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Antibiotic prophylaxis in lower limb amputation

We have prospectively studied the effect of 1-day prophylactic antibiotic therapy in lower-limb amputation for ischaemia. Twenty-seven patients were treated with Meticillin 1 g × 4 intravenously on the day of operation; 23 control patients did not receive any antibiotics.
Eight patients in the control group had postoperative wound infections compared to none in the Meticillin group. Seven patients were re-amputated because of infection. Preoperatively, *Staphylococcus aureus* was isolated in 5% of the patients in the Meticillin and 6% in the control group. In the postoperatively infected stumps, *S. aureus* occurred in 7% of the patients in the control group, and one patient developed gas gangrene.

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Several factors delay wound healing after amputation for arterial occlusive disease: malnutrition, ischaemia, haematoma and infection all play an important role. Recent investigations have demonstrated that postoperative wound infections is the main cause of failure (Lund & Sager 1977, Chodak & Plaut 1977, Holstein et al. 1979). However, few have studied the need for and choice of prophylactic antibiotics (Huizinga et al. 1983, Sonne-Holm et al. 1984).

We have studied the effect of short-term prophylactic treatment with Meticillin in lower limb amputation.

Patients and methods

Only patients with ischaemic gangrene and a preoperative assessment of the skin perfusion pressure (SPP) according to Holstein & Lassen (1973) were included. Patients treated with antibiotics within 1 week prior to the operation were excluded.

Fifty-three patients were randomly allocated to two groups. Three patients died of cardiac failure before the final result could be assessed and were excluded. Twenty-seven patients (Group A), comprising 14 men, median age 73 years, and 13 women, median age 75 years, received prophylactic Meticillin 1 g intravenously half an hour before the operation and every 6th h for 24 h. Twenty-three patients (Group B), comprising 10 men, median age 70 years, and 13 women, median age 76 years, did not get any antibiotic treatment.

Amputation was performed because of non-healing ischaemic ulceration with infection in 16 patients and impending gangrene with severe pain or established gangrene in 34 patients. Usually a below-knee (BK) amputation was performed when the SPP was ≥40 mm Hg, a through-knee (TK) amputation with the SPP between 40 and 20 mm Hg and an above-knee (AK) amputation in cases with a SPP ≤20 mm Hg.

In patients with gangrenous ulcerations, swabs for aerobic and anaerobic culture were taken the day prior to the operation. The skin of the operation site was prepared with chlorhexidine. A suction drain was used and was removed within 1–3 days and sent for bacterial culture. The skin sutures were removed after 3 weeks unless infection or haematoma occurred. In cases of necrosis of the stump, the skin sutures were removed and anerobic and aerobic cultures were performed.

Healing was defined as complete healing of the wound, sometimes after revision at the same level. Failure was defined as infection or necrosis of the stump, requiring re-amputation.

For statistical analysis, Fisher's exact test was used.

Results

Eight infections occurred postoperatively, all in Group B ($p < 0.01$). Four failures caused by necrosis without infection occurred in Group A, compared to eight failures in Group B, where seven failures were caused by infection (Table 1).

In Group A, 19 patients were amputated because of gangrene without infection and in

Table 1. Wound complications in 27 patients after prophylactic Meticillin treatment (A) compared with 23 patients without prophylaxis (B).

		No.	Postop. infection	Re-amputation	
				caused by infection	without infection
A	Infected	8	–	–	1
	Not infected	19	–	–	3
B	Infected	8	4	4	–
	Not infected	15	4	3	1
Total		50	8	7	5

eight patients pathogenic microorganisms were isolated preoperatively. None of the patients developed postoperative infection ($p > 0.05$) (Table 1).

Eight patients in Group B had infected gangrene and 15 had non-infected gangrene. Three failures caused by infection occurred among the patients with non-infected gangrene compared to four failures among patients with infected gangrene ($p > 0.05$) (Table 1).

Table 2. The bacterial cultures in patients with infected gangrene and/or postoperative infection

A	B	C	D	E	F
1	Sa, Pr, E	+	TK	H	–
2	Sa, Ps	+	TK	H	–
3	Sr, Pr	+	BK	H	–
4	Sa, Pr, E	+	BK	H	–
5	Ps	+	BK	H	–
6	Sa, Sf	+	BK	N	–
7	Sa	+	BK	H	–
8	Ec	+	BK	H	–
9	Sa	–	BK	I	E, Sf, Ec
10	Sa, Ps, E	–	AK	I	Sa
11	Sa, Ps, K	–	TK	I	Sf, Sa, Ps
12	Sa	–	BK	I	Sa
13	Pr, E, Sf	–	BK	H	–
14	Sa, Pr	–	TK	H	–
15	Pr	–	TK	H	–
16	Sa	–	BK	H	–
17	–	–	BK	I	Sa
18	–	–	BK	I	Sa
19	–	–	BK	I	Sa
20	–	–	AK	I	C

A Case no, B preoperative culture, C Meticillin prophylaxis, D Amputation level, E Postoperative course, F Postoperative culture.
C *Clostridium perfringens*, E *Enterobacter*, Ec *E. coli*, K *Klebsiella*, Pr *Proteus*, Ps *Pseudomonas*, Sa *Staphylococcus aureus*, Sf *Streptococcus faecalis*.
b. H healed, I infection, N necrosis.

Staphylococcus aureus was isolated preoperatively in five patients in Group A and six patients in Group B (Table 2). Frequently a mixed infection with *S. aureus* and gram negative bacteria was present. *S. aureus* was isolated from six patients with postoperative stump infection (Table 2). One patient in Group B became postoperatively contaminated with *Clostridia perfringens* and developed gas gangrene after an AK amputation.

Discussion

In series where prophylactic penicillin has been used for 2 to 7 days, postoperative infections have been reported to occur in over 50 per cent (Weaver et al. 1973, Huizinga et al. 1983). This suggests that penicillin is not superior to non-prophylaxis. However, several authors (Parker 1969, Hares et al. 1980, Huizinga et al. 1983) advocate prophylactic penicillin because of the risk of contamination with *Clostridia*. One of our patients in the control group developed gas gangrene after an AK amputation.

It has been suggested, that most of the postoperative wound infections are caused by organisms originating from the patients own gastrointestinal tract (Hares et al. 1980). This was not confirmed in our study in which *S. aureus* was the most frequently isolated bacterium. Also, Weaver et al. (1973) reported a two-third incidence of postoperative wound infections with *S. aureus*, often caused by contamination in the operating theatre or the ward and often with organisms identical with those found in the gangrenous lesion.

The type of antibiotics and the duration of the treatment are often debated. Experimental (Burke 1961) and clinical studies (Bowers et al. 1973) have shown that antibiotics, administered immediately before the operation or within 30 min after the incision is made, are effective in preventing an inoculum of bacteria from causing infection. Prophylaxis longer than 3 days seems unnecessary (Chodak & Plaut 1977, Nelson et al. 1983). Our result demonstrated that prophylactic administration for 24 h is sufficient to prevent postoperative wound infection.

Recently, new antibiotics have been advocated as prophylaxis in lower-limb amputations. Huizinga et al. (1983) used Amoxycillin-clavulanic acid administration for 2 days and reported a postoperative wound infection rate of 13 per cent, while Sonne-Holm et al. (1984) reported 16 per cent in a study of 1-day Cefoxitin prophylaxis; both Amoxycillin-clavulanic acid and Cefoxitin were better than penicillin and placebo, respectively. These results are comparable to Meticillin prophylaxis. However, the cephalosporins and Amoxycillin-clavulanic acid have a wider spectrum than Meticillin, but in preventing infection from *S. aureus* and other gram-positive aerobes, a penicillinase-resistant penicillin is as effective, and preserves more of the normal bacterial flora.

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