

# SURGICAL TREATMENT OF METASTATIC LONG BONE DISEASE

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## ABSTRACT

A retrospective study of the results of operative treatment of 60 long bones secondaries in 46 patients was carried out. The mean period of follow-up was 10 months. The most common primary in this study was carcinoma of the breast (28.2%), followed by carcinoma of the lung (21.7%) and unknown primary (10.9%).

Three groups of patients were studied - pathological fracture group, prophylactic fixation group and a mixed group. In the pathological fracture group, 70% of patients achieved good to excellent pain relief and 60.9% was able to walk with or without walking aids. In the prophylactic group, all the patients achieved good to excellent pain relief and 60% were able to ambulate with or without walking aids. In the mixed group, all the patients achieved good to excellent pain relief and 66.6% of the patients were able to walk with aids. The operative mortality in both the pathological fracture group and prophylactic fixation group was 10% and 33.3% in the mixed group. Multiple internal fixation performed at one operative session was associated with high operative mortality (50%).

**Keywords:** Spontaneous Fractures, Internal fixation, Metastasis

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## INTRODUCTION

Metastatic long bone disease accounts for 10 - 20% (Perez 1972)<sup>(1)</sup>, (Bonarigo 1967)<sup>(2)</sup> of bony secondaries in the terminally ill. It is a painful and distressing condition to the patient and family concerned. Surgical fixation for pathological fractures carried out prophylactically has been shown to provide good palliation to this group of patients who would otherwise die a painful death.

The aim of this article is to review our experience with operative fixation carried out both prophylactically and for pathological fractures on metastatic long bone disease. We also examined the results of multiple fixation at a single operation.

## METHODS AND MATERIALS

This is a retrospective study of consecutive cases operated between July 1987 - July 1990. Metastatic diseases occurring in sixty long bones in 46 patients were included in the study. The mean age of patients in the review was 57.2 yr (range 29 - 84 yr). There were 31 females and 15 males and the racial distribution was 39 Chinese (84.8%), 5 Malays (10.9%) and 2 Indians (4.3%). The mean period of follow-up was 10 months with 3 cases lost to follow-up and 13 patients still alive at the time of the study. Of the 60 long bones involved, 48 occurred in the lower limbs and 12 in the upper limbs (Table I). Proof that the bony secondaries were due to metastases was confirmed by histology obtained at time of operation. The primary

Table I - Distribution of long bone secondaries

Site of Secondary	No. of cases	%
Shaft of femur	18	30.0
Subtrochanteric femur	12	20.0
Humerus	9	15.0
Neck of femur	8	13.3
Intertrochanteric femur	3	5.0
Supracondylar femur	3	5.0
Tibia	3	5.0
Radius	2	3.3
Ulna	1	1.7
Fibula	1	1.7

tumour and the date of death were confirmed with the Cancer Registry of Singapore. The ambulatory status was assessed at the time of discharge for patient with lower limbs involvements. Ambulation was classified into bedfast, wheelchair, weight bearing with support and full weight bearing (Parrish 1970)<sup>(3)</sup>. Pain relief was also assessed upon discharge and was graded as excellent, good, fair and poor (Perez 1972)<sup>(1)</sup>. Excellent pain relief means complete pain relief, good means near complete relief requiring occasional non-steroidal anti-inflammatory drugs, fair means moderate relief and poor means no significant improvement. All metastases of the long bones had post-operative irradiation.

Three groups of patients were studied: 1) Pathological fracture group, 2) Prophylactic fixation group, 3) Mixed group. The mixed group included those patients who had fixation for pathological fractures and prophylactic fixation for secondaries to long bones. In the pathological fracture group, there were 33 long bones fractures in 30 patients. In the prophylactic group, there were 10 patients with 13 long bones metastasis. In the mixed group, there were 14 long bones involved in 6 patients. Multiple fixation was performed for 8 patients for multiple long bones involvement which is defined as 2 or more long bones involved.

## RESULTS

In our series, carcinoma of the breast (28.2%) was the most common source of primary, followed by carcinoma of the lung (21.7%) and unknown primary (10.9%) respectively

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**Table II - Distribution of Primary Malignancies**

Site of Primary	No. of Cases	%
Breast	13	28.2
Lung	10	21.7
Unknown	5	10.9
Multiple myeloma*	5	10.9
Colorectal	3	6.5
Large cell lymphoma	2	4.3
Prostate	2	4.3
Nasopharynx	2	4.3
Uterine cervix	1	2.2
Thyroid	1	2.2
Cholangiocarcinoma	1	2.2
Piriform fossa (oral)	1	2.2

\* Behaves like a metastatic disease with multiple lytic lesions in long bones.

**Table III - Interval between diagnosis of primary and development of metastasis**

Duration	No. of cases	%
0 - 6 months	14	43.4
7 - 12 months	4	12.4
> 12 months	14	43.4

14 cases first presented with bony metastases

(Table II). Cancers of the prostate and nasopharynx each accounted for 4.3% and thyroid cancer for 2.2%. As evident in Table I, the most common site of metastatic involvement was the lower limbs (80%) of which the femoral shaft accounted for 30%. There were 4 cases of metastatic bony involvements below the knee and 3 below the elbow. The duration between the detection of primary and development of bony secondary was within 12 months in 55% of the patients (Table III). Fourteen patients presented with a long bone secondary as the first indication of malignant disease. The longest interval between diagnosis of primary and development of metastases was 9 years in a patient with carcinoma of the breast.

The overall 30 day operative mortality in this study was 13% (6 patients) of whom one died during surgery and another on the first post-operative day. The mean post-operative survival in our series was 7.1 months (range 2 - 71 months) with 13 patients still alive at the time of writing. Forty-four patients (96.7%) survived more than 3 months and 20 patients (43.3%) survived more than 6 months. Carcinoma of the breast patients survived the longest with a mean of 12.8 months. Infection (17.4%) was the most common post-operative complication,

**Table IV - Post-operative Complications**

Complications	No. of cases	%
Urinary Tract Infection	4	8.6
Intramedullary nail Protrusion	3	6.5
Wound Infection	2	4.3
Osteomyelitis	1	2.1
Chest infection	1	2.1
Protrusion acetabuli	1	2.1
Loosening of screws	1	2.1

followed by implant complications (10.7%) (Table IV). Urinary tract infection (8.6%) was the most common in the infection group followed by wound infection (4.3%). One of the wound infections proceeded on to osteomyelitis which resulted in an above-knee amputation 4 months later. There were 3

cases of implant protrusion occurring over a mean of 3 months post-operatively. There was one case of protrusion acetabuli

**Table V - Ambulation Status**

Ambulation status	Pathological Fracture No. of cases	%	Prophylactic Fixation No. of cases	%	Mixed Group No. of cases	%
Full weight bearing	4	17.4	2	20	0	0
Weight bearing with support	10	43.5	4	40	2	66.6
Wheelchair	7	30.4	4	40	1	33.3
Bedfast	2	8.7	0	0	0	0
Total	23*		10		3*	

\* : 7 patients have upper limb involvements only

+ : 3 cases not included because 2 cases died within 24 hours and one case involved the upper limbs

**Table VI - Pain Relief in the 3 groups**

Pain Relief	Pathological Fracture No. of cases	%	Prophylactic Fracture No. of cases	%	Mixed Group No. of cases	%
Excellent	15	50	4	40	3	75
Good	6	20	6	60	1	25
Fair	5	17	0	0	0	0
Poor	4	13	0	0	0	0
Total	30		10		4*	

\* 2 cases not included because they died within 24 hours post-operation

after Moore's hemiarthroplasty as a result of extensive metastasis of the acetabulum.

#### Pathological Fracture Group

In the pathological fracture group, 61% of the patients were able to walk with or without support and only 2 patients were bedridden (Table V). The period of time required for patients in this group to achieve their state of ambulation was a mean of 8.5 days. Two patients were bedridden, one because of post-operative paraplegia from spinal secondaries and another had complete infiltration of the left femur with fracture at the mid-shaft with interlocking nail inserted. The pain relief in this group of patients was excellent in 50% and good in 20% (Table VI). The mean post-operative survival was 6.3 months (median 3 months) with 2 cases lost to follow-up and 10 patients still alive at the time of study. The 30-day operative mortality was 10% (3 patients). One of them was a case of carcinoma of the breast suffering from left humeral shaft fracture and fixed with a rush rod. She was known to have ischemic heart disease with a past history of cerebral vascular accident. She collapsed during anaesthetic reversal after surgery, resulting in post-anoxic brain damage. She had a stormy post-operative course and finally died of bronchopneumonia 26 days after operation. The other 2 cases died 3 weeks after surgery of advanced malignancy. They included one case of subtrochanteric fracture from carcinoma of the lung, treated with K-Y nailing and another case of left humeral shaft fracture from cholangiocarcinoma. There were 3 cases of implant protrusions of which 2 were Kuntscher nails and one AO nail occurring over a mean of 3 months. There were 2 cases of wound infections of which one proceeded on to osteomyelitis resulting in screw loosening and finally culminating in an above knee amputation 4 months post-operation. One patient developed protrusion acetabuli 6 months post-operatively after

Moore's hemiarthroplasty as a result of metastases of the acetabulum.

### Prophylactic Fixation Group

In the prophylactic group, there were 13 long bones fixations carried out in 10 patients. The mean post-operative survival was 5.1 months (median 5 months) with 2 patients still alive at the time of study. One patient (10%) died within 30 days of operation as a result of advanced lung cancer after bilateral closed Kuntscher nailing of femurs. All patients achieved good to excellent pain relief (Table VI) and no patient was bedridden in this group. Sixty percent were able to walk with or without aids and 40% were wheelchair ambulant (Table V). The mean time taken to achieve ambulation was 8.1 days. There were no post-operative complications.

### Mixed Group

In the mixed group, there were 6 patients with 14 long bones involved. The mean post-operative survival was 10 months (range 4 - 72 months) with one case lost to follow-up and one case still alive. There were 2 patients who died within 30 days of operation. One of them died during surgery as a result of acute myocardial infarction secondary to cement induced hypotension. She suffered from carcinoma of the lung and underwent open nailing for left subtrochanteric fracture and closed nailing for right subtrochanteric metastasis. The other patient died on the first post-operative day from acute myocardial infarction. All the patients had good to excellent pain relief (Table VI) and no patient was bedridden. Sixty-six percent of the patients were walking with aids and 33% of the patients were wheelchair ambulators (Table V). The mean time taken to achieve ambulation was 18 days.

### Multiple Fixation

In the study, 8 patients had multiple long bone metastases of which 6 of them had multiple fixation performed at one sitting. The 30-day operative mortality in this group of patients who had multiple fixations at one operative session was 50% (3 patients) while the remaining 3 survived a mean of 4 months post-operatively. The causes of death were as described in the above paragraphs under the Prophylactic Group and Mixed Group of patients. Two patients had surgery performed on different long bones on separate occasions but less than a month apart. These 2 patients achieved excellent pain relief with no post-operative complications. One of them is still alive at the time of writing, the other died 6 months post-operatively.

### DISCUSSION

The management of metastatic long bone disease has evolved through the decades. Codman<sup>(4)</sup> in 1922 considered metastatic secondaries in bones "a hopeless class" and Grunert, upon reviewing the literature from 1886 to 1904 concluded that pathological fractures never unite (Welch 1936)<sup>(5)</sup>. In the past, expectant neglect with enforced bedrest and narcotic analgesia was the treatment of choice. It was not until the 1940s when surgical treatment, mainly in the form of intramedullary nailing was reported. McLaughlin<sup>(6)</sup> described the principles and indications of the use of intramedullary nailing in the treatment of long bone pathological fractures which has since become the mainstay of treatment (Ehrenhaft 1949<sup>(7)</sup>, Fitts 1953<sup>(8)</sup>, Bennis 1955<sup>(9)</sup>, Johnson 1957<sup>(10)</sup>, Francis 1959<sup>(11)</sup>, Tachdijian 1959<sup>(12)</sup>, Takita 1963<sup>(13)</sup>). Prophylactic nailing for imminent pathological fracture was first reported by Gnessmann and Schuttemeyer in 1947 and is now recognised as a useful modality in treatment of secondaries in weight bearing bones (Devas 1956<sup>(14)</sup>, Bremner 1958<sup>(15)</sup>, Francis 1960<sup>(16)</sup>, Fidler 1973<sup>(17)</sup>).

Carcinoma of the breast is the commonest source of primary malignancy that spread to long bones in our series and

this is similar to other studies (Bonarigo 1967<sup>(2)</sup>, Marcore 1967<sup>(18)</sup>, Parrish 1970<sup>(3)</sup>, Galasko 1974<sup>(19)</sup>). Carcinoma of the thyroid, prostate and nasopharynx, which are commonly looked for as primary sites of bony metastasis accounted for just slightly over 10% of the long bone secondaries. Patients with carcinoma of the breast survived the longest (mean of 12.8 months) which concurred with a study by Parrish (Parrish 1970). More than half of the patients presented within the first 12 months after diagnosis of the primary. Careful follow-up of these patients clinically and radiologically during this period would allow early detection of bony involvements and thereby avert the danger of a fracture. As reflected in our studies, early diagnosis and prophylactic fixation give better results in terms of pain relief and ambulatory status compared to fixation after a fracture.

Although prophylactic fixation offers good post-operative palliation, it is not without risks. This is especially so when multiple fixation is carried out in a single operative session, which is shown in our series to be associated with a high operative mortality (50%). This often happens when a patient presents with a pathological fracture, and is noted to have a metastatic lesion in another long bone for which the surgeon decides to carry out prophylactic internal fixation at the same admission. Possible factors responsible for the high operative mortality include poor anaesthetic risks, long operating time with excessive blood loss and the use of bone cement. In our study, a large proportion of the post-operative mortality in this group of patients are related to hypovolaemia. This article advises caution when carrying out multiple fixation and advises the surgeon to be prepared to postpone the second fixation to another operative session should he feel that the risks outweigh the benefits.

We affirm that operative fixation of metastatic long bone disease offers good palliation for the cancer patient. The excellent results achieved with regards to pain relief and ambulation together with the reasonable period of survival post-operation make surgery worthwhile. Careful pre-operative assessment to identify high risk patients and close intra-operative monitoring will help in reducing operative mortality.

### CONCLUSION

Internal fixation of metastatic long bone disease has a definite role in the management of the patient with advanced cancer. It offers good palliation in terms of pain relief and ambulatory status. Multiple fixation at one operative session is associated with high operative mortality (50%). Careful pre-operative assessment and patient evaluation to identify high risks groups are necessary to avoid high operative mortality.

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