Infection after reamed intramedullary nailing of lower limb fractures

A review of 1,464 cases over 15 years

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We studied 1,464 consecutive immediately-reamed intramedullary locked nailings of tibial or femoral fractures. There was an increase in postoperative infection if the tibial fracture was open; the relative risk increased with the severity of the soft tissue lesion. There was a marginal increase in the postoperative infection rate for open femoral fractures. A comparison of these figures with those in other methods of treatment and the mechanical and clinical advantages of nailing leads us to propose this method of treatment for Grades I and II open fractures of the femur or tibia.

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Reamed intramedullary locked nailing in open fractures remains controversial because of the risk of deep infection. Our purpose was to determine the risk of postoperative infection after reamed intramedullary locked nailing of open tibial or femoral fractures in comparison to closed fractures, and to compare it with that of other means of treatment.

Patients and methods

All fractures of the tibia or femur which technically allowed the use of an intramedullary locking nail during a 15-year period were included, except Grade III (Gustilo and Anderson 1976) open fractures. 1,464 consecutive reamed intramedullary locked nailings of a tibial or a femoral fracture were performed between 1974 and 1989. 339 fractures were open: 239 tibial fractures (140 Grade I and 99 Grade II) and 100 femoral fractures (51 Grade I and 49 Grade II).

All fractures were operated on within 24 hours after the injury. After excision, the wound was closed in open fractures. Before 1984, no antibiotic treatment was given in closed fractures, while patients with open fractures received antibiotics according to the surgeon's evaluation of bacterial contamination of the wound. After 1984, prophylactic antibiotic treatment was given in all fractures, both open and closed.

Postoperative infection was considered to be present if there was purulent drainage from the wound, even if cultures were negative. The severity of the infection was classified into 3 groups according to treatment: 1) without reoperation, 2) with reoperation but with nail in place, and 3) with removal of the nail and external fixation. The result of the treatment of the infection was classified into 3 groups: 1) primary healing after the first therapy, 2) secondary healing after several therapies, and 3) complete failure of all treatments. The Chi-square test was used to compare frequency, severity, result of the treatment and influence of the time of nailing upon the infection rate for open or closed fractures. Grades I and II open femoral fractures were grouped to give sufficient numbers for statistical calculations.

Results

The incidence of postoperative infections (Table 1) was lower among closed tibial fractures than among open (3 percent vs. 11 percent), $P < 0.001$. The proportion of patients with a postoperative infection appeared to be higher the greater the severity of the soft tissue lesion (9 percent for Grade I vs. 15 percent for Grade II) but the difference was not fully significant, P 0.08. Among femoral fractures the incidence of postoperative infections was also lower among closed fractures (3 percent vs. 6 percent) but, again, the difference was not fully significant, P 0.09.

Among closed femoral fractures the incidence of postoperative infections dropped from 5 percent before 1984 to 1 percent thereafter, P 0.01. Among open femoral fractures, as well as among open and closed tibial fractures, no temporal change in incidence of

Table 1. Postoperative infections. Number of infections/number of fractures (percentages)

		Open		
Fracture	Closed	All	Grade I	Grade II
Tibia	16/481 (3.3)	26/239 (11)	11/140 (8.9)	15/99 (15)
Femur	18/644 (2.8)	6/100 (6.0)		

Table 2. Influence of perioperative antibiotics. Antibiotics were not given before 1984 systematically. Number of infections/number of fractures (percentages)

		Open		
	Closed	All	Grade I	Grade II
Tibia				
Before 1984	7/232 (3.0)	15/129 (12)	7/75	8/54
After 1984	9/249 (3.6)	11/110 (10)	4/65	7/45
Femur				
Before 1984	13/279 (4.7)	2/51		
After 1984	5/365 (1.4)	4/49		

Table 3. Severity (i.e. treatment) of postoperative infection

		Open		
	Closed	All	GI	GII
Tibia				
No reoperation	4	10	6	4
Reoperation without nail removal	8	14	5	9
Nail removal and external fixation	4	2	0	2
Femur				
No reoperation	2	0		
Reoperation without nail removal	15	5		
Nail removal and external fixation	1	1		

Table 4. Result of the treatment of infection

		Open		
	Closed	All	GI	GII
Tibia				
Primary healing	10	22	10	12
Secondary healing	3	3	1	2
Failure	3	1	0	1
Femur				
Primary healing	16	6		
Secondary healing	2	0		
Failure	0	0		

postoperative infections was suggested (Table 2).

The severity and the results of the treatments of postoperative infections did not appear to differ between open and closed fractures (Tables 3 and 4).

Discussion

Soft tissues lesions are the essential risk factor of infection for tibial fractures (Edwards 1965). This risk appears to be tolerable for Grade I fractures, as confirmed by Court-Brown et al. (1990, 1992), and dangerous for Grade II fractures, where some authors propose external fixation (Bone and Johnson 1986). It is important to notice that the severity of the infection and its outcome were not different after Grades I or II open fracture or after closed fracture. This suggests the use of emergency intramedullary nailing for both Grades I and II open fractures as well as for closed fractures (Önnerfält 1978). Immediate non-reamed nailing of the tibia leads to a theoretical preservation of the endosteal vascularization. However, Chapman and Mahoney's review of literature (1986) showed an infection rate of 3–7 percent for tibial fractures.

Delayed nailing after debridement, wound closure and temporary continuous traction had an infection rate of 3/57 femoral fractures and 11/156 tibial fractures in the series of Babin et al. (1981), and Brumback et al. (1989) concluded that immediate intramedullary nailing of Grades I and II open femoral fractures does not increase the risk of infection, in comparison to delayed nailing. Secondary nailing after debridement, wound closure and temporary external fixation of tibial fractures is a controversial technique; the transfixation pins may cause infection. None of

these techniques leads to a dramatic reduction of the infection rate in comparison with immediate nailing.

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