flap (postoperative).

Figure 5. Schematic representation of scar (medial aspect).
the sinus and deepened down to the bone, excising all gentian violet stained tissue. If the sinus is near the edge of the weight-bearing heel, the defect can be triangulated as described for a classical rotation flap. If the sinus is in the centre of the weight-bearing heel, we formerly used to triangulate the defect (Figures 1 and 2), but now only excise the sinus through a fusiform incision (Figures 3 and 4), thus reducing the scarring of the weight bearing skin making it look like a bipedicled flap.

The flap is now planned by marking the incision from the anterolateral edge of the instep, extending diagonally and proximally across the instep (schematic representations in Figures 1–5 and Figures 6 and 7). This marking is then continued proximally to the junction between the plantar and dorsal skin and then along this junction to the back of the heel, lateral to the line of the sinus. The incision is deepened down to expose the fibres of the plantar aponeurosis, and the flap is raised superficial to the plantar aponeurosis and the abductor hallucis muscle, exposing the aponeurosis from mid-sole to the heel (Figures 8 and 9). The floor of the sinus is thus approached from this aspect and all tissue stained with gentian violet paint is excised. If the sinus was excised by a fusiform incision, then the defect will form a part of the base of the flap. Other communicating sinuses marked by gentian violet are also excised. The plantar aponeurosis for about 1 cm from the sinus and the prominence of the calcaneum are excised. A wide chisel is used to pare the inferior surface of the calcaneum, excising a thin sliver of bone so as to expose cancellous bone. The final surface must be clean and flat.

Figure 6. Heel sinus.
The tourniquet is released, haemostasis achieved, and the viability of the flap ascertained. It is noticed that due to the fusiform excision of the sinus, (rather than the traditional triangulation practiced while rotating flaps), the flap tends to move partly like a transposition flap or a bi-pedicled flap rather than rotate completely. The site of the plantar sinus is sutured closed with non-absorbable monofilament suture and the flap incision can be sutured closed over a drain. (Figures 10 and 11). Whenever the tension has been great on this wound (flap incision), we have tended to remove these sutures. Consequently the flap incision has been allowed to heal by secondary intention. We have only occasionally (in five cases) applied a split thickness skin graft to heal this wound.

Sutures can be removed on postoperative day 10. Antibiotics are administered for 5 days postoperatively (as this is contaminated surgery usually with calcaneal osteitis) and the foot kept elevated.

One week after the wound has completely healed, the patient is mobilized in protective footwear. Mobilization is gradual, first partial weight bearing, slowly graduating to complete weight bearing over the period of 1–2 weeks. The footwear we provide consists of shoes with microcellular rubber insoles, arch supports and a heel-counter to bunch the tissues under the heel together to provide an enhanced fat-pad. This firmly fitting heel counter also causes the fat pad to surround the scar and prevents direct weight bearing on the scar. Graded weight bearing in such modified footwear facilitates early mobilization, which in turn helps us to reduce what we can of the already prolonged hospital stay.
Results

Thirty-four cases of chronic heel sinuses were treated over a period of 2 years by this technique. Six had more than one sinus, and the remainder had only one sinus, in the plantar surface of the heel. Thirty of these cases were men and only two were women. The age of the patients ranged from 19 to 60 years. The most common age group was between 21 and 25 (see Table 1).

The duration of ulcers or sinuses prior to surgery ranged from 4 months to 15 years. The most common duration seen was between 1 and 3 years (see Table 2). The follow-up period ranged from 6 months to 38 months (median 24 months).
The dimensions of the defect after excision, ranged from 1 cm transversely and 2 cm longitudinally to 2.5 cm transversely to 3.5 cm longitudinally (dimensions exceeding this were treated with other flaps).

Following the procedure, five cases showed a secondary defect in the medial aspect of the heel in a non-weight bearing area, which needed to be covered by skin graft. All the others were closed primarily, or as the defect was small, left to heal by secondary intention. In the five cases where skin grafting was needed, it was applied as another procedure and not at the same sitting. We accept that it would be wiser to apply the skin graft at the same sitting, or at least harvest the graft and apply it after 24 h, thus avoiding the need for further surgery and anaesthetic. The time taken to heal after surgery ranged between 16 and 45 days, except in four cases. In one case of multiple sinuses (the patient was a diabetic), the sinuses recurred. Repeated procedures resulted in a large raw area, which was finally covered by a cross-leg flap. In the second case, (also with multiple sinuses), the heel flap necrosed after debridement and needed a cross-leg flap cover. The third case was an elderly patient who started walking, bearing weight on the operated foot on the day following the surgery. The heel wound dehisced and the surgery was repeated after 2 weeks. The patient continued to use the operated foot for bearing weight within 4 days after the surgery resulting in wound dehiscence again. We finally applied a plaster cast with a window over the heel wound, and this healed after 136 days. The fourth case was that of a young man with multiple sinuses who after debridement lost a part of
the non-weight bearing heel, which was reconstructed using an inferiorly based reversed sural artery flap. Twenty-one cases healed without complications.

Complications seen included wound infection in eight cases, haematoma formation in one case, recurrence of the sinus or one of the sinuses in eight cases, small area of flap necrosis in three cases and eczema of the flap over the non-weight bearing heel in two cases.

Seven of these cases needed further surgery to deal with the problem of recurrence. As mentioned earlier, two needed multiple procedures and finally a cross-thigh flap. One was managed with a reversed sural artery flap. In the remaining four cases, the rotation flap was repeated.

**Discussion**

Many flaps have been described in the management of small defects of the heel. Fritschi\(^1\) has described a procedure by which an incision was made on the lateral aspect of the foot and
deepened to raise skin and subcutaneous fibro-fatty tissue of the sole. This tended not to scar the sole more than was necessary. (The only scar was that of the excision of the sinus.) However, this procedure does not raise a conventional, planned flap but by its approach to the calcaneum raises a flap of skin and fibro-fatty tissue. It (in the authors’ experience) has the disadvantage of not distributing the tension from the heel wound adequately, resulting in wound dehiscence and recurrence during the period of hospitalization in most of these cases.

Curtin⁷ presents many flaps, all of which leave secondary defects of the plantar surfaces which need to be covered by skin grafts. These are suitable for defects of the heel, which are more than 2.5 cm in diameter. Shah and Pandit⁷ have described a myocutaneous flap, using the flexor digitorum brevis, which leaves a small secondary defect of the instep. Here the flexor digitorum brevis is included with the plantar skin and plantar aponeurosis to ensure the viability of the flap without the precaution of a delay. Though this may be a good procedure to

Table 1. Age distribution

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<th>No of cases</th>
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<tr>
<td>1</td>
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<td>2</td>
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<td>9</td>
<td>51–55</td>
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<td>56–60</td>
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Table 2. Duration of ulcer

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</tr>
<tr>
<td>2: &lt;1 year</td>
<td>3</td>
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<tr>
<td>3: 1 year to 3 years</td>
<td>14</td>
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<tr>
<td>4: 4 years to 6 years</td>
<td>6</td>
</tr>
<tr>
<td>5: 7 years to 9 years</td>
<td>1</td>
</tr>
<tr>
<td>6: 10 years to 12 years</td>
<td>4</td>
</tr>
<tr>
<td>7: 13 years to 15 years</td>
<td>2</td>
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cover larger defects of the heel, it would be too radical a step to deal with the problem of small defects as the ones created by excising sinuses. In the six cases they have discussed, they saw one case of wound dehiscence, loss of skin graft of the secondary defect in one case, and the remaining four healed without problems. Shanahan and Gingrass have described a long transposition flap for large heel defects, where they include the plantar aponeurosis into the flap but the flap is raised without the underlying flexor digitorum muscle. They described their medial plantar flap in one case as a case report and noted no complication after a 3-year follow-up period. In their case, the patient was a young man who developed a trophic ulcer of the heel following a gunshot wound to the buttock, but regained medial plantar sensation. Their flap was therefore sensitive. The flap they describe also leaves a large secondary defect of the instep and extensive scarring of the heel.

Baker et al. have described an island flap of the instep, based on the medial plantar artery, to cover heel defects. They presented 12 medial plantar island flaps in cases following trauma with defects of varying sizes and sites. Four of these were for heel defects. Weight bearing was started between 30 days and 52 days following the surgery. They faced no complications in three of the cases. The donor site morbidity they saw most frequently was that of hyperkeratosis of the skin grafted site.

Thorne et al. have described flaps to cover different types of tissue defects of the heel. These flaps require incisions, which are made on the sole of the foot over weight bearing skin and non-weight bearing skin. All these flaps have the disadvantage of scarring large areas of the sole of the foot. Hasegawa et al. have described a flap from the leg, based on the anastomosis between the peroneal artery and the sural artery. This causes minimal scarring of the sole, but can only be used to cover large defects. Further this does not provide tissue native to the sole. There are occasions when we have had to resort to such flaps for heel wounds, but we feel that these procedures can be used specifically for heel ulcers that show a tissue defect greater than 2.5 cm across (in the transverse direction). However those described by Fritsch and Shah and Pundit can be used for chronic heel sinuses.

Chronic heel sinuses leave small tissue defects (< 2.5 cm across) after excision. These defects, if covered by the various flaps such as medial plantar flaps or the reversed sural artery flaps, cross-leg flaps or free-flaps, are large flaps, which leave large secondary defects. The tissues of the cross-thigh flap and the reversed sural artery flap are not native to the sole and therefore not suitable for weight bearing, and can be considered as a second or third option.

In all but four of the 28 cases we have discussed, wounds healed between 15 and 45 days postoperatively, and weight bearing was started soon after. There were secondary defects needing skin grafts only in five cases. There was recurrence in seven cases and four of these could be managed by repeating the same flap procedure.
The flap we have described above, has the following advantages:

- Minimal scarring of the weight bearing skin of the foot.
- Adequate distribution of the tensions to prevent recurrence or wound dehiscence.
- Adequate exposure of the calcaneum to enable paring and excision of osteitic bone.
- Provides tissue native to the heel.
- Is simple to raise.

It has the limitation of being able to cover only small defects of the heel and can be used mainly after excision of chronic heel sinuses. It cannot be used to cover large defects of the heel. Further, it also scars the instep, thus preventing the use of the medial plantar artery based flap in case of future recurrences.

Acknowledgements

We wish to thank Dr C. S. Walter, Director, The Leprosy Mission, South Asia for his permission and help in preparing this paper. We also acknowledge with gratitude Dr Wim van Brakel and Dr P. S. S. Rao for their help and valuable suggestions in preparing the paper. We gratefully acknowledge the help of all the medical officers, nursing staff and technicians who have helped in caring for all the patients studied here.

References