

TREATMENT OF SIMPLE FRACTURES OF RADIUS AND ULNA WITH INTERNAL FIXATION WITHOUT EXTERNAL SUPPORT

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INTRODUCTION

Fractures of radius and ulna in adults are difficult injuries to treat. The result of conservative treatment may be good, if one is lucky enough to get a good reduction and maintain it in plaster till the fractures unite. This may take anything from three to six months. In a large number of cases, however, the final result is often disappointing as the length, apposition, axial and normal rotational alignment must be retained for a good functional result. Invariably the proximal fragments undergo rotational deformity of pronation type which becomes difficult to restore by close methods. Hence the chances of mal-union or non-union are greater because of difficulty in reducing and maintaining the reduction of two parallel bones in the presence of the pronating and supinating muscles which have angulatory as well as rotatory influences. Therefore end results obtained by conservative treatment are far from satisfactory in the majority of cases, especially in adults where compensatory growth changes of childhood are lacking and where the ability to recover with an excellent functional result, in the face of only a fair anatomical result is usually absent. In the series of Knight and Purvis 1964, there were 41 cases with only 29% satisfactory results and required 4½-5 months immobilisation. They had 12% non-union. Bolton and Quinlan 1952 had 92 patients and displacement occurred in 14 cases and 10 cases had non-union. In the Series of Dr. K. S. Bose 1959, of 600 cases, only 45% had good results in adults.

Today our criteria of functional recovery are becoming more exact and there is an increasing tendency to find methods of early return to

function of the part so as to shorten the rehabilitation time, minimize disuse atrophy of soft tissues with speedier return to normalcy. In this series, square nails were used and patients were immobilised for 10 days only. We have included only simple fractures of the radius and ulna in the middle and upper one-third and single fractures of radius and ulna. Fractures of the radius and ulna at the lower end or compound and comminuted fractures have been excluded from this series. We want to prove that fractures of radius and ulna can be treated without plaster with good results.

The ideal treatment for fractures of radius and ulna would be to make the two broken bones work together within 10 days. Bonding has been tried for these cases but was not very useful due to breaking of the bonding material and delayed union. The old dictum 'A square peg in a round hole' is well known. It seems impossible to pass a square peg in a round hole, as a corollary, if it is possible to pass a square peg in a round hole then the security of this combination would be the finest. It was on this assumption that this work was started by using square nails in rounded medullary cavities, of radius and ulna. The idea of doing this work started in stages. Till 1952, these cases were treated with reduction and an above elbow plaster cast till the fracture was united. It is however not possible to obtain anatomical reduction in some percentage of cases though functional result was good. Plaster immobilization had to be prolonged and often repeated reductions were necessary. Non-union did occur in about 15% of cases. To curtail all these difficulties surgical intervention was sought for since 1952. Initially, Kirshner wires were

used. It was difficult to maintain corrected rotational deformity and electrical reaction was noticed in a few cases. Subsequently Lumbrinudi's wires were used. The results distinctly improved; however, plaster immobilisation had to be continued for about three months. Rush nails were used but were found to have no added advantage over Lumbrinudi's wires. Kuntscher nailing was also tried but it was technically more difficult and all sizes of nails were not available. Naturally a better method was necessary which would curtail immobilization without interfering with the end result. Dr. Sage suggested the use of square and triangular nails for fractures of the forearm. He however preferred prebent triangular nails. In one case of fractured Radius, no plaster was used with good results. This gave me food for thought and after considerable thinking, I felt that the time had arrived where we can treat fractures of the radius and ulna without plaster but we must have the proper nail. It was possible to make square nails of three diameters 3 mm, 2.5 mm and 2 mm. This first operation was done on 11.12.'59 (in a young adult aged 20 years having simple transverse fractures of radius and ulna in the upper one-third) by Dr. A. K. Talwalkar. In this case plaster was kept on for three weeks. The fractures consolidated uneventfully in four and a half months time. After this preliminary success every case of fractured radius and ulna which was simple and in the middle and upper one-third has been nailed without any regrets. We believe this operation should be done as a routine in every simple fracture of radius and ulna as the results are gratifying.

PRE-OPERATIVE MANAGEMENT

Roentgenograms of the forearm are taken in two planes on admission and the limb is immobilised in two aluminium gutter splints to alleviate pain. The patient is taken for surgery as soon as possible. In the majority of cases operation was undertaken between the second and fifth day. The diameter of the medullary cavity is determined from the roentgenogram. The length of both the bones is then measured on the normal side. The length of the ulna nail is measured from the tip of the olecranon to ulna styloid and that of radius is measured from the Lister tubercle to the head of the radius. It is very necessary to have an exactly fitting nail in length and diameter. In initial stages, thinner nails may have to be used. Sometimes the roentgenogram is deceptive, especially if taken from a short distance hence it is imperative to have a

nail of one diameter smaller and one diameter bigger with identical length at hand before starting the operation.

OPERATIVE TECHNIQUE

The operation is done under a pneumatic tourniquet under general anaesthesia. In this series the ulna was nailed first as it was found to be easier being a subcutaneous bone.

ULNA NAILING

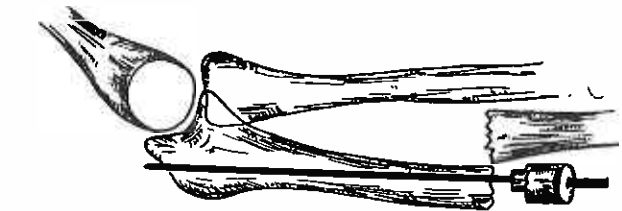


Fig. 1a.

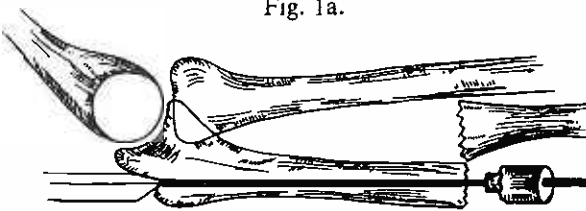


Fig. 1b.

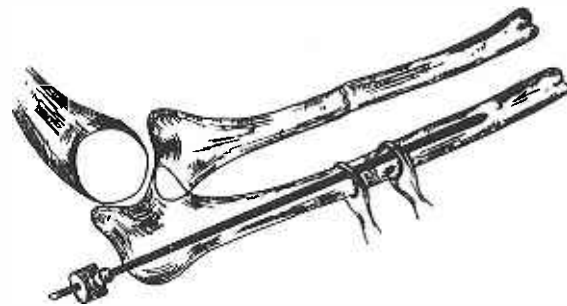


Fig. 2

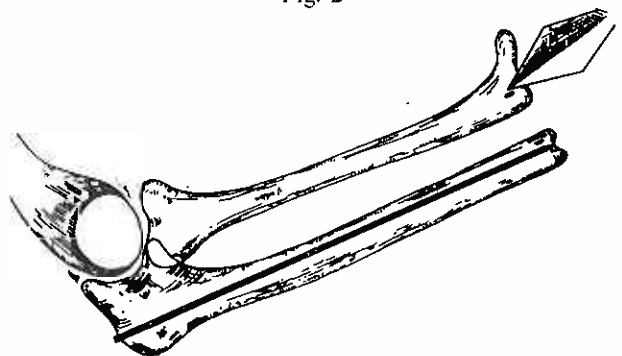


Fig. 3

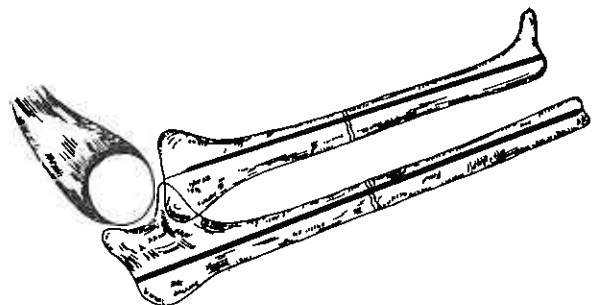


Fig. 4

The ulna is exposed by a 3 inch long incision over the subcutaneous border at the fracture site. The proximal fragments is taken out by a dissector and Kirschner's wire is drilled through it as in Fig. 1. The opening in the olecranon is enlarged by Kunster's awl. The awl is taken out and the square nail of correct size mounted in a special handle is introduced through the opening. The fracture is reduced by making use of two Burns forceps and the nail is driven through the distal fragment by gentle rotatory movements of the handle (Fig. 2.) The nail should never be hammered otherwise distraction, splintering and impaction may occur. It is very necessary to have a trusted assistant to pull the hand and another experienced assistant to push the nail into the distal fragment at the correct time. The Surgeon should concentrate on anatomical reduction at the fracture site with the least manipulation. The periosteum should not be elevated at the fracture site. Even the clots are retained at the Fracture site. A check roentgenogram must be taken before the nail is completely pushed inside. Skin alone is stitched.

THE RADIUS

The Radius is exposed by a lateral approach at the fracture site. The distal fragments is taken out by means of a blunt dissector. A second incision is made just lateral to the Lister's tubercle, (Fig. 3). The tendons are retracted. An opening is made into the dorsal aspect of the radius at the level by an awl, the bevelled end of the nail is introduced inside and guided up to the fracture site by pushing with the handle. The fracture is now reduced and the nail is guided into the proximal segment. It is imperative to have an absolute anatomical reduction with minimum trauma and no periosteal stripping at the fracture site otherwise restriction of pronation and supination, fixed pronation deformity or cross union are liable to occur. After the nail has entered sufficiently in the proximal fragment pronation and supination is tried. The fracture ends should move together as one piece, then and then alone is the nailing satisfactory. The nail should be introduced right up to the articular cartilage of head of radius to have a maximum hold. Check X-ray should be taken before the nail is fully inside. Skin is sutured alone by interrupted nylon sutures. The part is cleaned, dressings are applied and a well padded above elbow plaster is used.

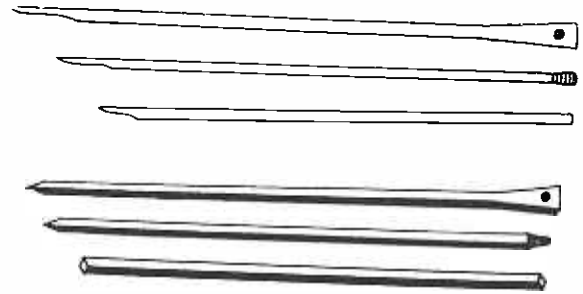


Fig. 5. The Radius and the Ulna Nails. The Radius ones are bevelled at one end. The 3 mm nail has a hole.

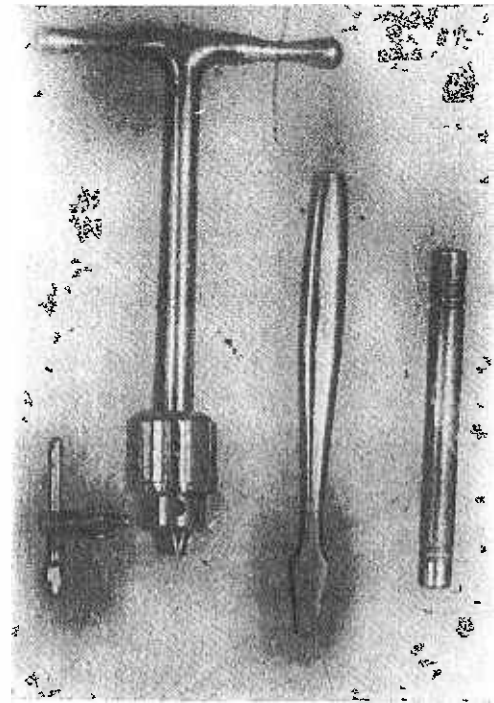


Fig. 6. Special instruments needed. The first one is a Jacob's Chuck on a Long Handle. The second one is a pointed blunt instrument for hammering the nail home. The third one is used for extracting the 2.5 mm and the 2 mm nails.

POST OPERATIVE TREATMENT

Post operatively the limb is elevated till the swelling has disappeared. Penicillin is given as a routine for 10 days. Finger and shoulder movements are encouraged from the next morning to avoid stiffness. After 10 days the plaster and the stitches are removed and active use of the limb is encouraged. Roentgenogram is taken every month till there is evidence of cortical union. Clinically the fracture becomes painless in three weeks time. Initially we had trouble due to the projecting ulnar nails causing pain and bursitis. It is our practice now to select a little shorter nail and then bury the nail completely into the olecranon.

METHOD AND MATERIAL

This series consists of cases of simple fractures of radius and ulna in the proximal two-



Fig. 7.

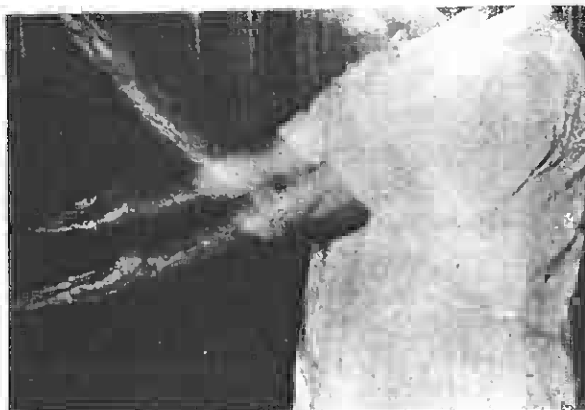


Fig. 9.

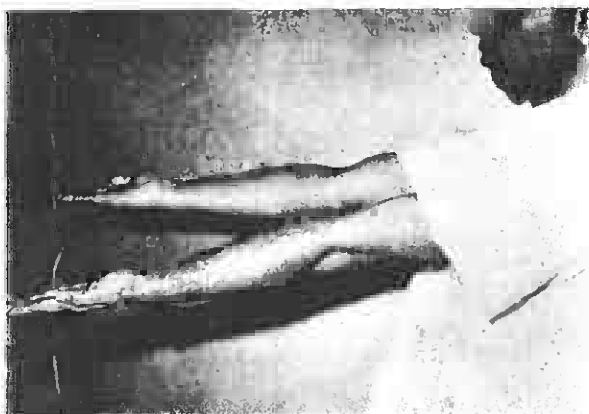


Fig. 8.



Fig. 10.

Figs. 7, 8, 9, & 10 show the results in a Medical student three months after the operation.
He has now become a surgeon.

thirds in adults. Compound fractures included in these series had puncture wounds or small clean lacerations over ulna.

In this series eighty cases have been analysed. They were treated from 1959 to 1963. A large series consisting of every type of fracture will be published after at least five years follow up is available.

This series consists of 80 cases treated in private by me alone from 1959 to 1963. 64 males and 16 females — 80.

TABLE I

Age in years	No. of cases
14-20	11
21-30	34
31-40	21
41-50	6
51-60	5
61-70	3
Total	80

TABLE II

Time of Operation	No. of cases
1-7 days	70
8-14 days	6
15-21 days	4
More than 21 days	-
Total	80

Please note that most of the operations are done very early.

TABLE III

THIS TABLE SHOWS THE SIZE OF THE NAILS USED

	Radius alone	ulna alone	Radius in both fractures	Ulna in both fractures
3.0 mm	1	4	16	38
2.5 mm	4	3	17	12
2 mm	4	-	19	6+
L. Wires	6	1	10	7—
	9	8	62	63-142

TABLE IV
SITE AND LEVEL OF THE FRACTURE

	Radius alone	Ulna alone	Radius & Ulna
Upper 1/3	5	-	12-17
Middle	3	1	40-44
Lower	1	7	9-17
Lower 1/3			1
Radius in two places			1
Ulna in two places			
	9	8	63

TABLE V
UNION OF BONES

	No. of cases	Union
Fracture of Radius alone	9	9
Fracture of Ulna alone	8	7
		1 L wire used
Fracture of both Radius & Ulna	56	56
L Wiring	7	7
Total	88	72
		8

TABLE VI

	Bony Union in	No. of cases
Fracture of Ulna	4 months	2
Alone	5 months	1
	6 months	4
L Wiring		1
	Total	8

TABLE VII

	Bony Union in	No. of cases
Fracture of radius alone	2 months	1
	4 months	1
	5 months	4
	6 months	3
	Total	9

TABLE VIII

	Bony Union in	No. of cases R & U	
Fracture/s of both bones	2 months	2	1
	3 months	-	3
	4 months	7	6
	5 months	23	20
	6 months	24	26
		Total	56 56

TABLE IX

	Incidence of non-union	Remarks
Knight and Purvis 1949	15%	
Robertson 1953	20	
Smith & Sage 1957	14	
Smith 1959	17	
Hicks 1961	7	
Present series	Nil	But not comparable.

Mr. Hicks did the calculations for the simple fracture for me. He found that there were three cases of non-union. My series is not comparable with the other series as it consists of simple fractures only. I consider there are two conditions, one simple fracture and the other compound cases and the results of the two are bound to be different.

TABLE X

Complications	No. of cases
1. Transient posterior interosseous Nerve Palsy	2
2. Bursa over olecranon or dorsum of wrist	4
3. Discharging sinus	2
4. Electrical re-action stopped after removal of nail. Did not affect the Union.	2
Total 10	

DISCUSSION

Complete functional recovery with sound osteosynthesis is the ultimate aim in the treat-

ment of the fractures of the forearm. Sound osteosynthesis demands accurate reduction and its maintenance till bony union. In this series, intramedullary fixation was carried out by square nails. The fixation was so rigid that one could demonstrate pronation and supination without any movements at the fracture site. Active movements were permitted after ten days. This proved to be a great asset in the rehabilitation programme and the sedentary workers can resume work in four weeks or so.

Functionally, it is essential to maintain rotatory movements at the radio-ulnar joints. The restriction of the rotatory movements occurs due to following reasons:

1. Pronation deformity of the distal fragment.
2. Narrowing of the interosseous space due to appositional angulation of one or both bones.
3. Residual posterior angulation of ulna forming a bone-block.
4. Derangement of the inferior radio-ulnar joint.

The first three were obviated by accurate reduction and its maintenance by the use of square nails having a correct fit in length and diameter. The fourth was not seen in this series as it is not seen in fractures of upper 2/3 of the radius and ulna. In this series it was observed that callus at the fracture site was minimum thereby confirming the observation of the AO group of Switzerland that if the fixation is adequate the callus will be minimal.

In forearm fractures, non-union is quite common either due to improper reduction or inability to maintain the reduction. Mal-union and non-union is quite common in conservative methods. It is quite high in cases where plate fixation is done. Smith had reported 20% non-union in his series. Hicks used a special lug plate which obviates the use of plaster cast. In his series non-union is known to occur in about five percent of cases. Nevill Brunwell used 6 hole plates. I am sure the operation must take a long time and the result in the hands of others will not be so good as in the publication. This method is much easier than plating. In this series the fixation was so firm that external fixation had to be kept on for a nominal period of ten days and non-union was not seen in a single case. Early movements helped in maintaining the tone of the muscles and good circulation which is so vital for fracture union. In conclu-

sion we advocate this operation as a routine for simple fractures in the upper two thirds of radius and ulna as the results are so gratifying.

I feel simple fractures should not be jumbled with Compound or communitated fractures.

There is a feeling that in conservative method the Union occurs earlier. I have already quoted Knight and Purvis who say that it takes 4-5 months for union by conservative method. As you have seen just now by this method also union has often occurred earlier. What must people compare is the clinical union by conservation method in 3-4 months to the bony union mentioned in this paper, as shown in an X-ray in 6 months time. Clinically in this series the bones are solid in one month.

The amount of stability obtained after the operation is unbelievable and the patient with sedentary occupation can go to work within 2-3 weeks. Only manual labourers cannot start their work till the fracture is clinically solid and no tenderness is felt at the fracture site.

I know that there are a lot of problems to be solved, as I find from my series in the hospital that there are more complications when the operations are done by various surgeons than when done by one surgeon. We have also got to find out whether operation immediately as I do it usually in private, is not the cause of less complications. I will end on a lighter vein by saying that there is likelihood of finding even a better method than this.

A manufacturer who suggested a change to improve the design of his product and reduce the costs was told that there was no better way to do it. "I am firmly convinced" he replied, "that there is always a better way to produce anything—except children".

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