

FRACTURES OF FEMORAL SHAFT:

A COMPARATIVE STUDY OF RESULTS
OF TREATMENT AT KENYATTA NATIONAL
HOSPITAL (K.N.H.)

FROM: JANUARY 1980

TO: DECEMBER 1984

DR. MURITHI G. K.

A THESIS SUBMITTED IN PART FULFILMENT
FOR DEGREE OF MASTER OF MEDICINE IN
SURGERY - UNIVERSITY OF NAIROBI

FEBRUARY, 1987

UNIVERSITY OF NAIROBI
LIBRARY

University of NAIROBI Library



0390075 0

ACKNOWLEDGEMENTS

I am very grateful to Mr. J. A. O. Mulimba, my supervisor for his continued guidance and advice throughout the whole work.

I would also like to thank the members of Records and Radiology Departments for their assistance especially Mr. A. F. O. Maloba from records Department.

Finally I thank Miss Cathleen Ithiri for typing the manuscript.

DECLARATION

THIS THESIS IS MY ORIGINAL WORK AND
HAS NOT BEEN PRESENTED FOR A
DEGREE IN ANY OTHER UNIVERSITY

SIGNED: *Imuel*

CANDIDATE

THIS THESIS HAS BEEN SUBMITTED
FOR EXAMINATION WITH MY APPROVAL

SIGNED: *Mulimba*

SUPERVISOR

CONTENTS

	TITLE
	SUMMARY
I	INTRODUCTION
II	AIMS OF STUDY
III	MATERIALS AND METHODS
IV	RESULTS
V	MANAGEMENT
VI	COMPLICATIONS OF INDIVIDUAL METHODS
VII	DURATION OF HOSPITALISATION
VIII	AVERAGE HEALING TIME
X	DISCUSSION
XI	CONCLUSIONS
XII	APPENDIX
XIII	REFERENCES

A STUDY OF FRACTURES OF FEMORAL SHAFT:
A COMPARATIVE STUDY OF RESULTS OF VARIOUS
METHODS OF TREATMENT AT KENYATTA NATIONAL
HOSPITAL (K.N.H.)

SUMMARY: The various methods used in management of fractures of femoral shaft were reviewed. A total of 306 fractures were seen and managed over the period of study. Complications associated with individual methods were compared and management of those complications was also reviewed. Duration of hospitalisation together with healing time in different methods were compared. It is suggested that prospective study can be carried out to compare healing time in different methods where radiological comparison can be done at similar or equal intervals.

I INTRODUCTION

Fractures of femur are quite common and rank high in list of admission in trauma wards at Kenyatta National Hospital (K.N.H.). Majority of these fractures are associated with road traffic accidents. With current increase of road traffic accidents on Kenyan roads fractures of femur are bound to rise accordingly. Healing of long bones takes a long time and is associated with a degree of morbidity. With incidence tending to rise, duration of hospitalisation becomes significant due to high demand for available hospital beds.

There are no hard and fast rules for treatment of femoral shaft fractures and choice of method used depends heavily on attending surgeon. However, associated injuries may have some influence on method used together with the type of fracture, apart from the experience of the surgeon.

It was with above background that the study was set to review the fractures of femur as seen in Kenyatta National Hospital (K.N.H.) in adult patients over a period of five years from January 1980 to December 1984. Children were not included in the study because treatment is almost uniform.

II AIMS OF STUDY

The aim of study was to review the incidence of femoral shaft fractures as seen in Kenyatta National Hospital (K.N.H.) and various methods used in management of these fractures and compare them in the following ways.

- (i) Rate and type of complications associated with each individual method.
- (ii) Average duration of hospitalisation for each method.
- (iii) Average healing time for each method.

The causes and types of fractures seen were also reviewed.

III MATERIALS AND METHODS

This was done by reviewing hospital records of patients admitted in Kenyatta National Hospital (K.N.H.) over a period of four years, from January 1980 to December 1984. All patients referred from other hospitals after initial treatment and developed complication were not included in the study. Also all the pathological fractures were excluded from this study.

DEFINITION: Femoral shaft is taken to mean tubular bone extending from a few centimetres from lesser trochanter to few centimetres above adductor tubercle in supracodylar region (1).

the oldest was 70 years. The mean age was 45.5 years. This shows that most of patients were in their primes of life and productive in the country.

Table I Age Distribution

<u>Age In Years</u>	<u>No.</u>	<u>Percentage</u>
16-20	23	8 %
21-25	44	15.4 %
26-30	44	15.4 %
31-35	44	16.7 %
36-40	53	16.7 %
41-45	21	7.4 %
46-50	14	4.9 %
51-55	14	1.4 %
56-60	11	3.6 %
61-65	3	1 %
65	2	0.7 %

(b) Sex Distribution

Majority of patients were males.

Table 2 Sex Distribution

<u>Sex</u>	<u>No.</u>	<u>Percentage</u>
M	232	81.7%
F	52	18.3%

(c) Causes:

There were four different causes as shown in the table below:

Table 3 Causes

<u>Cause</u>	<u>No.</u>	<u>Percentage</u>
Road Accidents	220	77.4%
Fall	57	20%
Assault	4	1.4%
Gun shot	3	1%

As shown road accidents account for majority of fractures seen in our wards. With rising road accidents in the country the fractures of femur are bound to rise as well.

(d) Incidence per year: The following table shows the distribution of patients over the five year period.

Table 4. Incidence

<u>Year</u>	<u>NO.</u>	<u>PERCENTAGE</u>
1980	48	16.9%
1981	52	18.3%
1982	45	15.8%
1983	50	17.6%
1984	88	30.0%

This shows roughly equal distribution over first four years with a sharp rise in 1984. This is likely to remain high.

(e) Types of Fractures

Out of 306 fractures, 295 (96.4%) were noted to be closed with the rest 11 (3.6)% open type.

Type I fractures were 182 = 59.5%

Type II fractures were 144 = 37.3%

Type III fractures were 11 = 3.6%

V MANAGEMENT:

There were three different methods used in management of these fractures. Initially all the patients were put on skeletal or skin traction

awaiting final decision. The patients were either continued on traction until union occurred or other operative methods either plating or K-Nailing applied. In all the cases there was no indication why any particular method was chosen.

(a) The following table shows number and percentage of fractures managed in various methods

Table 5 Methods of management

Method	NO.	Percentage
Traction	133	43%
K-Nail	93	30.39%
Plating	80	26.14%

This shows that traction is commonest method used in managing fractures of femur in our set up here.

(b) Management according to categories

Type I The 182 type I fractures were managed as follows:-

Traction 86 = 47.3½

K-Nail 87 = 47.8%

Plating 29 = 15.9%

Type II The 114 type II fractures were managed as follows

Traction 50 = 43.6%

K-Nailing 23 = 29.4%

Plating 41 = 36%

Type III The 9 segmental type of fractures were managed as follows:

8 were plated using long plates and one of them had two plates.

One had K-Nail.

Open fractures: The 11 open fractures were managed in the following ways:

5 - were treated by traction method and healed well with no problem of infection

3 - were plated of which one became infected.

3 - had K-Nailing of which one developed osteomyelitis from infected K-Nail, and another one developed wound infection.

According to above, the tendency is to treat segmental fractures with operative method usually plating. Other types of fractures didn't influence the method used in management.

(c) Associated Injuries

All the patients with other associated injuries were analysed in view of checking if the injuries influenced the type of method used.

Most of the patients didn't have any associated injuries. Majority of patients who had what was said to be head injury cleared within a few days of admission while on initial traction.

Table 6 Associated Injuries and Management

Type of injury	NO. of Cases in each method		
	<u>Traction</u>	<u>K-Nail</u>	<u>Plate</u>
1. Fracture tibia/fibula same side	5	4	3
2. Fracture tibia/fibula opposite side	1	1	1
3. Fracture pelvis	1	2	3
4. Fracture radius and ulnar	1	2	3
5. Fracture Humerus	3	3	4
6. fracture clavicle	2	1	3

This indicates that associated injuries didn't have big influence on type of method used except possibly for head injury patients who were mainly treated on traction.

VI COMPLICATIONS OF INDIVIDUAL METHODS

Each individual method had its own complications

(a) TRACTION

A total of 133 fractures were managed with this method with a total of 12 complications which needed surgical intervention to avoid or minimise disability.

The rate of complication here is therefore 10.5%. The following is a list of complications in this method and their management.

1. Non Union. This occurred five times (3.8%). They were managed by either K-Nailing or plating. At operation there was soft tissue interposition between fragments.

2. Excessive Shortening: This was when shortening was more than 3 inches as compared to normal limb. This was found in 2 cases (1.5%) and were managed by plating.
3. Malunion: Occured in two cases (1.5%) both needed corrective osteotomy.
4. Refracture: This occured in two cases (1.5%) which were managed by further traction.

This method was associated with high rate of minor complications which were however temporary. The commonest of these was stiffness of knee joint which occured in 25% of all cases. This improved in course of treatment as out patient.

The next common complication was lateral rotation which occured in 6% of cases. In this type of complication, the patients coped well with the disability.

Minor shortening of a limb less that 2 inches occured quite commonly in 15% of cases. This was not a problem to many patients but two were adviced to wear raised boots to compensate for shortening. All the minor complications were easily managed on physiotherapy on out patient bases or at home, however they were quite common and any one patient may have even more than one type of complication eg. shortening plus stiffness of knee joint.

B K-Nailing: A total of 93 fractures were managed in this method, and the number of complications in this group was 19, which is 20.4%. Some patients had more than one type of complications.

The following table shows types of complications with occurrence rate.

Table 7 Complications of K-Nail

<u>Type of complications</u>	<u>No. of Cases</u>	<u>Percentage</u>
1. Infected K-Nail	6	6.45%
2. Superficial Wound infection	3	3.22%
3. Delayed union	3	3.22%
4. Nail migration upwards	2	2.15%
5. Broken Nail	2	2.15%
6. Stiffness of knee joint	2	2.15%
7. Non Union	1	1.1%

As shown above there were a total of seven different types of complications. There was no indication of any type of complications being associated with any particular surgeon. Most of the operations were done by qualified orthopaedic surgeon or residents in orthopaedic rotations.

Management of above complications

Non Union: This occurred in one patient who had broken K-Nail. This was managed by removal/Nail followed by plating and bone graft.

/of

Stiffness of knee joint: This was not associated with K-Nailing as such but method of protection of fracture after operation. This occurred in patients who were put on external splintage following insetion of small size K-Nail, to avoid rotational movements of fragments. This however, improved after physiotherapy.

Delayed Union: This occurred in three patients who were associated with difficulty in K-Nailing. Here there was splitting of shaft longitudinally with excessive periosteal streaping. One other patient had infected K-Nail.

Broken K-Nail This occurred in two patients of of which one was seen in clinic before the Nail was completely broken and it was removed. The other patient had broken pieces which were removed and the fracture plated.

Nail Migration: This was always upward migration which caused a lot of pain in trochantetic region. The nail was hammered back.

Wound Infection: This was mainly superficial wound infection which healed with antibiotics and dressing.

Infected K-Nail_ This was the most serious of the complications leading to prolonged hospital stay and prolonged use of antibiotics. Incidentally this was the commonest of the complications. The treatment here was continuous irrigation of the bone marrow and systemic antibiotics. Early removal of K-Nail was done. Some patients had more than two operations for irrigation and sequestrectomy.

C Plating:

A total of eighty fractures were managed with this type of method. The total number of complications here was 35 with a rate of 43%. More than one type of complications may occur in any one patient.

The following table shows the types of complication and their occurrence rate.

Table 8: Complications of Plating

Type of Complication	No. of Cases	Percentage
1. Loose plate	3	3.7%
2. Broken plate	18	22 %
3. Infected plate	6	7.5%
4. Superficial wound infection	1	1.2%
5. Non Union	3	3.7%
6. Re fracture	2	2.5%
7. Delayed Union	1	12 %

As shown above seven different types of complication occurred in this method, with infected plate and broken plate leading in occurrence rate, and incidentally these were the most serious of the complications. The complications were managed as follows:-

1. Loose plate: These were re-admitted for removal of plate and replating where union had not occurred, and if union had occurred or fracture was stable, external splintage was used.
2. Broken plates: These were managed as above, 11 patients were replated and 7 patients had external splintage after removal of plate. Three patients had broken plate twice i.e. after re-plating, they broke again. This was associated with delayed union.
3. Infected plate: Associated with chronic osteomyelitis and were managed with prolonged use of antibiotics and in all cases plates were removed early.

4. Superficial wound infections: Seen only in one patient and this healed with antibiotics and dressing.
5. Non-union: Occured only three times and two of them had broken plates. All three were treated with compression plating and bone graft with union eventually occuring after a long time.
6. Re-fracture: This occured in one patient who refractured twice, first time above the plate and second time below the plate. In both cases the original fracture had healed. Incidentally this was compression plating.

VII DURATION OF HOSPITALISATION

Hospital stay varied in different group of patients.

(a) Traction

The average hospital stay in this group was 9.1 weeks. There were 17 cases which were not included in final analysis because they over stayed.

The hospital stay is slightly low in our set up because some patients are discharged when fracture was stable on external splintage mainly **plaster** cylinder.

The seventeen cases who overstayed need mention because they reflected complications of

this type of method which can be detected early or other methods can be used in initial management.

1. Seven cases had delayed union or non union and needed operation after initial traction of 13-14 weeks. At operation all had soft tissue interposition at fracture site.
2. Three patients had delayed union and were treated with prolonged traction, one of them was elderly man of seventy years.
3. Two patients had excessive overlap and hence shortening or malunion and had to have surgical correction after initial traction of 4 months.
4. One patient had angulation and had to have refracturing to correct deformity and then traction again.
5. Two patients were associated with fracture Tibia/Fibula opposite limb and hence mobilisation was not possible.
6. One patient had refracture after traction and had further traction.
7. One patient had septic arth ritis in opposite knee which led to stiff knee joint and hence mobilisation was not possible.

B. K-Nail Group

The average hospital stay in this group was 5.3 weeks.

There were 3 patients who were not included in this analysis because they overstayed.

Majority of patients had an average duration of 2 weeks waiting time before operation.

Analysis of patients who stayed over average time was done in an effort to find any reason why they over stayed longer than 14 weeks. Fourteen weeks were taken because, the fracture is expected to have healed then without operation.

The following are the findings:

1. 4 patients had bilateral fractures of femur, and even after operation early mobilisation was not possible.
2. 5 patients had infected K-Nail, needing longer stay to control infection.
3. 2 patients had wound infection.
4. 2 patients had broken K-Nail, needing more operations.
5. 2 patients had delayed union due to difficulty in operation.
6. 8 patients were associated with long waiting time before operation.
7. 7 patients were associated with other injuries mostly fracture of tibia/fibula on the same or opposite limb, hence mobilisation was not easy.
8. 8 patients had head injuries and another man of seventy years developed hypostatic pneumonia and could not be mobilised easily.

This indicates that if complications can be

reduced, average stay could be reduced as well also operations should be planned early to reduce recumbency.

(c) Plating method:

The average hospital stay in this group was 5.9 (6) weeks this analysis excluded seven patients who over stayed longer than 14 weeks.

The average waiting time before operation in this group was 3.5 weeks.

There were 28 patients who stayed longer than average 6 weeks and analysis of these was done to find out why this was so. The following is the analysis:-

1. 5 patients waited about 4 weeks before operation.
2. 4 patients had other associated injuries and hence early mobilisation was not possible.
3. 1 patient had bilateral fractures of femur and early mobilisation was not possible.
4. 1 patient had refracture after plating
5. 2 patients had broken plates.
6. 1 patient had loose plate.
7. 5 patients had infected plates.

This indicates long duration of hospitalisation is mainly due to complications and long waiting time before operation is performed.

VIII AVERAGE HEALING TIME

This was purely on clinical grounds. There were few records in all the groups which indicated when the fracture had healed. Majority of operated patients reappeared in clinic for removal of plates when the fracture had long healed, having been seen in clinic only once or twice after discharge from ward. For non-operated patients the follow up was equally disappointing, patients appearing in clinic very irregularly.

The average healing time was worked out in few patients in all groups who had proper records hence this may not be representative of actual healing time

The average healing time in K-Nail group was the shortest which was 4.5 months, followed by traction which was 5 months and this was closely followed by plating which was 5.5 months.

A small series of 13 patients had all records. This group had dynamic compression plating using A.O. instruments. The average healing time here was 3.5 months. All the fractures were plated within the first two weeks. The small series indicates that for plating, compression plating gives better results in healing time and early mobilisation.

X DISCUSSION

The femoral shaft is long tubular bone well covered by muscles which provides excellent blood supply. Because of this healing of fracture of femur should not be a big problem. Unfortunately the muscles due to their contraction displaces the fragments which makes some surgical intervention necessary to avoid malunion and minimise disability.

This fracture in adults is associated with prolonged disability and frequently permanent disability. Because of long time to heal, and the associated disability, the economical burden imposed by this injury is great and constant efforts to develop methods of treatment which will shorten enforced recumbency and lighten the financial strains are always being developed. The objective of any method employed is to effect recovery in shortest time and at minimum cost (13).

(a) History of Methods:

The oldest method was practiced even before Hippocrates. In this method the fracture was reduced manually and immobilised by external splintage like boards (2,8). This was the only method available until Chailiac in 1350 (14), introduced idea of skin traction which gave the advantage of eliminating the risk of displacement and overlapping due to insufficient external fixation.

The discovery of X-ray by Rontgen in 1885 (2) indicated that most fractures were not healing satisfactorily. In 1847 Malgaigne introduced idea

of skeletal traction using malgaine's hooks (2) which affected more traction on fracture site. This was later improved after introduction of Stainman' pin in 1907 for use as skeletal traction (2).

Traction remained a popular method of treatment more so in fractures associated with soft tissue injuries and open wounds where the fracture continued to heal while awaiting closure of the wound. This method is however associated with prolonged recumbency and needs frequent adjustment of traction (4).

Open reduction was attempted as early as 1823 by Rogers, where he used wires for fixing the fracture (4). This was found to have poor results. In 1905 plating method was started by Lane which proved to be stable in some fractures (4).

External skeletal fixation has also been tried and this dates as back as 1870 by Bonnet with some success (4).

In 1940 Kuntschner published his work on use of intramedullary fixation of this fracture using long nails. This method was popularised in Germany during the second world war using the war casualties. After the war the method became very popular until 1960's when reports of complications started being published. (8).

Plating also became popular with development of safe anaesthesia more so with introduction of compression plate by Muller and Willernergger. (8).

Mooney and his associates in 1970 introduced plaster cast brace for use as ambulatory treatment

of femoral shaft fractures (6,8,). This method combines safety of closed traction method and early mobilisation offered by operative methods.

(b) Results as compared to others

In this study there were three available methods for managing fractures of femur as shown earlier. Traction was the most commonly used method and this corresponds well with studies done elsewhere. Nichols working in England found traction was used in 73%. In the centre he did his study (9). In this same study road accidents contributed 84% of total causes of the fracture as compared with ours which is 77%.

The results of individual method are very much comperable to results of studies done elsewhere. Traction method is associated with prolonged recumbency while operative methods offers short recumbency (13). Internal fixation is however associated with high rate of complications more so when plating is chosen as the method of treatment and the worst being sepsis (8,13). After internal fixation sometimes the fracture needs protection before healing is achieved, inform of external splintage (13). In some studies the rate of complication in plating is as high as 53% (13) in this study it is 42% and the worst of the complication is osteomyelitis.

The short recumbency offered by operative methods may be masked by rate of occurence of complications where by hospital stay is prolonged while treating complications, which also increases

the cost of treatment in terms of drugs and management as a whole. All operative methods needs second operation to remove the metals.

Traction method is relatively safe in terms of infection and don't require elaborate operative techniques but it requires great manipulative skill to achieve acceptable anatomical reduction to minimise its complications. Radiological follow up and adjustment of traction is necessary to avoid overlapping of fragments, over traction and detecting fractures which need operative reduction. Measurement of limb length and comparing with sound limb helps to detect malunion early.

The commonest single complication of this method though temporary was stiffness of knee joint, which was about 25%. This is expected from the fact that the knee is immobilised for long (13). This together with prolonged recumbency have been minimised with introduction of plaster cast bracing after initial traction of few weeks for the fracture to be "sticky" (13,5,6,11,15,16). These braces allow knee joint movements and physiological stress for fast healing of fracture while the patient is mobilised.

Compression plating offers fast clinical healing as shown in small series of compression plating.

XI CONCLUSIONS

1. The safest method for average surgeon is traction. Therefore traction should be standard method of treatment for femoral shaft fractures unless special circumstances dictate otherwise

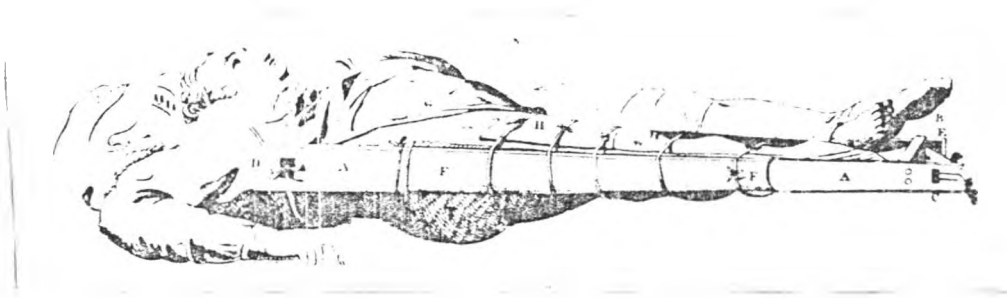
2. Fractures needing internal fixation should be detected early to minimise recumbency.
3. *There is need to improve traction in our set up to detect complications early and possibly introduce early ambulatory methods by use of cast bracing to reduce hospitallisation period and stiffness of knee joint.*
4. K-Nail in proper operative environment gives best results of operative methods.
5. Plating for fractures of femur should be left to special cases where other methods are not applicable.

APPENDIX 1 a,b,c,d,

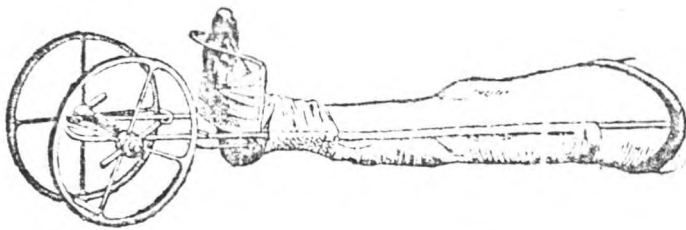
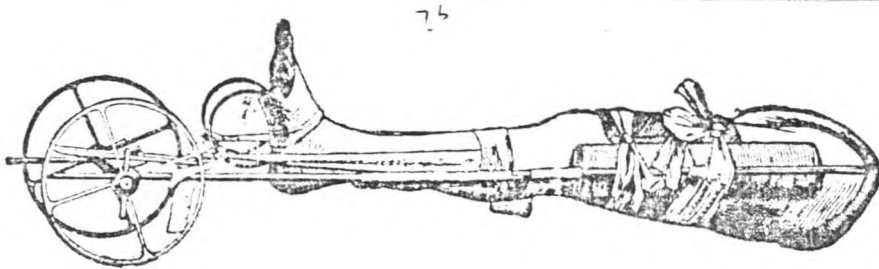
a earliest method of immobilisation after manual reduction,

b & c Improvement by applying continous traction

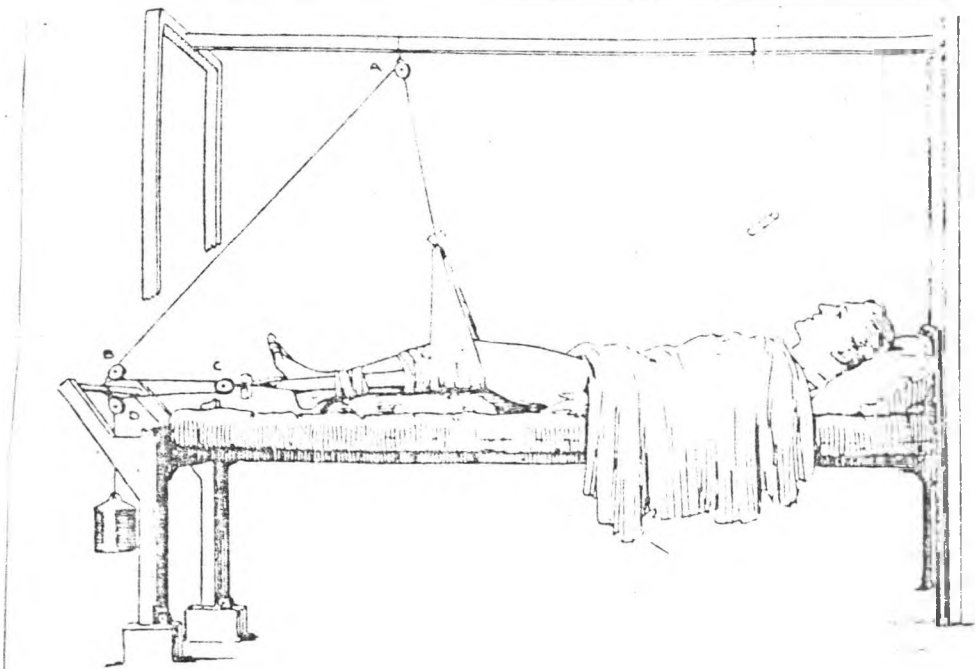
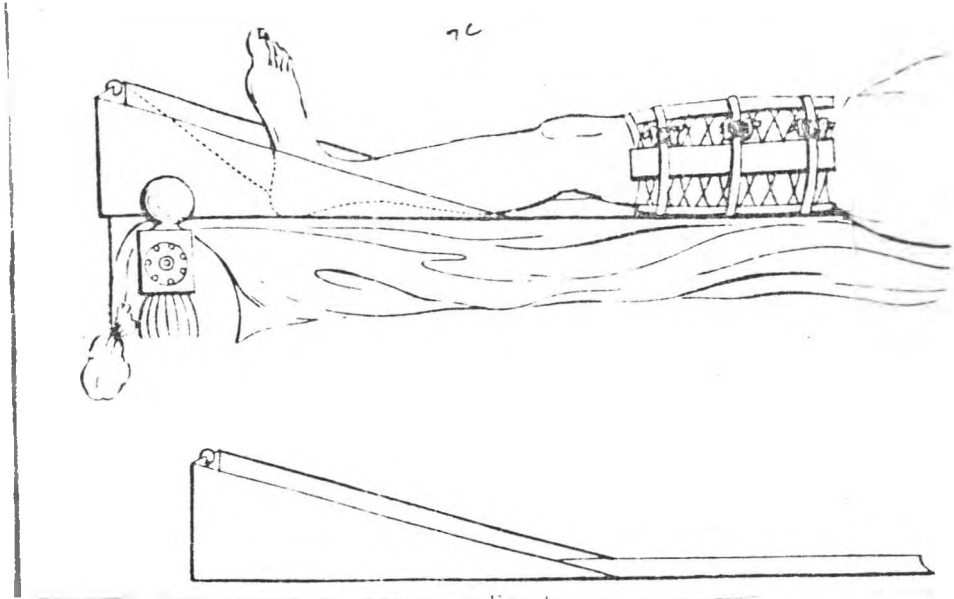
d Russel's traction



a- Patient immobilised on boards



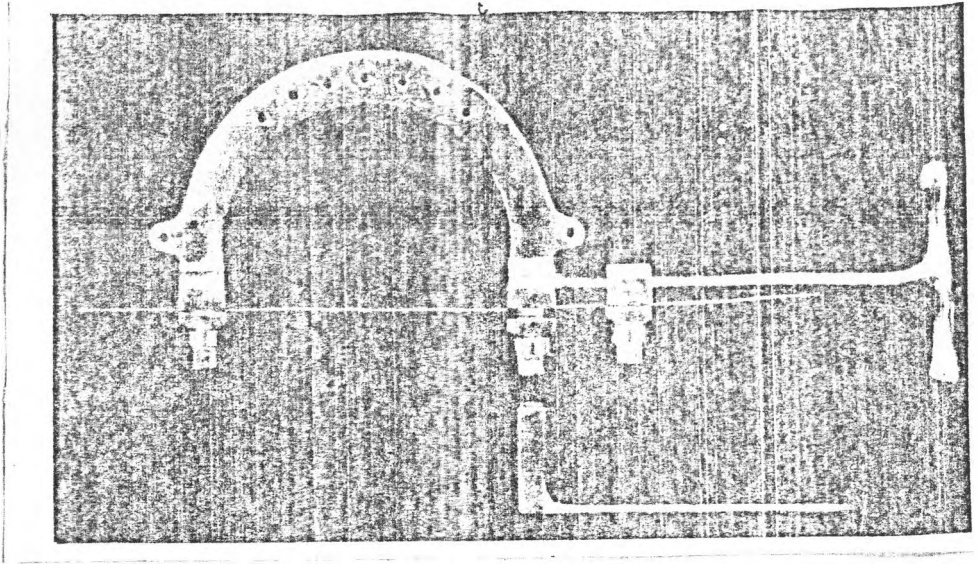
APPENDIX 1



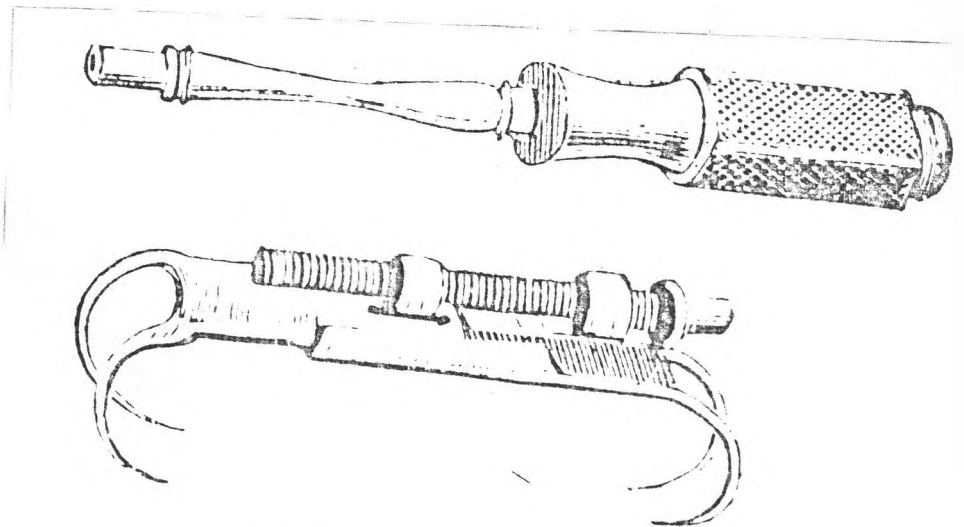
d Russel's traction

APPENDIX II

Different types of hooks and pins which have been used for skeletal traction

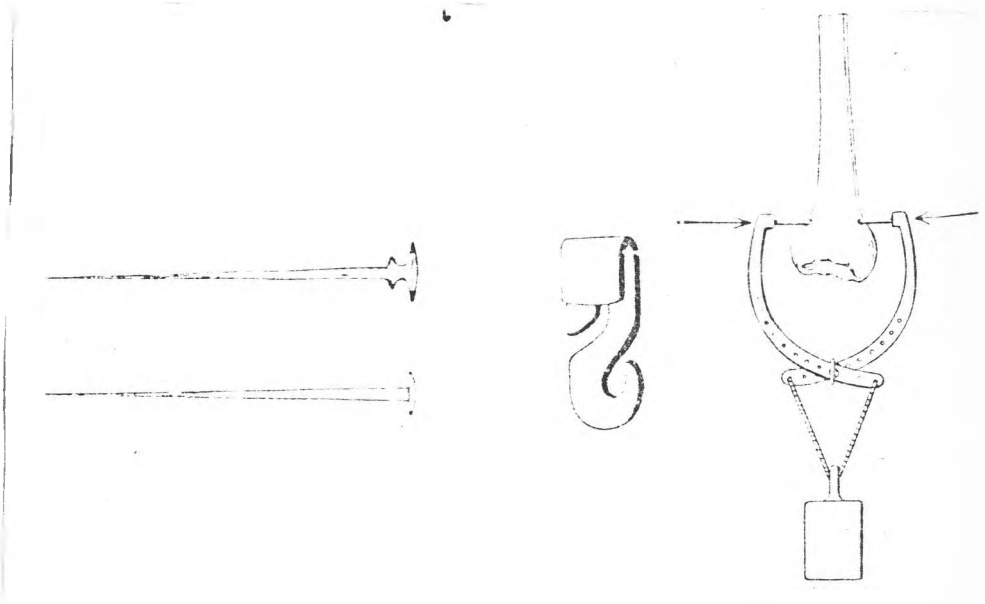


Traction bow with a fine wire for skeletal traction



Malgaigne's hooks.

APPENDIX II



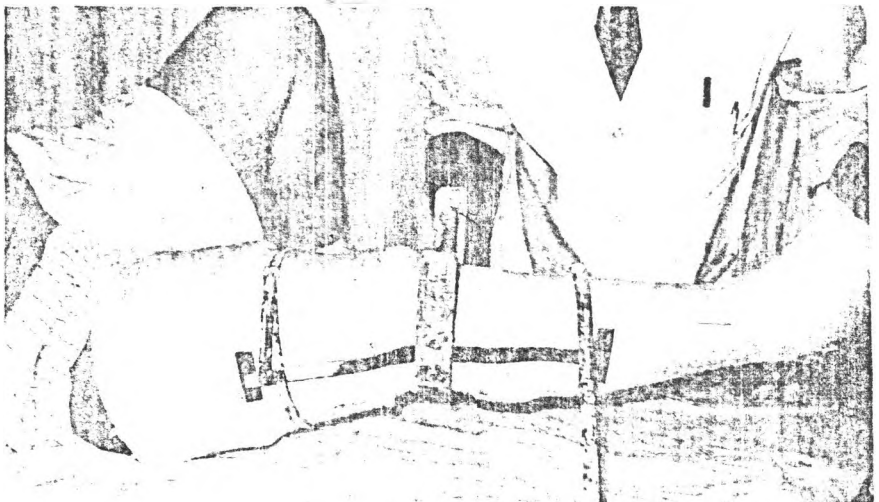
Steinmann's original pins and Traction hooks

APPENDIX III

Application of cast brace



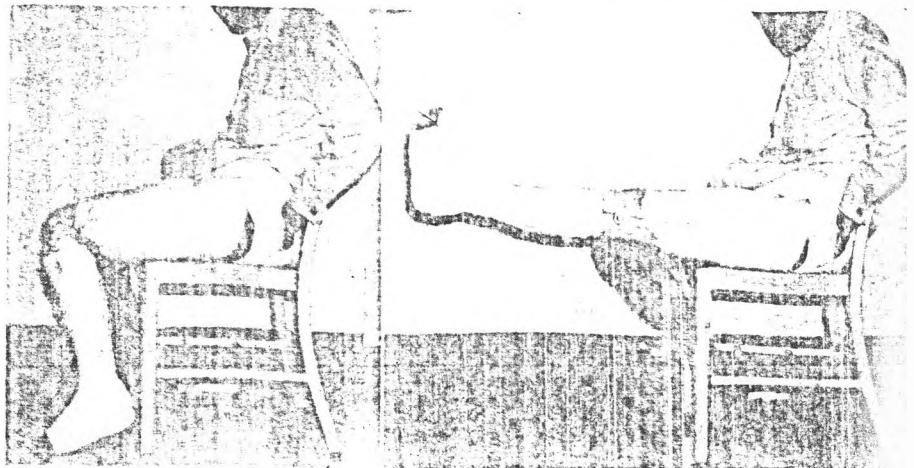
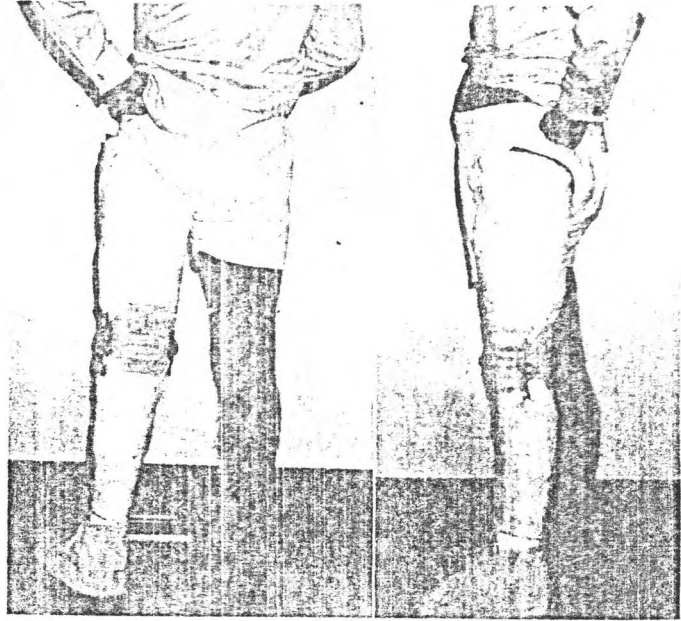
Cast brace for proximal and middle thirds of femur
with a pelvic band



Applied cast brace

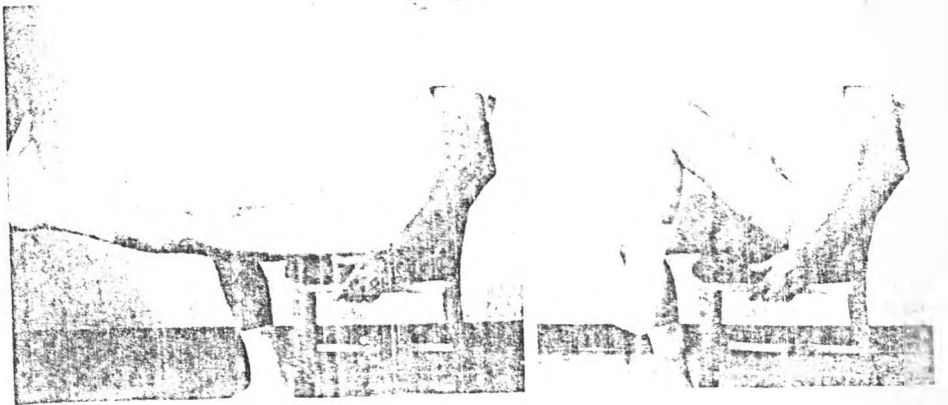
APPENDIX III

Patient on cast brace showing knee joint movements



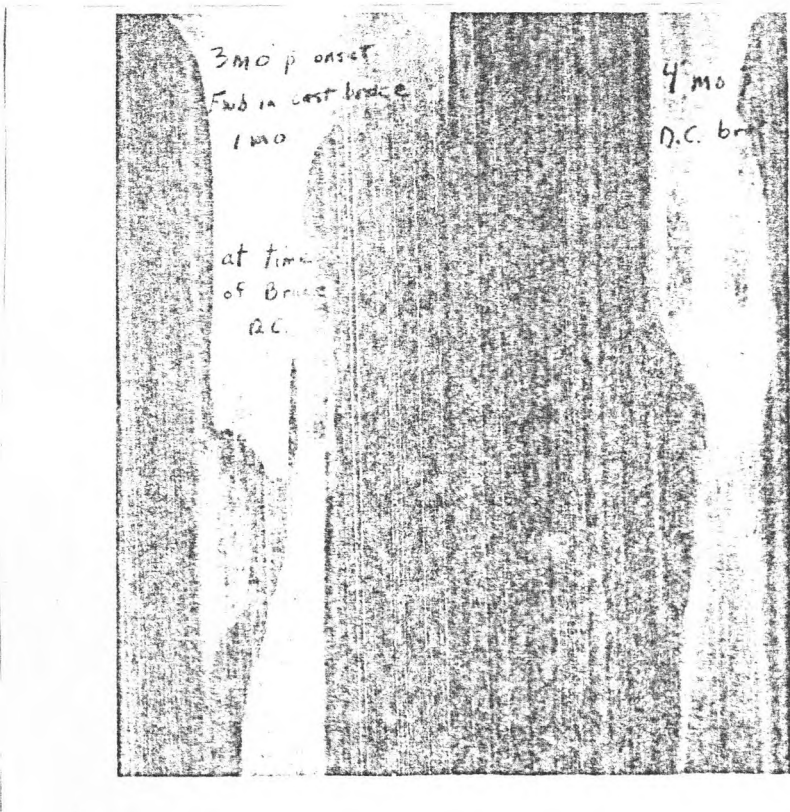
APPENDIX III

Fracture managed by cast brace showing union and good
knee joint motion



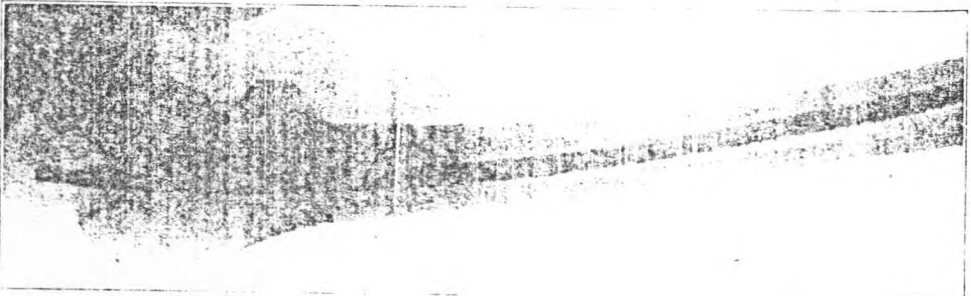
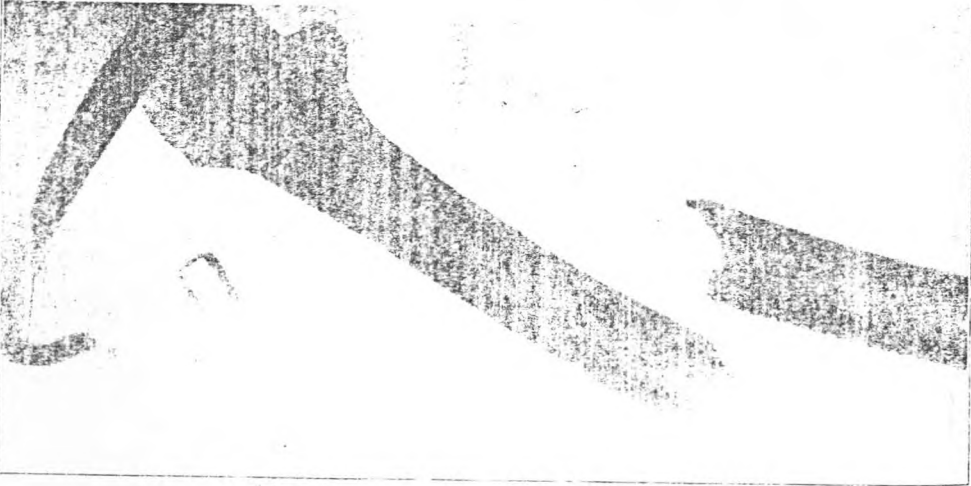
APPENDIX III

Fracture treated by cast brace showing functional union and radiological union

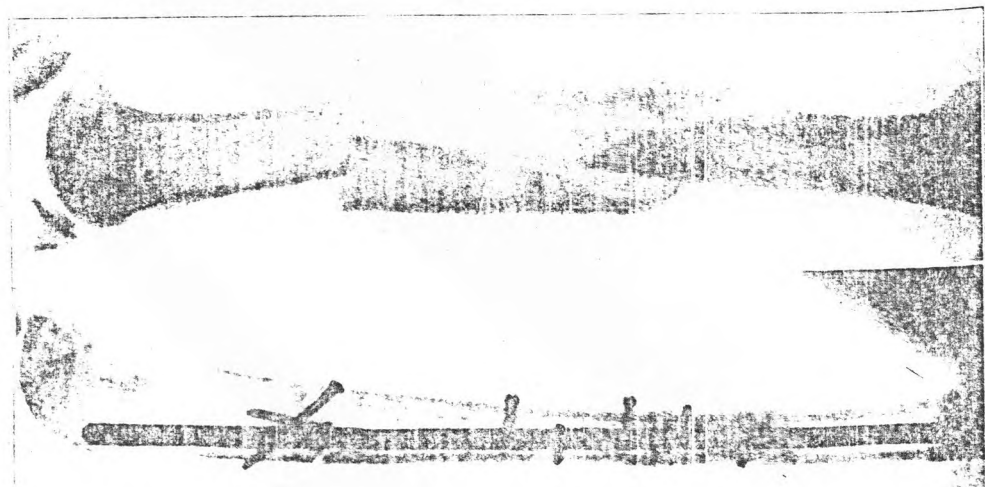
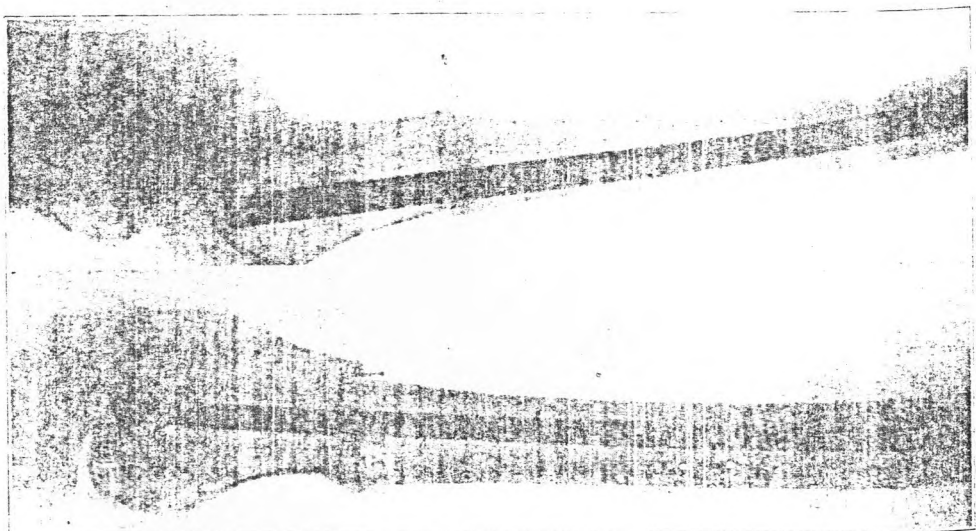


APPENDIX IV

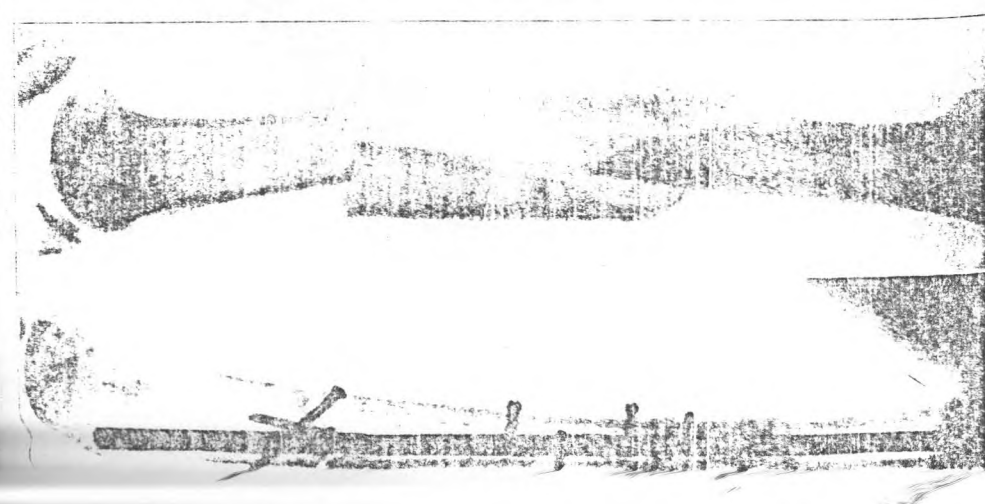
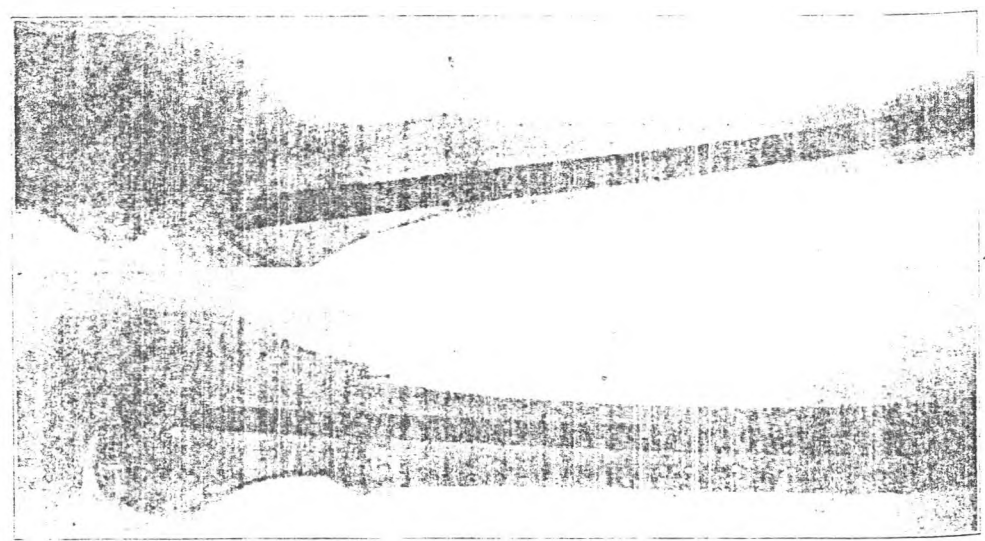
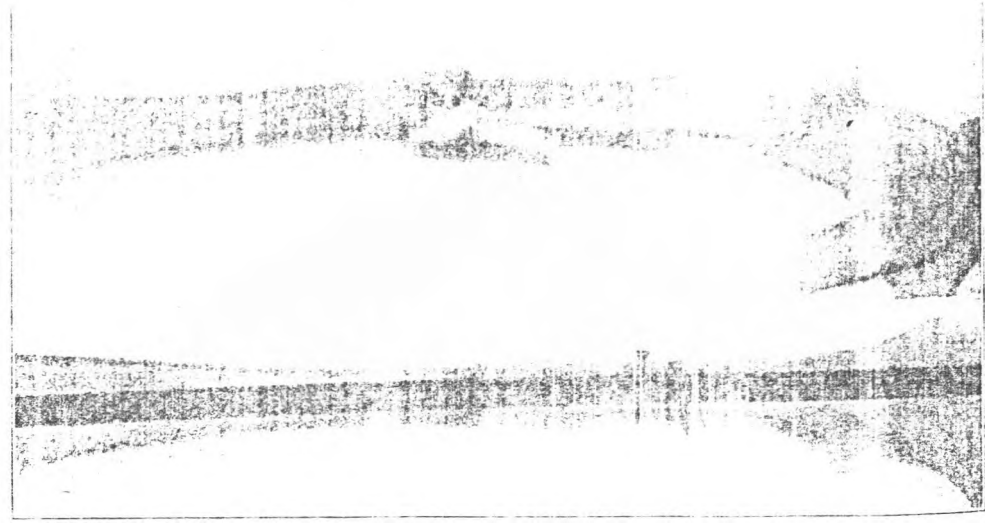
Different types of fracture treated by intramedullary nails



APPENDIX IV

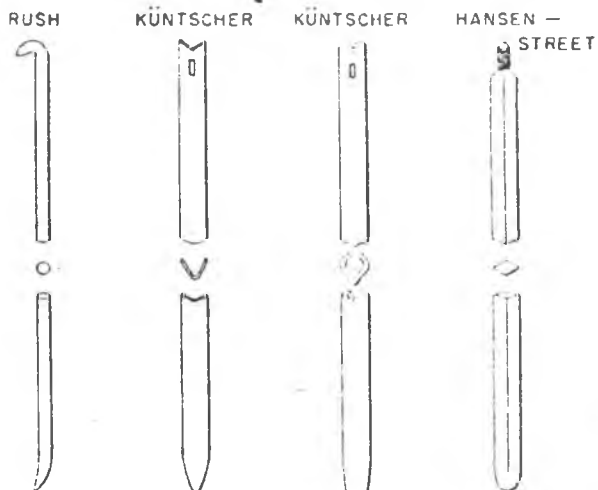


APPENDIX IV



APPENDIX V

Different types of Intramedullary nails used

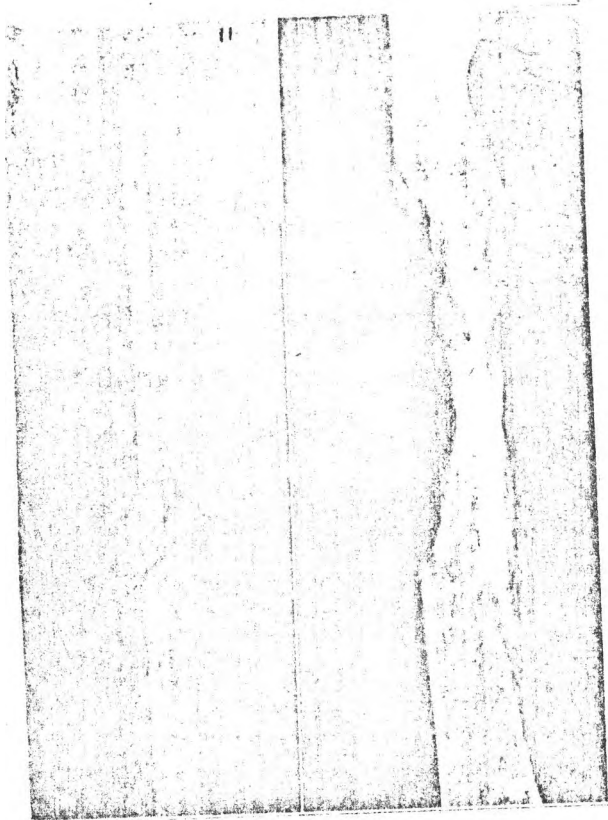


Fracture Treated by plating showing broken plate and subsequently treated by Intramedullary Nail



APPENDIX VI

A fracture showing one of most serious complication of internal fixation - osteomyelitis.



REFERENCE

1. Carr C. R.
Results of Treatment of Fractures of femur by:
K-Nailing - J. Bones/Joint Surgery
55A: 690-700 1973
2. Palter L. F.
History of Traction.
J. Bone/Joint Surgery
50A: 1603-1617 1968
3. Stryker W. S.
Comparison of Results of operative and Non
Operative Treatment of Fractures of Femoral
Shaft.
J. Bones/Joint Surgery
52A: 815-1970
4. Street D. M.
Medullary Nailing of Femur Comperative Study
of Traction, Plating and Nailing.
JAMA 143: 709-74 1950
5. Anderson
Conservative Treatment of Femoral Shaft
Fractures. J. Bones/Joint Surgery
49: 1371- 1967
6. Mooney Vert
Cast Bracing for Fracture of Femur.
J. Bones/joint Surgery
52:815-1970
7. Carpenter
Complication of K-Nail.
J. Bones/joint Surgery
52A: 815-1973
8. Mohinder A. M.
Fracture of Shaft of Femur Progress In
Treatment.
1961-1971. AM J. of Surgery 127:434;41
9. Nichols. P. J. R.
Rehabilitation after Fractures of Femur.
J. Bones/Joint Surgery
45B: 96-102 1963
10. Letter
Indications for K-Nailing
JAMA 158: 1001-1955
11. Connolly F.
Closed reduction and early cast bracing in
Fracture of Femoral Shaft.
J. Bones/Joint Surgery
55A 1559-1581 1973

12. Dencker Haws
Fracture of Femoral Shaft Comperative Study
of methods of Treatment Acta Chir Scand.
13: 173-184 1965
13. Colonel Francis M.
Fractures of the Shaft of Femur In Adults.
Evaluation of methods of Treatment
JAMA 128: 1006-1012 1945
14. Petterson A. H.
Ten year experience with Femoral Shaft Fractures
J. Trauma 15: 348-355 1975
15. Schweigel J. F.
A comparison of Ambulatory Verses Non-
Ambulatory Care of Fractures of Femur.
J. Trauma 14: 474-481 1979
16. Scully T. J.
Abmulatory Non Operative Management of Fracture
of Femur
CLINIC ORTH. 100: 195-207