WOUND SEPSIS FOLLOWING INTERNAL FIXATION OF LONG BONE FRACTURES WITH METAL IMPLANTS

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SYNOPSIS

This article is a retrospective study of infection after metallic internal fixation of femoral neck, femoral shaft and forearm fractures. All cases done between 1966-1968 were reviewed and the incidence of post-operative superficial and deep infection was worked out. The overall incidence of infection and the incidence of deep infection was compared in the three fractures. However, only deep infection, as defined in this article, is considered surgically significant. The results show a high rate of deep-seated post-operative infection in femoral neck and femoral shaft fractures and no case at all in forearm fractures. The possible causal factors causing this are discussed.

Internal fixation of long bone fractures with metal implants is an established practice in most major centres. Despite the advantages of internal fixation in selected cases, post-operative sepsis poses a major hazard. The aim of this article is to review three common long bone fractures treated operatively to evaluate the incidence of post-operative wound sepsis and the factors influencing it.

MATERIAL

All fractures of the femoral neck (including the trochanteric region), femoral shaft and forearm bones treated by internal fixation between the years 1966-1968 in the University Department of Orthopaedic Surgery were reviewed. There were 151 trochanteric and femoral neck fractures, 83 femoral shaft fractures and 44 forearm fractures. The type of internal fixation device used varied according to the type of fracture. All cases of trochanteric and femoral neck fractures had a pin and plate inserted (either a two piece or a fixed angle device). Except for three cases in whom a Müller plate was applied, all other femoral shaft fractures had an intramedullary nail inserted. Fractures of the forearm bones were internally fixed either with plates or intramedullary rods. Post-operative wound infections were classified as superficial or deep. Under superficial infections were included all those wounds which had erythematous margins, edema and induration of the surrounding skin, discharge from the wound margins or a frank stitch abscess. The deep infections included all the wounds which had frank suppuration seated deep to the deep fascia and down to the fracture site.

TROCHANTERIC AND REMORAL NECK FRACTURES

Of the 151 fractures in this group, 88 were trochanteric and 63 were of the femoral neck. Eighty-eight fractures occurred in males and sixty-three in females. There were 33 post-operative wound infections of which 19 were superficial, twelve were deep and in two instances it was not possible to determine the degree of infection from the old case records (Table I). All wounds healed except two which were still discharging when the patients died due to other causes. The incidence of wound infection in two different age groups is shown in Table II. Although the total number of infected wounds was more or less the same in those under 59 as compared to those above 60 years of age, the number of patients with deep seated suppuration was somewhat higher in patients above the age of 60; 11 out of 26 infections being deep seated as compared to only one out of seven in patients under the age of 59. The number of deep seated infections was also higher amongst those who had sustained trochanteric fractures as compared to those who had sustained femoral neck fractures (Table III). In 34 cases the wounds were drained post-operatively. The total number of infected wounds and deep seated sepsis was higher in the presence of a drainage tube. However there was no case of deep suppuration in the twenty-five cases in whom a closed suction drain was inserted (Table IV).

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TABLES I TO V: INFECTION IN 151 TROCHANTERIC AND FEMORAL NECK FRACTURES

TABLE I

Type of Infection	No. of Cases	%	Healed	Not Healed
Superficial	19	12·5	19	—
Deep	12	7·9	10	2 (died)
Unknown	2	1·3	2	—
TOTAL WITH INFECTION	33	21·8	31	2

TABLE III

Type of Infection	Trochanteric Fractures	Neck Fractures
Superficial	8	11
Deep	9 (10·2%)	3 (4·7%)
Unknown	2	0
TOTAL WITH INFECTION	19 (12·5%)	14 (4·7%)

TABLE II

Age Group (Years)	Total No. of Cases Operated Upon	No. of Cases with Infection	Superficial Infection	Deep Infection	Type Unknown
59 and below	30	7 (23·3%)	5 (16·6%)	1 (3·3%)	1
60 and above	121	26 (21·5%)	14 (11·5%)	11 (9·0%)	1
TOTAL	151	33 (21·8%)	19 (12·5%)	12 (7·9%)	2

TABLE IV

Type of Infection	No. of Cases with Drains (34)			No. of Cases without Drains (Total 117)
	Closed Suction (25)	Corrugated (7)	Unknown (2)	
Superficial	6 (24%)	2 (28·6%)	—	11 (9·4%)
Deep	0	3 (42·9%)	—	9 (7·7%)
Unknown	1	—	—	1
TOTAL WITH INFECTION	7 (28%)	5 (71%)	—	21 (17%)

TABLE V

Type of Infection	No. of Cases with Antibiotics Total 137	No. of Cases without Antibiotics Total 14
Superficial	15 (10·9%)	4 (28·5%)
Deep	10 (8·0%)	2 (15·0%)
Unknown	2	—
TOTAL WITH INFECTION	27 (19·6%)	6 (42·9%)

Prophylactic antibiotics were administered post-operatively in the majority of the cases; 137 out of 151 (Table V). Although the incidence of infection is much higher amongst those who had no prophylactic antibiotics, the total number of cases in this group is so small that it cannot be considered significant.

COMMENTS

The overall incidence of infection after open fixation in these fractures has been quite high (21·8%) and even deep seated frank suppuration occurred in 7·9% of cases. This is considerably higher than that quoted (5·1%) in a survey of all post-operative orthopaedic wounds at Walter Reed General Hospital as reported by G.J. Schonholtz and C.A. Borgia (1962). However, in that survey all the wounds that were infected had to have a positive bacterial culture to be classified as a wound infection. A slightly higher incidence of infection amongst those above the age of 60 is perhaps due to the fact that the tissue response and healing power after a major fracture at that advanced age are poor with increased susceptibility to wound infection. Trochanteric fractures which have a good deal of associated soft tissue damage and hematoma are more likely to have post-operative wound sepsis as compared to the femoral neck fractures in which the hematoma is minimal and the fracture site is not exposed. Although the number of cases with closed post-operative drainage of the wounds is not large, closed suction drainage appears to influence the incidence of infection in this series because of the 25 cases so treated there was no case of deep infection. It would seem right to suggest that closed suction drains should be preferred to corrugated drains for drainage of post-operative hematomas.

FEMORAL SHAFT FRACTURES

82 patients with femoral shaft fractures were studied. One patient had fractures of both femoral shafts. Supracondylar fractures were not included in the study. 67 patients were males and the remaining 15 were females. 76 fractures were simple and 7 were compound. Out of the 82 patients, 16 developed post-operative wound infection. 4 patients had superficial infection, 10 had deep infection and in 2 instances it was not possible to determine the degree of infection from the old case records (Table VI). One patient with deep infection went overseas and his fate is unknown. All the other wounds healed except 2 who had chronic discharging sinuses until 1970. The incidence of wound infection in relation to type of fracture is shown in Table VII. 13 patients out of 76 with simple fractures developed infection while 3 out of 7 with compound fractures developed infection. In 53 cases the wounds were drained. 52 of these had post-operative closed suction drainage and only one had a corrugated drain. The number of infected cases in this group where drainage was instituted was 11. 7 cases had no post-operative drainage at all and there was no case of infection in this group. In 22 cases it was not possible to tell from the old case records whether or not a drain had been used and in this group there were 5 cases of infection (Table VIII).

Prophylactic antibiotics were administered post-operatively in the majority of the cases; 76 out of 82. All the 16 cases that developed infection were on antibiotics.

TABLES VI TO VIII: INFECTION IN FEMORAL SHAFT FRACTURES

TABLE VI

Type of Infection	No. of Cases	% of Cases	Healed	Not Healed	Unknown
Superficial	4	4·9	4	—	—
Deep	10	12·2	7	2	1
Unknown	2	2·5	2	—	—
TOTAL WITH INFECTION	16	19·5	13	2	—

TABLE VII

Type of Infection	Simple Fractures Total 76		Compound Fractures Total 7	
Superficial	4	5·3%	—	—
Deep	8	10·6%	2	28·6%
Unknown	1	1·3%	1	14·3%
TOTAL WITH INFECTION	13	17·1%	3	42·8%

TABLE VIII

Type of Infection	Cases with Drains Total 53	Cases without Drains 7	Unknown 22
Superficial	3	—	1
Deep	7	—	3
Unknown	1	—	1
TOTAL WITH INFECTION	11	—	5

There were 19 cases in which the intramedullary nail was removed. In 13 cases the indication for removal was pain while in the remaining 6 cases the indication for removal was infection. In all these six cases the infection healed after removal of the nail but in 3 of these 6 cases, the removal of the nail was combined with sequestrectomy. In the 2 cases that had still not healed by 1970, there was a chronic discharging sinus and the intramedullary nail was still present.

COMMENTS

The overall incidence of infection after open fixation in these fractures is also quite high (19·5%) and compares with the incidence in femoral neck fractures. However the incidence of deep seated frank suppuration in femoral shaft fractures is higher (12·2%) as compared to 7·9% in femoral neck fractures. This could be due to the more extensive soft tissue damage and hematoma formation that go with fractures of the femoral shaft and also due to the fact that some of the fractures were compound. As shown in Table VII, the rate of deep infection was 10·2% in the simple femoral shaft fractures and 28·6% in the compound fractures. Since there were only 7 compound fractures the percentages of the incidence of infection in relation to the type of fracture is not statistically significant but it is well known fact that compound fractures have a higher rate of infection compared to simple fractures when both have been internally fixed.

Closed suction drainage did not seem to help in reducing deep infection as in neck and trochanteric fractures. Of the 10 cases with deep infection there were residual sinuses in 2 i.e. 20%. None of the cases required amputation.

Weber and Hirtzman (1964) reported 35 cases of bone infection following intramedullary fixation of femoral shaft fractures with an amputation rate of 29% and residual sinuses in 20% in these 35 reported cases. They did not comment on the incidence of wound infection but rather discussed the outcome in infected cases.

FOREARM FRACTURES

44 patients with forearm fractures were studied. Of these 35 were males and 9 females. There were 35 simple fractures and 9 compound. All the operations were done under tourniquet. There were 7 cases of superficial infection and no case of deep infection (Table IX). All the superficial infections healed eventually within 2 months. In only 1 case was the internal fixation device (in this case an intramedullary rod) removed and that was because it was protruding from the elbow. The incidence of wound infection in relation to the type of fracture is shown in Table X. Out of 35 patients with simple fractures, 6 developed superficial infection while out of 9 patients with compound fractures, 1 developed superficial infection. In this compound fracture that developed infection, the wound was a puncture hole but the patient also had associated infection of the fingers at the time of operation because of compound dislocation of the fingers. No form of drainage was used in 38 cases and all the 7 cases of superficial infection occurred in this group (Table XI). The remaining 6 cases had a closed suction drain and none of them developed any infection.

Prophylactic antibiotics were administered postoperatively in 35 cases. 5 cases that subsequently developed infection were already on prophylactic antibiotics. 2 cases that developed infection had no antibiotics (Table XI).

TABLES IX TO XI: INFECTION IN FOREARM FRACTURES

TABLE IX

Type of Infection	No. of Cases	% of Cases	Healed	Not Healed
Superficial	7	15·9	7	—
Deep	—	—	—	—
Unknown	—	—	—	—
TOTAL WITH INFECTION	7	15·9	7	—

TABLE X

Type of Infection	Simple Fractures Total 35		Compound Fractures Total 9	
Superficial	6	17·1%	1	11·1%
Deep	—	—	—	—
Unknown	—	—	—	—
TOTAL WITH INFECTION	6	17·1%	1	11·1%

TABLE XI

Type of Infection	With Drains Total 6	Without Drains Total 38	With Antibiotics Total 35	Without Antibiotics Total 9
Superficial	—	7	5	2
Deep	—	—	—	—
Unknown	—	—	—	—
TOTAL WITH INFECTION	—	7	5	2

COMMENTS

The overall incidence of infection was 15·9% in forearm fractures as compared to 19·5% in femoral shaft fractures and 21·8% in femoral neck fractures but the significant finding is that there was not even one case of deep seated frank suppuration in forearm fractures. This could be due to two factors:—

(i) in forearm fractures the soft tissue damage and haematoma formation is usually less than in the other two categories of fractures;

(ii) all the operations for fixation of forearm fractures were done under tourniquet leading to minimal post-operative haematoma formation.

Because of the small number of compound fractures, it is not possible to comment on the relationship between the incidence of infection and type of fracture. Although there were only six cases with closed suction drainage there is no case of infection in this group and it seems reasonable to advocate closed suction drainage after internal fixation. The value of antibiotics is questionable.

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