OUTCOME AFTER FLAP COVER FOR EXPOSED TOTAL KNEE ARTHROPLASTIES

A REPORT OF 25 CASES

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The long-term functional result of exposed total knee arthroplasty, treated by flap cover, is presented and the results compared with those of a randomly selected control group. The wound was successfully covered and the prosthesis was preserved in 76% of cases, but the final functional score was not as good as in those with primary wound healing.

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Total knee arthroplasty has now become as generally successful as total hip replacement (Insall and Kelly 1986) but there is a higher incidence of wound breakdown, and this may leave the prosthesis exposed. This is a very rare complication and there are few reports on its management. We have collected 25 cases and have studied the final functional outcome after treatment by flap cover.

PATIENTS AND METHODS

We identified seven male and 18 female patients from several hospitals who had undergone flap cover for exposed knee prostheses at the Regional Plastic Surgery Unit between April 1982 and August 1991. Both plastic and orthopaedic hospital records were studied, and 20 of the 25 patients were reviewed in a special clinic for the assessment of function. Four patients had died and one could not be traced.

The age at the time of arthroplasty was 49 to 82

years (mean 69). Eleven patients had rheumatoid arthritis and 14 osteoarthritis. Fourteen of the patients had had a total condylar (Howmedica, Pfizer Hospital Products Group, London, UK), 6 a Kinematic (Howmedica, Pfizer Hospital Products Group, London, UK), 4 a Press-fit condylar (Johnson and Johnson, Bracknell, Berks, UK) and one a Sphero-centric prosthesis (Howmedica, Pfizer Hospital Products Group, London, UK). The arthroplasty incision had been midline in 14 and medial parapatellar in 11.

Ten patients had had surgery before their arthroplasty: three had had tibial osteotomy, two previous arthroplasty, four open medial meniscectomy, and one patient had had a failed arthrodesis before the arthroplasty. Other factors which may have influenced wound breakdown were long-term steroid treatment (2), diabetes mellitus (1), diabetes mellitus and hypoproteinaemia (1), and hypothyroidism (1). Wound cultures proved that there was significant infection in 15, by the organisms shown in Table I. Follow-up after closure was from 1 to 10 years (mean 5.4).

Table I. Final outcome in 25 patients who had flap cover of an exposed knee arthroplasty with or without infection

	Healed	Arthrodesis	Amputation
Infected			
<i>Staphylococcus aureus</i>	6	2	0
<i>Staphylococcus albus</i>	1	1	0
<i>Pseudomonas aeruginosa</i>	2	0	0
Haemolytic streptococci	0	1	0
Enterococci and diphtheroids	0	0	1
<i>Proteus mirabilis</i>	1	0	0
Not infected	9	1	0
Total	19	5	1

The delay between wound breakdown and flap closure of the defect was from 1 to 9 months (mean 3.6), and the types of flap are shown in Table II. The mean hospital stay after the arthroplasty was 9.4 weeks, comprising 5.8 weeks (2 to 13) after the knee replacement and 3.6 weeks (1 to 8) for plastic surgery.

Functional outcome was evaluated from the BOA knee assessment chart (Aichroth et al 1978) and recorded as 'excellent' for scores of 90 or more, 'good' for 80 to 89, 'fair' for 70 to 79 and 'poor' for less than 70 (Wright et al 1990). The maximum BOA score is 55 points; we

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converted this to a percentage. We compared the results with those for a randomly selected group of 76 knees in 50 patients (39 female and 11 male) aged 47 to 82 years (mean 67) who had primary wound healing after total condylar knee replacement in one hospital.

RESULTS

The flap healed and the prosthesis was retained in 19 of the 25 cases (76%). Five patients required removal of the prosthesis followed by arthrodesis; one had an above-knee amputation.

In the 20 patients seen at review, the flap had healed in 16. Of these, knee function was reduced in one from fair before arthroplasty to poor at follow-up, and it was unchanged in five from poor. The other ten patients had some improvement: two from poor to fair, six from poor to good and two from fair to good. The overall results were much worse than those in the control series after total knee replacement with primary healing (Table III). The average range of motion in the 16 was from 11° (0 to 90) to 76° (40 to 120) as against 2° (0 to 10) to 102° (65 to 125) in the control group.

Of the 15 patients with definite bacterial infection (Tables I and IV), ten had flap healing (67%), four had subsequent removal of the prosthesis and arthrodesis and one patient, infected with both enterococci and diphtheroids, required above-knee amputation. The most common pathogen was *Staphylococcus*.

Five of the 11 patients with rheumatoid arthritis eventually required arthrodesis, the other six healed well (55%). Both of the patients on long-term steroids also had rheumatoid arthritis; both required arthrodesis. Thirteen of the 14 patients with osteoarthritis healed (93%), one required amputation.

The rate of healing was 94% for patients with wound breakdown within two weeks of arthroplasty, as against 44% after later breakdown. All the fascial flaps healed, as did 63% of the muscle flaps. Only two patients who had had previous surgery to the knee proceeded to arthrodesis, the other eight healed satisfactorily (Table IV).

DISCUSSION

Wound breakdown with the exposure of the arthroplasty prosthesis is rare, and is a challenge for both plastic and orthopaedic surgeons. The recommended management in the past has been implant removal followed by arthrodesis, but the aim is now to preserve both the prosthetic components and the function of the knee.

The first stage is the excision of non-viable tissue and obliteration of dead space by appropriate flap cover (Fig. 1). McCraw, Dibbell and Carraway (1977) described the gastrocnemius muscle flap, and this has subsequently been used to cover exposed knee prostheses (Sanders and O'Neill 1981; Gault and Quaba 1986; Bengtson et al 1987; Greenburg et al 1989; Eckardt et al 1990; Siim, Jakobsen and Medgyesi 1991; Horowitz, Lane and Healey

Fig. 1a

Fig. 1b

Fig. 1c

The use of medial gastrocnemius flaps. Figure 1a – The incisions have been marked for excising non-viable tissue and raising the medial head of gastrocnemius, based on its proximal attachment. Figure 1b – A myocutaneous flap has been used to cover the exposed prosthesis. The donor area is covered by a split-skin graft. Figure 1c – An alternative method is to raise the medial head of the gastrocnemius as a muscle flap, which is passed under a medial skin bridge and sutured to the skin of the excised wound. In this case, the muscle flap is covered by a split-skin graft and the donor area is closed primarily.

Table II. Healing related to the type of flap cover in 25 patients

Type of flap	Healed	Not healed
Fasciocutaneous		
Saphenous fasciocutaneous (n = 5)	5	0
Fasciocutaneous posterior calf flap (n = 3)	3	0
Lateral arm free flap (n = 1)	1	0
Muscle or myocutaneous		
Medial gastrocnemius (n = 14)	8	6
Latissimus dorsi (n = 2)	2*	0
Total	19	6

* one latissimus dorsi flap failed and was later replaced by a medial gastrocnemius flap

Table III. Knee scores after flap cover compared with a control series using the BOA knee assessment chart, as *percentage* of group

Score	Exposed TKR (n = 16)	Control group (n = 76)
Excellent	0	50
Good	50	41
Fair	12	8
Poor	38	1

Table IV. The influence of prognostic factors on wound healing

	Healed		Unhealed
	Number	Per cent	Number
Infection			
Not infected	9	90	1
Infected	10	67	5
Diagnosis			
Osteoarthritis	13	93	1
Rheumatoid	6	55	5
Delay before wound breakdown			
< 2 weeks	15	94	1
> 2 weeks	4	44	5
Type of flap			
Fascial	9	100	0
Muscle	10	63	6
Surgery before TKR			
Yes	8	80	2
No	11	73	4

1992; Gerwin et al 1993). A muscle flap provides a fresh blood supply which can deliver antibiotics and humoral defence factors to the wound. The fasciocutaneous flap was first described by Pontén (1981) and used by Lewis et al (1990) to cover exposed knees. The use of this type of flap causes no functional deficit at the donor site; it is useful when a gastrocnemius flap cannot be utilised or the wound dehiscence is not extensive. The saphenous free flap was described by Acland et al (1981), who have also used it as a local axial rotation flap to cover the knee. If

no local rotation flap is available, a free-tissue transfer flap, such as the latissimus dorsi flap, may be useful.

Previous reports of flap repair have concentrated on the outcome of the flap itself and the retention of the prosthesis, with no comment on subsequent function. A total knee prosthesis without functional motion is perhaps no better than arthrodesis. In our series, flap cover leading to revascularisation and wound healing salvaged the implants in 19 of 25 cases (76%). Two-thirds of these 19 patients retained an improvement over their prearthroplasty function, although this was less impressive than that in the control series with primary wound healing. None of the salvaged knees had excellent results and only 50% were good, as against excellent or good results in 91% of the control group (Table III).

We reviewed prognostic factors which might influence wound healing (Table IV): healing rate was much better in non-infected cases, in osteoarthritic versus rheumatoid arthritis and after early compared with late wound breakdown. Gerwin et al (1993) have recommended modified two-stage exchange arthroplasty for exposed and infected knee prostheses; five of their six patients had successful wound healing and reimplantation.

In our series all nine fascial flaps healed, but only ten of 16 muscle flaps. This difference is perhaps related to the use of fasciocutaneous flaps for small defects, and muscle flaps for major dehiscence. We found no significant difference in healing rate for knees with surgery before knee arthroplasty and primary operations.

Conclusions. Flap coverage salvaged about three-quarters of exposed knee arthroplasties, but left a worse final functional outcome than in those with primary healing. Despite this the outcome was better than that after arthrodesis. Results were better after early, non-infected breakdown in osteoarthritic patients.

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