

Arthrodesis Of A Flail Shoulder In Poliomyelitis

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Abstract

Fifteen patients with a mean age of 14.86 years (11 males and 4 females), suffering from flail shoulder secondary to poliomyelitis with good elbow and hand functions, and good power in serratus anterior and trapezius muscles were treated by shoulder arthrodesis in 40 to 60 of abduction, 20 to 30 of flexion, and 25 to 30 of internal rotation. 80% of the patients were satisfied with the procedure and were able to reach mouth, opposite axilla, side pocket, back pocket, and anal region. 80% were able to sleep on the fused side. Authors proposes that extra amount of abduction is required, so as to compensate for the weakness of elbow flexors in poliomyelitis

INTRODUCTION

Twenty first century is considered to be era of arthroplasty with emphasis on to provide painless, mobile and stable joint. Arthrodesis, especially shoulder arthrodesis appears to be procedure of the past. In western world, indications for shoulder arthrodesis have been narrowed down to complete brachial plexus lesions, deltoid muscle paralysis, massive rotator cuff deficiencies following multiple attempts at repair, multiple failed athroplasties, chronic infections, bone resections following tumor resection and chronic dislocations³. But in developing countries of Asia and Africa, where poliomyelitis is still prevalent and one usually come across patients with flail shoulder secondary to poliomyelitis. These patients usually have good elbow and hand functions and good seratus anterior and trapezius muscles are unable to optimize their upper extremity due to their inability to place their hand in space. Glenohumeral arthrodesis stabilizes the extremity and allows effective use of hand. Such patients can then fully utilizes their upper extremity potential and can work effectively at bench level.

There is controversy regarding the position of arthrodesis, particularly abduction and method to measure it. Authors in their study, while presenting the results of shoulder arthrodesis, have tried to discuss different methods of evaluations and amount of abduction in shoulder arthrodesis.

MATERIAL AND METHODS

The study included 15 patients of extensive paralysis of shoulder secondary to poliomyelitis with fair to good elbow and hand functions and good trapezius and serratus anterior

muscle power in time period from January 1991 to December 2000. The age of patients varied from 9 to 23 years (mean 14.86). Among them 11 were males and 4 females. Left side was affected in 70% and right side was affected in 30% of the patients. 80% were affected from poliomyelitis at the age of 1-3 years whereas 20% were affected at the age of 4-5 years. Special care was taken for the selection of the patients so as to exclude the patients suffering from paralysis of scapulo-thoracic muscles and without good elbow and hand functions.

Supine position was used in all cases. Intra-articular arthrodesis was done using Steindler method with two to three 4 mm cancellous screws. Bone grafting was done in all cases. The joint was fused in clinical abduction of 40- 60, 20- 30 of flexion and 25-30 of internal rotation. All patients were given shoulder spica in post operative period till solid fusion. Antero-posterior skiagrams were taken immediately after the operation and thereafter at the interval of 4-6 weeks till fusion were evident on x-rays. After the removal of shoulder spica, vigorous supervised physiotherapy of the scapulo-thoracic muscles, elbow and hand was started.

RESULTS

Results were analyzed in terms of

- 1) Position of arthrodesis
- 2) Functional assessment in terms of whether patients are able to reach mouth, opposite axilla, comb hair, side pocket, back pocket, perineal region, and zip or unzip their pant.

3) Ability to lower the arm by side of body without the prominence of scapula.

Results are summarized in table number 1.

Figure 1

Ser	Age/ Sex	Side	AOP	Position of arthrodesis (degree)			BG	CP (wk)	Fall out-up (yrs)	COP	MAA	POS	Surgeon evaluation	Patient evaluation	Complications
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	15/M	L	1	40	30	30	N	24	9.6	N	90	N	Satisfy	Satisfy	
2	18/M	L	1	40	30	30	Y	16	9.1	N	80	N	Satisfy	Satisfy	Screw sensation
3	13/M	L	3	40	20	30	N	20	8.8	N	80	N	Satisfy	Satisfy	
4	10/F	L	2	60	20	30	Y	14	10.1	N	90	N	Satisfy	Satisfy	Screw sensation
5	20/M	R	4	40	25	25	N	16	7.7	N	70	N	Satisfy	Satisfy	
6	16/M	R	3	40	30	30	N	18	7.6	N	80	N	Satisfy	Satisfy	
7	17/M	L	5	40	20	25	Y	16	7.2	N	60	N	Satisfy	Satisfy	Screw sensation
8	16/M	L	1	40	30	30	Y	16	7.1	N	80	N	Satisfy	Satisfy	
9	9/F	R	2	40	25	30	N	14	7.2	N	70	N	Satisfy	Satisfy	
10	13/M	L	2	60	30	30	Y	17	6.1	N	60	N	Satisfy	Satisfy	Screw sensation
11	12/M	L	1	40	30	30	N	14	6.9	N	80	N	Satisfy	Satisfy	
12	14/F	L	1	40	30	30	N	16	6.6	N	70	N	Satisfy	Satisfy	
13	13/M	R	3	40	20	25	N	17	5.6	N	80	N	Satisfy	Satisfy	
14	12/M	R	2	40	20	30	N	17	4.3	N	70	N	Satisfy	Satisfy	

Abbreviations: - AOP = Age of onset of polio, Abd= abduction, Flex= flexion, IR=internal rotation, BG=Bone graft, Wk= weeks, Yrs=years, COP= Change of profession, MAA=Maximum abduction achieved, POS= Prominence of scapula, M= Male, F= Female, L= Left, R=Right, N=No, Y= Yes,

There was consolidation of all fused shoulder within 16.2-18 weeks (mean 17.1weeks).

Preoperatively none of the patients could reach mouth, opposite axilla and combing of hair where as all could reach mouth (figure 1), opposite axilla(figure 2),

Figure 2

Figure no. 1 Able to reach mouth



Figure 3

Figure no2 Able to reach Opposite axilla



and combing of hair after the operation except four female patients could not comb their hair as they had long hair. Four patients could buckle of their belt (3males and 1female), 3 male patients could jip or unzip and reach back pocket of their pant. All could perform the same after the operation(figure 3).

Figure 4

Figure no. 3 Able to reach Back pocket



Three patients were able to reach their side pocket and two patients could take care of perineal needs preoperatively. Fusion of the shoulder did not alter their preoperative status(figure 4).

Figure 5

Figure no. 4 Able to reach Side pocket



None of the patients needed to change their profession as

none of them was involved in profession which involved overhead work.

Postoperatively 40% of patients achieved abduction up to 80-90, 40% achieve upto70-80, and 20% achieved less than 70(figure 5).

Figure 6

Figure no. 5 abduction achieved after shoulder arthrodesis.



80% of the patients could sleep on the fused side. Results were satisfactory as per surgeon evaluation in all cases where as 70% of the patients were satisfied with the outcome of the operation. All patients were able to lower the arm by the side of body without any abduction deformity.

COMPLICATIONS

There were no major complications in this study. Three patients (two males and one female) had symptomatic internal fixation, i.e. had sensation of screws in the operated site but did not require any intervention. Two male patients could not sleep on fused side. There was prominence of scapula in two male patients when arm was lowered by the side of body. All patients could comb their hair except female patients, as they had long hair.

There was no pseudoarthrosis.

DISCUSSION

Rowe CR¹¹ enlisted the important requisites after arthrodesis of the shoulder: - (1) the hand should be able to reach the face, head, and the midline of the body anteriorly and posteriorly; (2) the arm should be in position of maximum strength for lifting, pushing, and pulling; (3) the shoulder should be comfortable when arm is at side of the body, and the scapula should not be prominent in this position. To achieve all these requisites in fused shoulder, there should be

single optimal position of abduction, flexion and internal rotation. Unfortunately, there is no consensus neither regarding method of measuring of abduction nor the final position of arthrodesis in literature, particularly regarding the amount of abduction. Barr and committee¹ recommended that angle of abduction be determined by measuring angle formed by vertebral border of scapula and shaft of humerus. Charanley and Houston² recommended the angle be determined on the basis of clinical position of the arm to the side of the body. Rowe¹¹ suggested using the angle formed by the shaft of humerus and lateral border of scapula. Hawkins and Neer⁵ advised abduction to be determined by measuring the angle between the medial border of scapula and the humerus. Johnson et al⁷ reported his technique for measuring the position of shoulder arthrodesis using moiré photography, based grid illumination, giving topographic image to an object. With his technique, the neutral position of scapula can be found, enabling a more accurate determination for the arthrodesis. We used the clinical method for determining the position of arthrodesis from the side of body as it fairly consistent and simple to use on the operation table. It is believed to be accurate within 10 degree³.

Most controversial point in shoulder arthrodesis appears to be position of arthrodesis. The consensus appears to be to favor less abduction and forward flexion and more internal rotation. Barr and committee¹ advised 50 of abduction, 15 to 25 of flexion, and 25 of internal rotation in cases of paralytic shoulder. Rowe¹¹ proposed that excessive abduction and flexion causes winging of scapula and fatigue of scapulothoracic muscles. He proposed 20 to 25 of abduction and flexion. More internal rotation of 40 was advised so that hand could reach the mid line. Hawkins and Neer⁵ recommended 25 to 30 of abduction, 20 to 30 of flexion, and 25 to 30 of internal rotation. Richards et al¹⁰ recommended a position of 30 of abduction, flexion, and internal rotation. Matsen et al⁹ recommended a position of 15 of abduction and forward flexion and 40 of internal rotation. Clare et al³ recommended a position 10 to 15 of abduction and forward flexion, and 45 of internal rotation. This trend toward having less abduction is based on the hypothesis that lifting and elevation of hand to the face are accomplished more effectively when there is no abduction of hand. Abduction of the arm tends only to transfer the hand laterally away from the centre of gravity of the body, to increase the moment exerted by any object being lifted, and to diminish the strength and agility of the hand and extremity¹¹. We performed the arthrodesis in the position of 40 to 60 of

abduction, 20 to 30 of flexion, and 25 to 30 of internal rotation. We feel that shoulder should not be fused in excessive abduction of 60 as it produces extra strain on scapulothoracic muscles, and can cause winging of scapula as happened in our two cases. Shoulder was fused in 60 of abduction as both patients were young at the time of surgery. Extra abduction was given to ensure good contact, hence the union. But in cases of poliomyelitis, where elbow flexors are usually weak, some amount of extra abduction is needed. Rowe¹¹ also noted this point and advised extra abduction for strong scapulothoracic muscles and weak elbow flexors so as to facilitate the hand to mouth by horizontal position of elbow. We tried to accomplish same by fusing the shoulder in minimum of 40 of abduction.

Hucherson DC⁶ reported 4 excellent results in 6 patients in whom shoulder arthrodesis was done secondary to paralysis of the shoulder. Etiology of the paralysis was not mentioned. May VR⁸ reported 12 excellent or satisfactory results in 14 patients shoulder arthrodesis. In excellent group, all patients could abduct the arm up to 90, could touch top of the head, and get his hand to the mouth place his hand in his trouser pocket. The arm hung easily by the side of body and there was no pain. Schroeder NA¹² et al performed compression arthrodesis in 16 patients. The results were rated good by 10 patients. nine (56.25%) could use limb with fused shoulder to dress, eight to eat using knife, 7 to perform personal hygiene, 10 to tie shoe laces. only 4 could comb hair where as only 5 patients could work with hand above the shoulder. Cofield RH and Briggs BT⁴ analyzed the results of shoulder arthrodesis after an average follow up of nine years and six months in 71 patients. Pain relief was adequate in 3/4 of the patients, 3/4 could do activities requiring reaching the trunk, one half could reach up to head, and one quarter were able to do light work with arm at the shoulder level or higher. 53 return to work. 73% of the patients could sleep on fused side. Hawkins RJ and Neer CS⁵ fused 17 shoulders. Out of 17 patients, 9 patients could function at head level to comb hair and could sleep on fused side, wash their face and shave with no or slight difficulty. 14 patients could work satisfactorily at waist level. Only 3 patients could successfully function behind their backs, using the back pocket and toilet tissue. Only 6 patients could return to work. Richard et al¹⁰ assessed the functional analysis of shoulder arthrodesis in 33 patients with brachial plexus injuries. 21 patients were able to work at shoulder level. One half of the patients could eat or perform toilet functions. Almost all were able to perform work at the waist level. In our series 80% of the pts were satisfied with the outcome of

the procedure. All pts could reach mouth, opposite axilla and comb hair and perform function at waist level. All pts could use hand for toilet purposes. 80% could sleep on fused side. Our results are better when compared with the series in which arthrodesis was done in non paralytic disorders. May be expectations of the patients are less in paralytic cases in which dangling limb is stabilized by arthrodesis.

To summarize, the arthrodesis of flail shoulder in poliomyelitis is a valuable procedure as it offers advantages such as greater ease in turning in the bed, putting a coat, better use of hand, for examples to steady the hand while writing and there is feeling of security and stability in the shoulder. Also a flail shoulder is usually carried higher than normal and fusion restores its appearance and position.

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