

Arthrodesis of Post Polio Residual Paralytic Shoulder

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ABSTRACT

Introduction: Poliomyelitis in children can cause paralysis of shoulder girdle muscles and this disability may be decreased to some extent increasing the stability of shoulder either by tendon and muscle transfer or by the arthrodesis of joint. Shoulder arthrodesis is indicated as a possible treatment for these children in order to stabilize the shoulder. The present study was planned in those patients with extensive paralysis of muscles around the shoulder to assess the functional rate after surgery.

Material and methods: The study group included all the patients who had their initial shoulder arthrodesis done at the BIRRD over a period of five years. There were 57 operations in 57 patients for the post polio residual paralysis (PPRP) of the upper limb. Post operatively the functional skills of the extremity was conducted.

Results: 32 cases attended the call back clinic out of 57 cases. In all the patients the pre-operative goal was accomplished. The mean flexion is 54° with minimum being 10° and at maximum being 110°. The mean abduction is 78° with minimum being 30° and maximum being 100°. The internal rotation range is 10°-50° with average of 16°. The scapulohumeral angle range is 10° to 60° the average is 42.5°.

Conclusion: The shoulder arthrodesis is an excellent mode of treatment for the patient with extensive muscular post polio residual paralysis around the shoulder (with normal trapezius and serratus anterior). The definite excellent results are attained by proper selection of cases and when both glenohumeral and acromio-humeral fusion is done with a broad cancellous screw and with a lag screw principle fixation.

Keywords: Arthrodesis; Poliomyelitis; Post Polio Residual Paralysis

INTRODUCTION

The dream of eradicating polio globally by 2000 AD has not been fulfilled. On the contrary, fresh outbreaks of polio have been reported in this century not just from parts of the developing world but even from countries previously declared polio-free. Immunization programmes have been thwarted by war, terrorism and failure of governments to sustain universal immunization targets.¹

Poliomyelitis is an exclusive human disease transmitted from a patient or a symptom-free carrier through the fecal-oral route. Manifestations are varied ranging from asymptomatic (most common) to the most severe forms of debilitating paralysis.² The morbidity it leaves behind is really a devastating in sense of socio-economical and psychological factors. Hence, the need for rehabilitation of these patients is needed very much.

In the upper limb the pattern of paralysis is seen as the centripetal type with always the multi-pennate fibres of deltoid and some times associated with anterior pectoral and posterior spinal fibres. Next in order is elbow flexors, elbow extensors, wrist dorsiflexors and opponens pollicis. It is also associated with paralysis of the rotator cuff muscles of the shoulder. Due to this pattern of paralysis the person is disabled in using the

hand inspite of normal functional hand. The stability of shoulder is very much necessary to place the hand wherever necessary to use it's optimal.

Muscle transfer versus arthrodesis: The disability may be decreased to some extent by increasing the stability of shoulder either by tendon and muscle transfer or by the arthrodesis of joint.³⁻⁵ The trapezius transfer to replace lost deltoid appears to be an excellent mode of treatment. In practice it's extensibility makes it not a good operative transfer. In view of the leverage of entire upper limb, the muscle that is transferred will sag leaving shoulder fall once again with in short time. Hence, to keep the shoulder in desired position with out any wastage of muscle power, arthrodesis of shoulder leaves an excellent alternate method.⁶ Where, in shoulder is positioned in desired position and it is further moved indirectly by intact trapezius.

The pattern and severity of paralysis determine the appropriate method. Arthrodesis is taken up when paralysis about the joint is extensive, provided that power in atleast the serratus anterior and trapezius is fair or better. The present study was planned in patients with extensive paralysis of muscles around the shoulder to assess the functional rate after surgery.

MATERIAL AND METHODS

All the patients who had undergone arthrodesis over a period of 5 years were included in this study. 57 operations in 57 patients with PPRP of the upper limb were taken up for the study. The primary goal of surgery was to stabilise the glenohumeral and suprahumeral articulation. 25 cases were not traced in the follow up period. The present study was conducted only on 32 subjects. Among 32 patients, 17 male and 15 female and 14 operations were conducted on right shoulder and 18 on left. The individuals selected for study were with good hand and elbow flexion and of fair strength.

Prerequisite: Upper extremity functional skills were evaluated before surgery. This is to assess minimum to have a normal trapezius and serratus function. The study subjects were informed the pros and cons of surgery. The patients were made clear although apparent rotation will occur because of glide of scapula on the chest wall, no true rotation of the shoulder will be possible for the patients to reach above the horizontal

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How to cite this article: Srikanth Sriramoju, Omkarnath Gudapati, Narasimha Rao KL, Jagadesh G. Arthrodesis of post polio residual paralytic shoulder. International Journal of Contemporary Medical Research 2017;4(6):1347-1350.

and manage to eat, to look after perineum hygiene and some limitations to comb hair.

Preoperatively a shoulder spica is prepared with the arm in desired position of shoulder fusion. The spica was cut lateral side and preserved to be worn immediately after surgery and before recovery of the patient from general anesthesia. The articulate surface of proximal part of humerus and glenoid were denuded of cartilage. The under surface of acromion was fused with soft tissue. The internal fixation with screws, passed from acromion down the shaft of humerus and from lateral surface of humeral head to the glenoid with a desired position of arm. The desired position of the fusion was 30 degrees of abduction, 25 degrees of flexion and 25 degrees of internal rotation was maintained by the assistant while transfix action screws are passed.⁷⁻⁹ The functional position is confirmed by bringing the draped hand to the level of mouth. The both cancellous and cortical screws of both 3.5 and 4.5 mm of A.O. system were used with lag effect. The 16 mm threads were preferred as they give compression. Acromion is osteotomised and humerus was elevated to accomplish the acromion humeral fusion while passing screw down the acromion into the shaft. Post operatively, the shoulder was immobilised in a spica cast for three months.⁸ After spica removal patients were followed clinically and radiographically atleast until fusion was judged to be solid. The radiographs were analysed to determine the solidity of fusion, the presence of stress fracture, and the discrepancy in length of the extremity compared with that of the contra lateral extremity.

STATISTICAL ANALYSIS

Data so obtained was analysed using SPSS version 18 and was expressed as percentage and number as required.

RESULTS

57 cases were operated during 1992-97 and out of these patients 32 had attended the call back clinic and only these patients were considered for this study. There were 17 male patients and 15 female patients were operated, 18 on left shoulder and 14 on right shoulder. The age of the patient at the time of operation is ranged from 6 to 24 years. The duration of follow up period was ranged from 3-41 months with mean of 20.4 months. 26 of the patients were students, 2 of them were housewives, 2 were business men, 1 was village assistant and 1 was agricultural labourer (Table-1).

In order to have functional hand, elbow opponens plasty was done in 2 patients, flexor plasty was done in 4 patients, one was operated for synostosis of forearm, one was operated for pronator deformity and wrist arthrodesis was done in one patient (Table-2).

Fusion: The glenohumeral fusion was attempted in all patients. 12 cases operated with a single 3.5 mm cortical screw and out of which 3 resulted in non union. 13 cases were done with a single 4.5 mm cancellous screw of which 2 were ended with non union. 2 cases were done with double 3.5 mm cortical screw of which one resulted in non union. 4 cases were done in a combination of 4.5 mm cancellous screw and 3.5 mm cortical screw resulting in union. One case was done with 3.5 mm cortical and cancellous screw ended with union. One case was done with 4.5 mm cancellous screw resulting in union. Acromioclavicular fusion was attempted in 16 cases and out of which 4 resulted in non union

(Table-2).

Bony fusion was judged by clinical and radiological criteria and was achieved in all cases, except in 6 patients (18.75%). Of these non unions that resulted 3 were fixed with a single 3.5 mm cortical screw and one of which was broken. 3.5 mm cortical screw was used for one of the non union cases. 4.5 mm cancellous screw was used in 2 non union cases with out crossing the joint line. No bone graft was used for any of the cases. The average fusion period was 12 weeks with in shoulder spica.

Function: In the extremities the function was assessed on the basis of the patient's subjective stated ability to perform the seven common activities of daily living (ADL). 29 of the patients could lift the 5 kgs weight with the extremity besides the side of the trunk. 31 of them could attend to personal hygiene and toilet need, 32 of them could dress, 29 of them could eat with a spoon held in the hand on the fused side, 16 could use the hand for light work with the arm positioned at shoulder level, 21 could sleep side lying on the fused limb without notable discomfort and 23 of them could comb hair.

Based on functional ability assessment for common daily activities the patients rating was given to the patients as excellent, good and poor. 24 (75%) of the patients were graded as excellent, 2 (6.2%) as good and 3 (9.4%) with poor function

Patient Details	Number
Total patients underwent surgery	57
Patients attending follow up	32
Patients considered for the study	32
Male patients	17
Female patients	15
Pattern of shoulder involvement	
Left	18
Right	14
Occupational Details	
Students	26
Housewives	2
Businessmen	2
Village assistant	1
Agricultural labourer	1

Table-1: Patient's details

Procedure	No. of cases	Nonunion
Glenohumeral fusion		
Single 3.5 mm cortical screw	12	3
Single 4.5 mm cancellous screw	13	2
Double 3.5 mm cortical screw	2	1
Combination of 4.5 mm cancellous screw and 3.5 mm cortical and cancellous screw	4	1
3.5 mm cortical and cancellous screw	1	-
Acromioclavicular fusion	16	4
Elbow opponens plasty	2	-
Flexor plasty	4	-
Synostosis of forearm		
Pronator deformity	1	
Wrist arthrodesis	1	

Table-2: Procedure details

Post-operative mobility of shoulder	
Mean flexion	54° (minimum 10° and maximum 110°)
Mean abduction	78° (minimum 30° and maximum 100°)
Average internal rotation	16° (range is 10° to 50°)
Average scapulohumeral angle	42.5° (range is 10° to 60°)

Table-3: Post-operative mobility of shoulder

Complications	Number of patients
Post-operative infection	None
Fracture of humerus	1
Implant failure	1

Table-4: Post operative complications

(Figure 1).

Pain: 5 patients were reported with pain and sever pain was observed in one case only.

Patient’s subjective assessment: All the patients are on the opinion that they are benefitted from the surgery including those with non union. The benefits in the form of elevation of the arm which they were not able to perform earlier, four patients noticed of increase of girth of forearm, eight were noticed fullness in the scapular area probably due to hypertrophy of trapezius. Six patients were concerned regarding the internal rotation of the arm. 12 of the patients were concerned of the screw in the shoulder and want it to be removed.

Humeral shortening: In the present study, the average shortening was 1.4 cms with minimum of one cm and maximum of 3 cms. None of the patients were noticed shortening of limb. The primary goal of the operation in all these patients was to have the mobility in the shoulder girdle. In all the patients the pre-operative goal was accomplished. The mean flexion is 54° with minimum being 10° and at maximum being 110°. The mean abduction is 78° with minimum being 30° and maximum being 100°. The internal rotation range is 10°-50° with average of 16°. The scapulohumeral angle range is 10° to 60° the average is 42.5° (Table-3).

None of the patients had post operative infection. In one patient had fracture humerus on 7th post operative day while playing at school. The case was treated with native treatment and ended with loss of abduction. Implant failure occurred in one case (Table-4).

DISCUSSION

Poliomyelitis in children can cause paralysis of shoulder girdle muscles leading to a flail shoulder. Shoulder arthrodesis is indicated as a possible treatment for these children in order to stabilize the shoulder.¹⁰

Kumar K et al¹¹ studied pattern of muscle paralysis and paresis in the upper limb among 31 children with poliomyelitis and reported a similar incidence of involvement of the upper limb alone is the same as of the upper and lower limbs together, and of the spine and upper limb. The left arm was more commonly affected than the right. The muscle most frequently paralysed was the deltoid. When complete paralysis of the whole deltoid occurred and was associated with paralysis of the rotator cuff muscles, the shoulder often subluxed downwards. The next most commonly affected muscles were the elbow flexors and

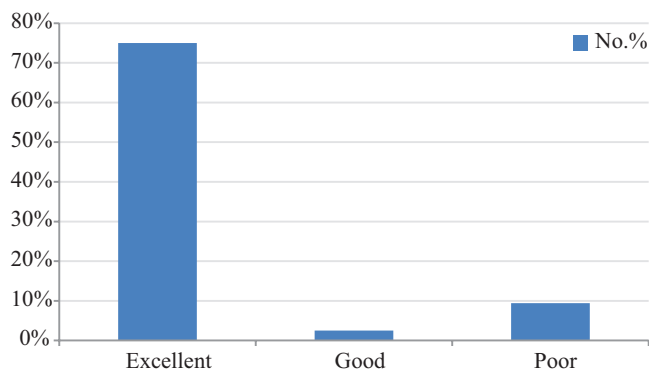


Figure-1: Functional ability assessment

extensors. In the hand the opponens pollicis was most often involved. As far as the spinal segments are concerned, C5 involvement was usually associated with paralysis and C7 with paresis. Shoulder arthrodesis has evolved such that a combined intra-articular and extra-articular technique utilizing a plate and compression screws are the standard of care.¹²

Primary arthrodesis requires rigid internal plate fixation and both an extra- and an intra-articular site of fusion. Depending on bone volume and quality needed, the patient may require bracing for 8 to 10 weeks, autogenous or allograft bone grafting, or a vascularized fibular bone graft to reconstruct the bone deficiency, along with prolonged spica cast immobilization.¹³

The shoulder stabilization in post polio residual paralysis patients is by the way of either muscle tendon transfer or arthrodesis. In tendon transfers the trapezius is used to replace the lost function of deltoid and it appears to be an excellent mode of treatment. Hence to keep the shoulder in desired position and without any wastage of muscle power, arthrodesis of shoulder leaves an excellent alternative procedure. It is further moved indirectly by intact trapezius.¹⁴ Besides in polio patients with extensive paralysis around shoulder makes the arthrodesis as the method of choice.

It is mandatory have a functional hand and form before they are subjected to shoulder arthrodesis. If any correctable deformity is present it has to be corrected surgically if necessary.

23 (72%) of the patients are below 15 years, showed non union rate of 4 (17%). The remaining patients are over 16 years and showed non union rate of 2 (22%). The non union rate is almost similar in both the groups.

It was found that the union is good with usage of large cancellous screw, when the principles of rigid fixation with screw are followed. The good union rate due to cancellous screw is due to compression.¹⁵ The narrow screws resulted in metal fatigue in the form of breakage or bending of screw. Good union rate can be attained with narrow screw with the application of lag screw principal or multiple screws are used parallel to each other. Cross screw fixation was done in 2 cases and both resulted in non union. The cause might be mode of fixation during arthrodesis. The limitation of the study is a small sample. Cancellous screw

of large size gave better results compared to narrow or cortical screw. Multiple screws are always beneficial, provided it is used to parallel to each other.

When acromio-humeral fusion was done, it had better functional results due to large amount of bony mass participating in arthrodesis.¹⁶ This was attained by approximating the denuded acromion and humerus either by pushing up the humerus or by osteotomising the acromion and inverting to the humerus and fixed by a lag screw.^{17,18} In the present study series, spontaneous fusion occurred in 2 cases but it will not occur in every case. Deliberate attempt is needed for better results. Because of screw breakage in one case, refusion¹⁹ was done with broader cancellous screw for both glenohumeral and acromio-humeral fusion. For primary refusion, no bone graft is necessary.²⁰ In one case, screw was backed out to produce spontaneous ulceration and tendency to come out. This could be due to foreign body reaction and after removal it left no sequele.

The disability from poliomyelitis is considerable both for activities of daily living and in earning a livelihood. Hence, patients demand a reconstructive procedure.²¹

Good functional rate following the surgery was observed in the present study series. Except internal rotation deformity and no other cosmetic defect is complained by the patient.

CONCLUSION

The shoulder arthrodesis is an excellent mode of treatment for the patient with extensive muscular post polio residual paralysis around the shoulder (with normal trapezius and serratus anterior). The definite excellent results are attained by proper selection of cases and when both glenohumeral and acromio-humeral fusion is done with a broad cancellous screw and with a lag screw principle fixation.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 03-02-2016; **Accepted:** 10-02-2016; **Published:** 14-07-2017