

OPEN REDUCTION AND INTERNAL FIXATION OF FRACTURE BOTH BONES OF FOREARM THROUGH A SINGLE POSTERIOR CURVILINEAR INCISION

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ABSTRACT

BACKGROUND

Fractures of both the radius and ulna in adults are usually treated by operative method and plating of both forearm bones by two separate incisions is the most commonly adopted method. Sometimes we find difficulty in closure of the wound, particularly when we need adding bone graft to our procedure. When we came across this difficulty, we have started doing fixation through a single curvilinear incision placed posteriorly and exposing radius and ulna through two separate muscle planes.

MATERIALS AND METHODS

From 1995 to 2016 we have treated 130 consecutive cases of fracture both bones of forearm with this method, 43 patients were female, and 87 patients were male. 22 patients required bone grafts. Fractures united in all patients, there was no skin necrosis or cross union.

RESULTS

All patients gained more than 90% of elbow movements and radio ulnar movements. Mean DASH score was 14. Single scar in the extensor aspect of forearm is cosmetically better than two scars produced by anterior exposure.

CONCLUSION

Treatment of fracture both bones of forearm through a single curvilinear posterior incision is cosmetically better, there is no difficulty in wound closure and there is excellent range of motion of both elbow and radio ulnar joints, and if we carefully develop muscle planes and remain aware of position of posterior interosseous nerve there is no chance of neurological complications.

KEYWORDS

Fracture Both Bones of Forearm, Open Reduction and Internal Fixation, Single Curvilinear Posterior Incision.

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BACKGROUND

In the human body forearm as a part of upper extremity serves the dual purpose of stability and mobility. Presence of superior and inferior radio ulnar joints and the interosseous membrane allows the radius to rotate on ulna to place our hand in different directions. So, whenever we come across fractures of both bones of forearm, we have to keep in mind that restoration of normal anatomy should be our goal. To achieve that fractures of both the radius and ulna in adults commonly needs operative interference, particularly in fractures of midpart of the bones. It can be managed by closed reduction and interlocking nails, open reduction and plate screw fixation of both radius and ulna.

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As the radius is a bent bone intramedullary device is not the implant of choice. Open reduction and internal fixation (ORIF) is commonly done through two separate incisions. There are many muscles, nerves, and vascular structures in the forearm and they change position on forearm rotation. Considering safety of these of these vital structures. Henry¹ anterior exposure for radius is still very popular and Thomson² described posterior exposure of radius in the midpart of the bone. Ulna is a subcutaneous bone and its exposure was never a problem. But both anterior and posterior exposures may lead to some complications.³ The anterior exposure may cause injury to the superficial branch radial nerve, lateral antebrachial cutaneous nerve and cephalic vein. Post exposure may lead to injury to post interosseous nerve. While treating fractures both bones of forearm by open reduction and internal fixation we always considered the possibility of radioulnar synostosis and thereby jeopardizing pronation and supination. Radius and ulna can also be exposed through two separate posterior incisions.⁴ The proximal part of ulna and radius can be exposed through single posterior incision.⁵ For exposing

radius and ulna in the midpart biplanar posterior exposure is also described by single straight-line incision or by curvilinear incision^{6,7} While using two separate anterior incisions we have faced difficulty in wound closure particularly after addition of bone graft. For last 20 years we are doing ORIF through single curvilinear posterior incision only for fractures of the midpart of both bones of forearm. To avoid the occurrence of radioulnar synostosis have used two separate muscle planes to reach radius and ulna.

MATERIALS AND METHODS

From 1995 July onwards, we are always using single posterior curvilinear incision for doing ORIF in cases of fractures both bones of forearm in adults. From July 1995 to September 2016 we have treated 130 consecutive with this exposure. 43 patients were female, and 87 patients were male. They were aged between 18 years to 67 years. 116 cases were fresh fractures and 14 cases were delayed presentation and nonunion. In most of our patients it was due to a fall from standing position, in a few cases it was caused by sports injuries and road traffic accidents. Fracture pattern in our study were either of Type A or Type B according to AO/OTA classification. We have excluded paediatric cases, infected cases from this study. Age, sex and type of fractures are detailed below in table 1.

Age Group	Male	Female	Type A	Type B
18 yrs. to 30 yrs.	27	03	22	08
31 yrs. to 50 yrs.	35	32	58	09
51 yrs. and above	25	08	25	08

Table 1

Operative Procedure

After proper preoperative investigations and anaesthetists checkup patients were taken to OT. General or regional anaesthesia was given. The patient was placed supine, pneumatic tourniquet was applied in the upper arm and the forearm was placed in on a side table. Cleaning and draping were done, and tourniquet was inflated. A curvilinear posterior incision was given. If the fractures of both radius and ulna were at the same level or the radius fracture at higher level the incision starts from lateral to medial side and it was opposite in case of higher level ulnar fracture.



Figure 1. Curvilinear Incision Line, Differs According to the Level of Fracture

(Figure 1) After incising the skin and superficial fascia it was separated for 1.5 cms and the deep fascia was incised in the same line. Fracture radius was exposed in between extensor carpi radialis brevis and abductor pollicis longus and if fracture is at higher level sometimes, we had to split supinator at its most lateral aspect to protect the posterior interosseous nerve.



Figure 2. Two Different Muscle Planes for Exploration of Radius and Ulna

(Figure 2) Fracture ulna was exposed in the plane between extensor carpi ulnaris and flexor digitorum profundus. After trial reduction of both bones they were fixed with plate and screws one after another, in most cases radius first followed by ulna.



Figure 3. Fixation of Fractures with Plates and Screws and Wound Closure

(Figure 3) In the initial years we used DCP for radius and tubular plate for ulna, subsequently we are using LCDCP for both radius and ulna in 22 cases we had to do bone grafting. Tourniquet was deflated, and haemostasis was done, wound was closed in layers except the deep fascia which was not closed. A drain was placed before skin closure. (Figure 3) A cotton wool dressing was applied, and the limb was kept in a triangular arm sling.

Postoperative Care

Radiological record was done by taking immediate post op X ray. IV broad spectrum antibiotics were given for three days and nonsteroidal anti-inflammatory drugs were given for five days. Patients were encouraged to do finger movements from the next day. At two weeks stitches were removed and a long arm cast was done. This cast was maintained for six to eight weeks. On removal of cast the fractures were re assessed and guarded activities were started. All fractures were united within 16 weeks. Range of motion of elbow and radio ulnar joints were recorded, and patients were encouraged to do active and assisted active exercise.

RESULTS

In three patients there were tourniquet palsy involving radial nerve which fully recovered within 12 weeks. Radial nerve palsy involved brachioradialis and extensor carpi radialis longus and brevis, so we were sure that it was not due to an injury to post interosseous nerve and at six weeks we have found that brachioradialis power was returning.



Figure 4. Pre and Postoperative X-Ray Plates of a 52 Years Male Patient



Figure 5. Functional Results and Nice Cosmetic Scar in a 38 Years Old Female



Figure 6. Functional Results in a 18 Years Old Male Patient



Figure 7. Functional Results in a 43 Years old Female



Figure 8. Functional Results in 63 Years Old Male, and 35 Years Old Male

Superficial skin infection was seen in five cases, in those cases antibiotics continued and wound dressed, in all cases it healed by three-weeks' time. Union occurred in all cases and 90% of movements of elbow joint and radio ulnar joints were achieved. (Figures 4-8) After one year the final assessment were done taking into consideration of ability to perform activities of daily living, power of wrist muscles and radioulnar movements. For final assessment of outcome there are two to three scoring systems like DASH, MFA^{8,9} and Quick DASH. We have found Quick DASH questionnaire suitable for our patients and did the scoring according to this system. DASH system is briefly narrated below.

The Disabilities of the Arm, Shoulder and Hand (DASH) Score⁸

Please answer every question, based on your condition in the last week.

Please rate your ability to do the following activities in the last week.

1. Open a tight or new jar
2. Write
3. Turn a key
4. Prepare a meal
5. Push open a heavy door
6. Place an object on a shelf above your head
7. Do heavy household chores (eg wash walls, wash floors)
8. Garden or do yard work
9. Make a bed
10. Carry a shopping bag or briefcase
11. Carry a heavy object (over 10 lbs)
12. Change a light bulb overhead
13. Wash or blow dry your hair
14. Wash your back
15. Put on a pullover sweater
16. Use a knife to cut food
17. Recreational activities which require little effort (e.g. card playing, knitting, etc)
18. 1Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g. golf, hammering, tennis, etc)
19. Recreational activities in which you. move your arm freely (e.g. playing frisbee, badminton, etc)
20. Manage transportation needs (getting from one place to another)
21. Sexual activities During the past week,
22. To what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?
24. Arm, shoulder or hand pain
25. Arm, shoulder or hand pain when you performed any specific activity
26. Tingling (pins and needles) in your arm, shoulder or hand
27. Weakness in your arm, shoulder or hand
28. Stiffness in your arm, shoulder or hand

29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand?
30. I feel less capable, less confident or. less useful because of my arm, shoulder or hand problem

So, we have adopted a rather simple questionnaires' (Quick DASH).

1. Open a tight or new jar.
2. Do heavy household chores (e.g., wash walls, floors).
3. Carry a shopping bag or briefcase.
4. Wash your back.
5. Use a knife to cut food.
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).
7. During the past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?
9. Arm, shoulder or hand pain.
10. Tingling (pins and needles) in your arm, shoulder or hand.
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand?

Scoring was done in the following manner

No	difficulty/pain/inability	1
Mild	difficulty/pain/inability	2
Moderate	difficulty/pain/inability	3
Severe	difficulty/pain/inability	4
Inability	to perform	5

Age Group	Male	Female	Mean DASH Score
18 yrs. to 30 yrs.	27	03	12
31 yrs. to 50 yrs.	35	32	14
51 yrs. and above	25	08	17

Table 2

In our series the mean DASH score was 14.

DISCUSSION

Single posterior incision is rather unusual one for open reduction and internal fixation of fracture both bones of forearm particularly for fractures in the midpart of both bones. Boyd⁵ posterior approach is commonly used for fractures in the proximal part of forearm but incidences of synostosis is quite high. We were also using two separate anterior incisions till such time we faced trouble in wound closure after adding bone graft in delayed cases and nonunion cases. From 1995 we are using a single curvilinear

incision placed posteriorly and developing the muscle plane as described in operative procedure. This is basically a little modification of Thomson² posterior approach for radial shaft, we are developing the muscle plane between extensor carpi radialis brevis and abductor pollicis longus as described by Thompson and made the incision a little long so that there was no undue tension on muscles, nerves and vessels while developing two separate muscle planes. We were using this approach for fractures in the middle of forearm and starting it either medially or laterally and never faced any problem of getting adequate exposure of both radius and ulna. Ulna being a subcutaneous bone there were no difficulty in exposing it in between the muscles of extensor carpi ulnaris and flexor digitorum profundus. A single straight posterior incision also described⁶ with very good outcome in good number of cases (115 patients with 116 fractures) We had to split supinator in a very few cases only and in those cases, we have very carefully elevated the supinator with periosteum elevator starting from most lateral part of it. With this retraction of supinator, posterior interosseous nerve always remained protected. R M Shenoy⁷ used posterior curvilinear incision for all level fractures of both bones of forearm. In lesser number of patients (18) reported by him all showed good results and no evidence of radioulnar synostosis. Bauer¹⁰ reported very high incidences of radioulnar synostosis (41.6%) by using single posterior incision in twelve cases by Boyd approach but in his series most of the synostosis occurred in fractures in the upper part operated by Boyd exposure. Failla et al¹¹ showed most of the post traumatic synostosis occurred in the proximal part of forearm. In our series we have included the fractures in the midpart of both bones and our exposure is essentially a modification of Thompson exposure and made the incision a little long so that during mobilization soft tissues are kept safe, probably this has saved us from occurrence of injury to posterior interosseous nerve and radioulnar synostosis and in our cases and the scar was very much cosmetically acceptable one. We think a curvilinear incision gives more flexibility of soft tissue mobilisation than a single straight incision. We have already mentioned that we started doing this procedure when we faced difficulty in wound closure with two incisions after addition of bone graft. During all these years we never faced any difficulty in closure of wound. We do not find any disadvantage of this procedure as compared to two separate anterior incisions.

CONCLUSION

Fractures in the middle of both bones of forearm can be very effectively treated by single posterior curvilinear incision. With proper respect to the anatomy of the area there is no chance of neurovascular damage, radioulnar synostosis and the scar is also better than two anterior incisions.

REFERENCES

- [1] Henry AK. Extensile exposure. 2nd edn. Edinburgh E & S Livingstone Ltd. 1966.
- [2] Thompson JE. Anatomical methods of approach in operations on the long bones of the extremities. *Ann Surg* 1918;68(3):309-329.
- [3] Catalano LW, Zlotolow DA, Hitchcock PB, et al. Surgical exposures of radius and ulna. *J Am Acad Orthop Surg* 2011;19(7):430-438.
- [4] Colton CL, Hall AJ. Atlas of orthopaedic surgical approaches. Butterworth-Heinemann 1991:192-193.
- [5] Boyd HB. Surgical exposure of the ulna and proximal third of the radius through one incision. *Surg Gynecol Obstet* 1940;71:86-88.
- [6] Wahsh AA. Exposure of both the radius and ulna through a single posterior incision: a technical note *Sicot J* 2015;1:21.
- [7] Shenoy RM. Biplanar exposure of radius and ulna through a single incision. *J Bone Joint Surg Br* 1995;77(4):568-570.
- [8] Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG). *Am J Ind Med* 1996;29(6):602-608.
- [9] Swiontkowski MF, Engelberg R, Martin DP, et al. Short musculoskeletal function assessment questionnaire: validity, reliability, and responsiveness. *J Bone Joint Surg Am* 1999;81(9):1245-1260.
- [10] Bauer C, Arand M, Mutschler W. Post traumatic radioulnar synostosis after forearm fracture osteosynthesis. *Arch Orthop Trauma Surg* 1991;110(3):142-145.
- [11] Failla JM, Amadio PC, Morrey BF. Post-traumatic proximal radio-ulnar synostosis. Results of surgical treatment. *J Bone Joint Surg Am* 1989;71(8):1208-1213.