

ACROMIOCLAVICULAR DISLOCATION

END-RESULTS OF SCREW SUSPENSION TREATMENT

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AMONG the various operative methods for the repair of complete acromioclavicular dislocation which have been advocated are fascial suture,^{1, 2} wire fixation,^{3, 4, 5} and excision of the tip of the clavicle.^{6, 7} The proponents of each of these procedures have reported favorable results in their own hands.

It is now six years since I introduced treatment by screw suspension.⁸ In a little over a year, from December, 1940, to January, 1942, I performed this operation upon eight patients. This is a report of the end-results of each of those operations. Nine additional cases in which this method was used by other surgeons are included in the clinical protocol, although they are excluded from the summary of end-results, as none of them was ever seen by me personally.

This operation was designed temporarily to maintain reduction of a complete acromioclavicular separation by the insertion of a single vitallium screw, under local anesthesia, through the outer portion of the clavicle into, and through, the underlying coracoid process of the scapula. Subsequent to publication of my original paper the same operation was independently devised by Vere-Hoge in England. It was used successfully there in the treatment of air casualties of the recent war.⁹

In each of my cases the screw alone was depended upon for full support during the period of healing. Although a sling was always prescribed post-operatively no patient wore it more than a few days because of the relief and feeling of well-being experienced as a result of the screw support.

Seven of my cases were freshly incurred injuries but one of them became a three-month-old redislocation, with a frozen shoulder, before final and successful repair. One other came to me as a two-month-old injury, with frozen shoulder. The patients varied in age from 23 to 74 years and, in physique, from paratroopers to elderly ladies. All were operated upon in the hospital, with full operating room facilities and assistance available. They spent only one night in hospital (with the exception of the two cases of frozen shoulder which were kept longer for traction suspension following freeing of the adhesions about the shoulder joint). One patient went home the day of operation.

In no case in which the newly designed flanged screw was inserted through both cortices of the coracoid process did it pull out, even partially; nor did the original fine-threaded screw pull out in three of the four patients in whom it was used. In two cases the screw broke without pulling, with one failure in a man who refused reoperation and one success, with permanent reduction and full function. The screw was removed from two of my

patients, at six and seven weeks, respectively, with no recurrence of dislocation in either one. No screw has ever migrated to another part of the body.¹⁰

Callus and bone, visible by roentgen ray, have developed within the substance of the coracoclavicular ligaments to some extent in every case. At times this has resulted in the formation of a considerable mass of bone but with no interference with function. Absorption of bone about the screw threads has occurred without affecting the end-result in any way, but it seems to be the exception rather than the rule when the screw is properly placed.

Six of my patients have now been followed, with personal examination, over four years, two of them more than five years, since operation. Another was last seen at two years and three months and another at six months. In six patients perfect reduction and function of the acromioclavicular joint have been preserved by the screw repair. One patient has perfect function and has been doing heavy work for three years although the screw pulled a quarter of an inch. Another completely redislocated after the screw broke at four weeks and the patient has refused further treatment.

If the results in these eight cases are considered with respect to anatomy (A), economics (E), and function (F), and are graded from 0 to 4 (0 denoting failure and 4 being excellent), they may be summarized as follows: Six cases—A₄—E₄—F₄; one case—A₃—E₄—F₄; one case—A₀—E₂—F₂.

Details of the operative technic have already been published.⁸ The following modifications have been made as the result of added experience:

(1) *The Screw and Its Implantation.*—Only a screw of an electrolytically inert material, having a wide-flanged thread of minimal pitch and a broad, flat head, should be used. In most patients the one and a half-inch screw will grip the under surface of the coracoid adequately with the acromioclavicular dislocation reduced. Occasionally, when the distance between coracoid and overlying clavicle, following reduction, is greater than normal (one-half inch) or the individual has very large bones, it may be necessary to employ the one and five-eighths or the one and three-quarter-inch screw.

Complete reduction must be secured before the hole in the clavicle is drilled and the screw inserted so that proper direction of the screw is assured. A tiny hole may be made with an awl in the upper surface of the coracoid to start the screw but the coracoid must not be drilled and the screw must penetrate both cortices of that bone.

Roentgenograms taken during operation have proven superior to fluoroscopy as a means of checking placement of the screw. It is more comfortable for the patient, and easier for the surgeon, if the patient is supine on the table rather than sitting in a chair during the operation. The clavicle depressor originally recommended⁸ has been found unnecessary.

(2) *Postoperative Care.*—Although my patients have all regarded a sling as a nuisance, it is an excellent psychologic adjunct to treatment, for it serves as a constant reminder of their potential infirmity until soft-tissue support is attained. The sling should be removed at times during the day and the pa-

tient encouraged to do arm-swinging exercises and "crawling up the wall." He should also be allowed to bathe, dress and feed himself, to shave and to brush and comb his hair, all from the day after operation. In between these activities, and at night, a sling should be worn for the first eight weeks. Any heavy work during this period must be interdicted by the surgeon in no uncertain terms and he should see the patient frequently to make sure that these orders are obeyed. The screw may be left in place indefinitely or removed after eight weeks.

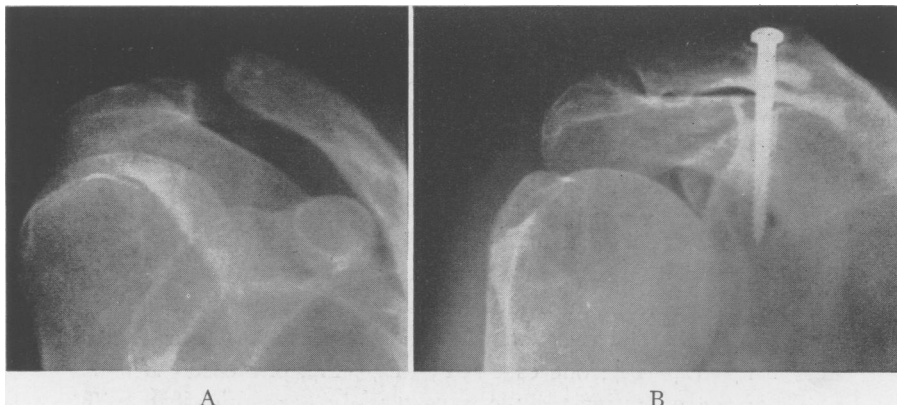


FIG. 1.—Case 1: P. B., housewife, age 74.

A. Before operation.

B. Five years and 4 months result with old type screw. A4—E4—F4.

CLINICAL PROCTOCOLS

Author's Cases:

Case 1.—P. B., the first patient to undergo this method of repair was operated upon 12-14-1940, at age 74.⁸ She had sustained a complete right acromioclavicular dislocation from a fall three days before operation (Fig. 1A). Severe generalized arthritis made immobilization of the upper extremity inadvisable. Personal examination over five years after operation reveals no gross deformity, no limitation of motion and no impairment of strength compared with the other shoulder. This in spite of the fact that two months after operation she fell downstairs again and pulled the screw about one-eighth inch as shown by roentgen-ray.

COMMENT: In view of the fact that later roentgenograms (Fig. 1B) showed absorption of bone about the screw it is obvious that permanent maintenance of reduction is dependent, as was anticipated, upon firm healing of the soft-parts and not upon the screw. The formation of bone between coracoid and clavicle is interesting. Five years and four months result: A4—E4—F4.

Case 2.—M. B., was operated upon 2-7-'41, at the age of 73,⁸ ten hours after she had fallen from a chair. The tip of the clavicle was displaced 1.5 inches above the acromion and nearly compounded the overlying skin (Fig. 2A). An excellent reduction

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was secured, but at three weeks she did heavy housework, against advice, and redislocated. The same screw was replaced but failed to hold. Three months after the original operation this screw was removed and replaced, under direct vision, with a specially designed flange-threaded screw. At the same time adhesions which had formed about the shoulder

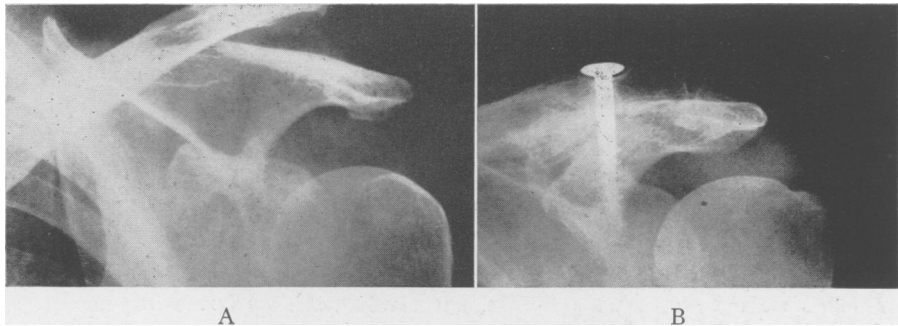


FIG. 2.—Case 2: M. B., housewife, age 73.
A. Before operation.
B. Five years and 2 months result. A4—E4—F4.



FIG. 3.—Case 3: J. M., laborer, age 65.
Two years and 3 months result with old type screw which broke.
Patient refused reoperation. A0—E2—F2.

joint were broken up by manipulation under general anesthesia. Clinically, the patient has no complaints referable to the injury or repair. She does all her own housework. There is no deformity, no loss of strength and she has full active motion in the affected shoulder.

COMMENT: This case proves that screw suspension can be used successfully in an old persistent dislocation even in the presence of a frozen shoulder severe enough to require manipulation under anesthesia. The lack of bone absorption about the screw threads is noteworthy as is the production of new bone in the soft-tissues between coracoid and clavicle (Fig. 2B). Note that the screw penetrated both cortices of the coracoid. Five years and two months result: A4—E4—F4.

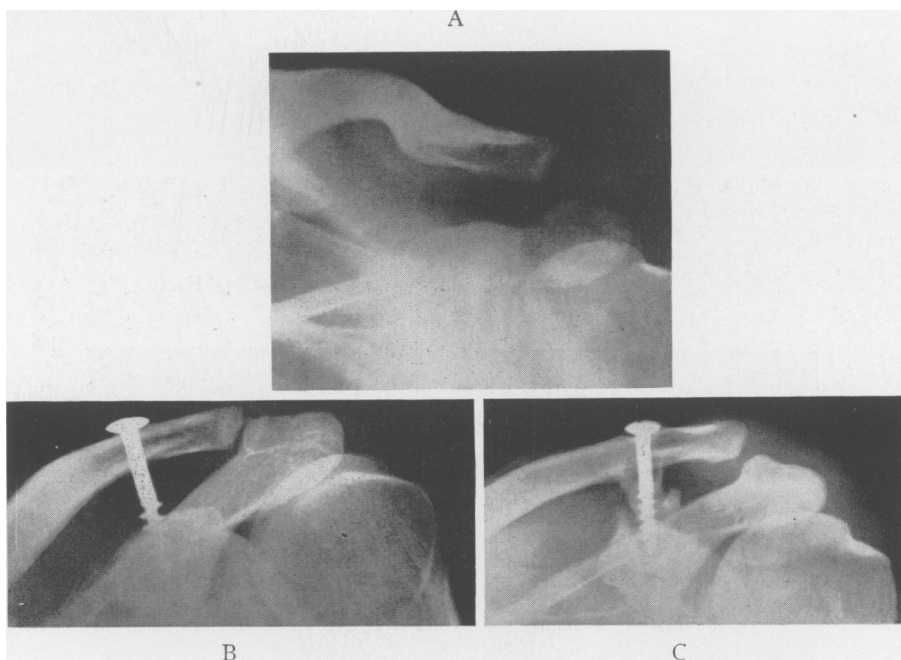


FIG 4.—Case 5: E. G., laborer, age 27.
A. Before operation.
B. Screw not inserted deeply enough.
C. Four years and 10 months result. A3—E4—F4. Excellent function although screw had pulled slightly.

Case 3.—J. M., was operated upon 2-20-1941, at the age of 65.⁸ A fall on the ice two days previously had resulted in a complete right acromioclavicular dislocation. Full reduction was not secured at the time of operation. The old style screw was used and at four weeks it broke, with recurrence of dislocation (Fig. 3). This patient persistently refused reoperation with the new type of screw. When last examined, two years and three months after operation, his only complaint was of occasional pain in the affected shoulder and weakness in the arm.

COMMENT: Partial reduction placed the screw at a great mechanical disadvantage and subjected it to increased stress, yet, because the screw was inserted through both cortices of the coracoid it did not pull out—it broke. The result at two years and three months, must be classed as an operative failure, patient refusing further treatment: A0—E2—F2.

Case 4.—A. M., was operated upon 2-20-1941, at the age of 34, for a complete left acromioclavicular dislocation.⁸ This was a compensation case involving a highly nervous, very apprehensive individual whose injury was the result of a fall the day before operation. Roentgenograms⁸ and clinical examination at seven weeks showed excellent reduction with complete, strong painless function. However, patient worried constantly about having a metal screw in her shoulder and it was removed by another surgeon. When patient was last seen by me, six months after the original operation, there were no complaints referable to the shoulder and she had been doing heavy work as a masseuse for three and a half months. There was no deformity, no limitation of motion, no weakness and no pain.

COMMENT: The screw in this case was placed through both cortices of the coracoid and though it was of the old fine-threaded variety it held securely until it was removed. Six months result: A4—E4—F4.

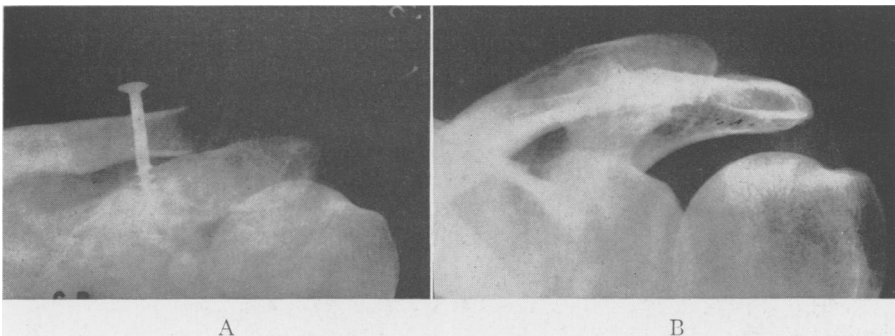


FIG. 5.—Case 6: C. P., athlete, age 24.
A. Screw not inserted deeply enough.
B. Four years and 6 months result. Note abundant callus. Served overseas as paratrooper. A4—E4—F4.

Case 5.—E. G., was operated upon 4-23-1941, at age 27, for a complete left acromioclavicular dislocation (Fig. 4A and B) resulting from a fall on the shoulder a day or two before. This patient resumed heavy work in less than four weeks, against advice. Recently, five years since operation, this patient writes from California: "I have been doing heavy work now for about three years. The screw is still where you put it. I hardly ever give it a thought any more as my left shoulder don't pain or bother me." Roentgenograms (Fig. 4C), taken 2-5-1946, show slight pulling of the screw with new bone formed about the shaft and no absorption about the screw threads.

Case 6.—C. P., at the age of 24, suffered a complete left acromioclavicular dislocation when he was struck forcibly on the point of the shoulder by another man's head during a baseball game. Operation was performed, 8-22-1941, one week after injury, with the new flanged screw. In this case, also, the screw pulled slightly (Fig. 5A). At six weeks the screw was removed, under local anesthesia. This patient was a big, heavily-muscled young man who was accepted for enlistment in the air corps within one year after operation. Later, he served as a paratrooper in the Pacific. Examination, 2-5-'46, revealed an apparently normal shoulder. There was no pain, limitation of motion, deformity or weakness. Roentgenograms (Fig. 5B) show maintenance of good reduction, with a heavy mass of bone apparently uniting the coracoid to the overlying clavicle. On roentgenograms taken in other planes, however, a pseudarthrosis can be seen to traverse this bony mass horizontally.

COMMENT: In both the preceding cases, the screw was not inserted far enough to grip both cortices of the coracoid and the patients resumed heavy work, against advice, too soon. Four years and ten months result in Case 5: A3—E4—F4. Four and one-half years result in Case 6: A4—E4—F4.

Case 7.—R. H., at the age of 23, sustained a complete right acromioclavicular dislocation (Fig. 6A) by landing on the point of his shoulder while making a flying

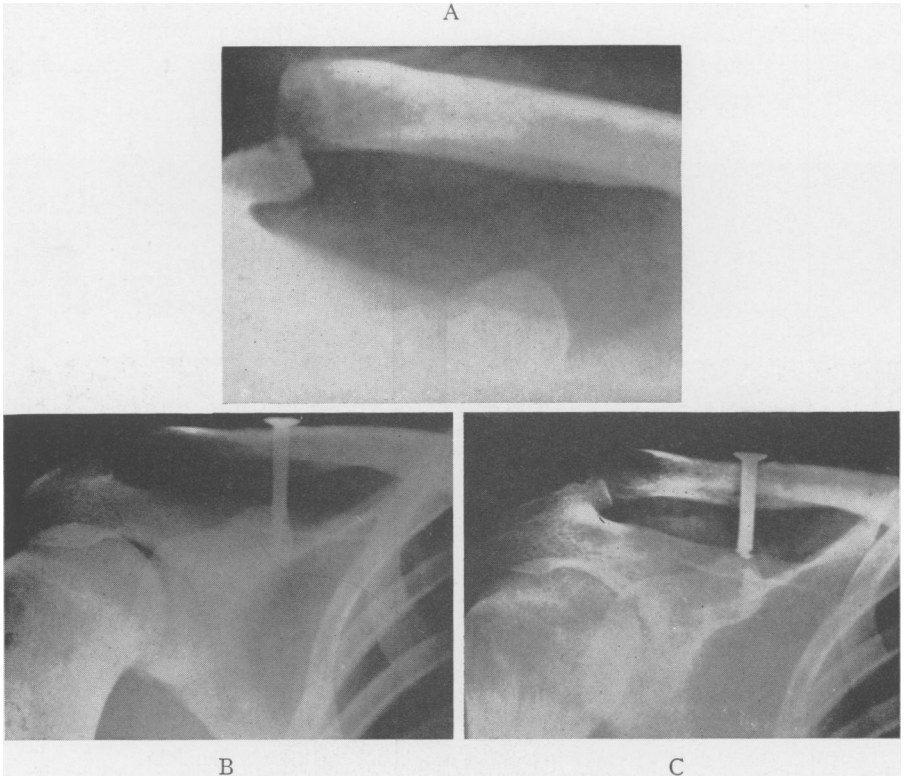


FIG. 6.—Case 7: R. H., electrical engineer, age 23.

A. Failure of pressure dressing.

B. Screw reduction.

C. Four years and 2 months result. Reduction maintained despite breaking of screw. Patient accepted by navy. A4—E4—F4.

tackle in a football game. This was another tall, muscular individual. Tight adhesive strapping for two weeks failed to maintain reduction and caused extreme skin irritation. Operation was performed, 12-20-1941, with the new flanged screw. Excellent reduction was secured (Fig. 6B), and he returned to full (clerical) work eight hours a day the second day after operation, without a sling. He dressed and took care of himself from the day of operation but he noticed a slight restriction of motion in reaching across his chest or behind his back. Ten weeks after operation, while lifting a 75-pound weight, he felt the screw snap and immediately found himself with a complete range of motion. In 1944, he was accepted for service in the navy. Examination, 2-22-1946,

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revealed no pain, tenderness, limitation of motion, weakness or deformity. Roentgenograms (Fig. 6C) show the broken screw, but reduction well-maintained and considerable bony callus in the healed coracoclavicular ligaments.

COMMENT: In this case the screw obviously interfered to a slight extent with full range of motion in the acromioclavicular joint until the screw broke. When, as here, the screw restricts motion, it should be removed at eight weeks. Four years and two months result: A₄—E₄—F₄.

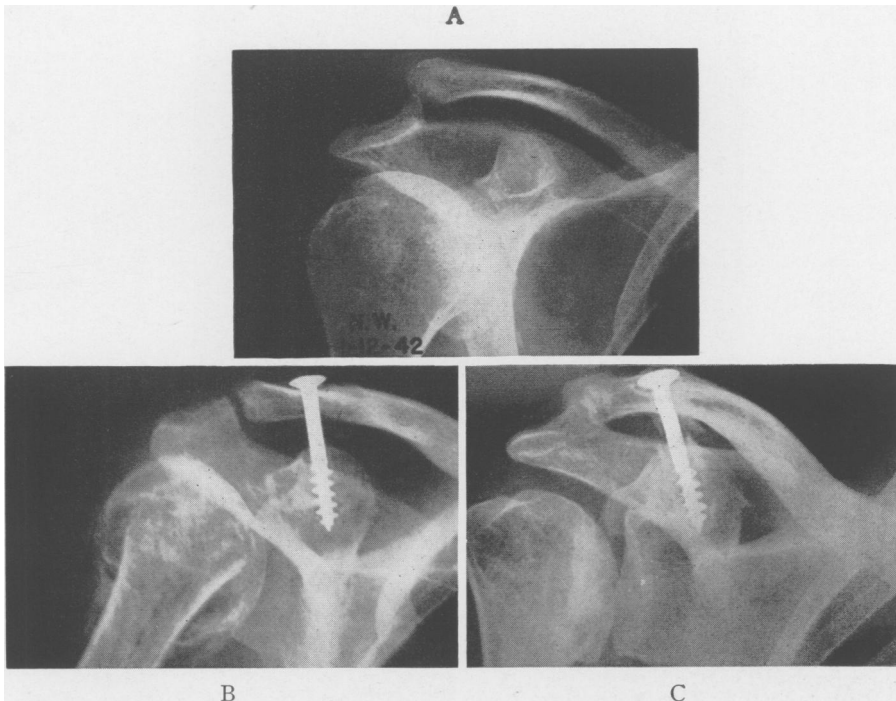


FIG. 7.—Case 8: N. W., housewife and business woman, age 47.

A. Firmly adherent acromioclavicular dislocation and frozen shoulder.

B. Fracture of humerus following remanipulation by another surgeon seven weeks after original surgery. Note that screw did not pull in spite of force applied.

C. Four years and 2 months result. No recurrence of acromioclavicular dislocation. A₄—E₄—F₄. Surprisingly good function with malformed head of humerus.

Case 8.—N. W., at the age of 47, was knocked down by an automobile more than two months before she came for treatment. During this time she had been wearing a pressure dressing and receiving physiotherapy three times a week. Examination revealed a very thin, extremely apprehensive woman who seemed on the verge of a nervous breakdown. There was a persistent severe dislocation of the right acromioclavicular joint, the tip of the clavicle riding above the acromion (Fig. 7A). It had become fixed in this position by adhesions and could not be reduced. All motions in the shoulder joint were severely limited by adhesions and attempts at passive motion elicited intolerable pain. At operation, 1-13-1942, the adhesions about the frozen shoulder joint were broken up by manipulation under general anesthesia. The acromioclavicular joint was exposed, adhesions severed by sharp dissection and complete reduction was secured. This was

maintained by the insertion of a flanged vitallium screw in the usual manner. One week after operation I was called to active army duty and lost control of the patient. Seven weeks after the initial surgery, manipulation under anesthesia was again performed by another surgeon to free the shoulder joint which had refrozen. This, unfortunately, resulted in a fracture through the rarefied surgical neck of the humerus (Fig. 7B) although reduction of the acromioclavicular dislocation was maintained by the screw. The patient was discharged three weeks later, but for eight months she returned to

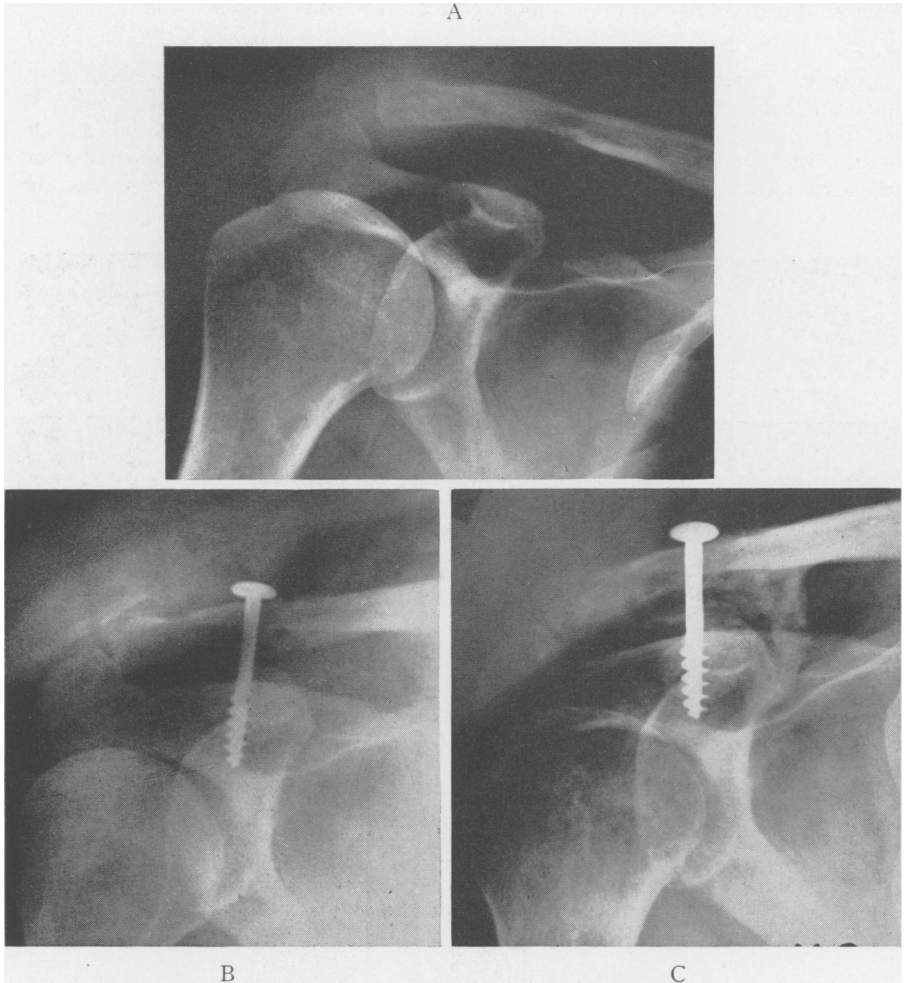


FIG. 8.—Case 9: M. C., laborer, age (?) (Courtesy of Dr. D. H. Maunz, Bradford, Pa.)

A. Preoperative film.

B. Screw inserted well through both cortices of coracoid.

C. Five months result. Note maintenance of reduction despite heavy work and extensive callus formation in coracoclavicular ligaments. A4—E4—F4.

the clinic daily for physiotherapy. When seen four years and two months after operation, this woman had changed from a pain-ridden cripple to a cheerful housewife. The acromioclavicular joint remained reduced, but there was restriction of motion in the shoulder joint due to the fracture of the humerus previously mentioned. She could reach

well behind her back, to the back of her neck and the top of her head. Roentgenograms (Fig. 7C) show reduction of the acromioclavicular joint with the screw encapsulated by bone. The humeral fracture has healed, with a deformed head.

COMMENT: This case was an old acromioclavicular separation complicated by a badly frozen shoulder and a subsequent fracture of the surgical neck of the humerus incurred during treatment. Four years and two months result of the acromioclavicular repair: A₄—E₄—F₄.

Cases of Other Surgeons (based on personal communication):

Case 9.—(From Dr. Daniel H. Maunz, Bradford, Pa.) M. C., a manual laborer, 12-14-1941, suffered a complete acromioclavicular dislocation (Fig. 8A). An attempt to insert the screw in the coracoid, 1-2-1942, with patient sitting upright, failed. On 1-6-1942, with patient lying on his back and under general anesthesia, open reduction of the acromioclavicular separation was accomplished, the coracoid was exposed and the

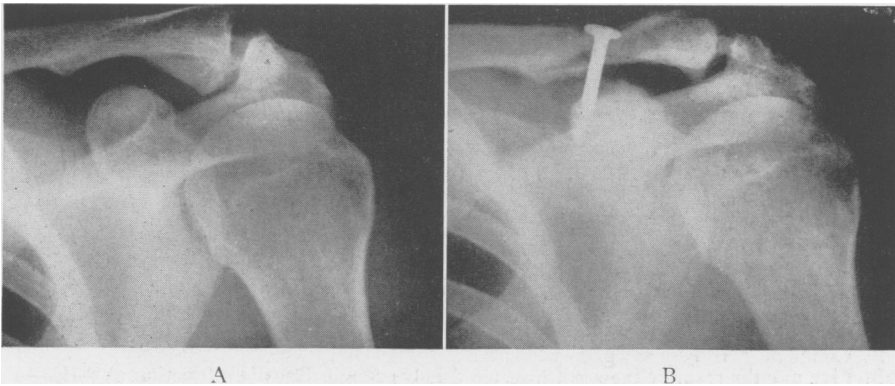


FIG. 9.—Case 10: N. B., laborer, age (?) (Courtesy of Dr. G. K. Coonse, Boston, Mass.)
A. Four months old acromioclavicular dislocation.
B. Six months result. Dislocation over-reduced. A₄—E₄—F₄.

screw inserted under direct vision (Fig. 8B). Latest roentgenograms (Fig. 8C), taken more than three months after operation, show maintenance of excellent reduction, no absorption about the screw threads and a mass of fresh callus extending from coracoid to overlying clavicle. When last seen by Doctor Maunz in June, 1942, five months after operation, the patient was doing heavy work and had no complaints. This patient died of other causes some two years ago.

COMMENT: Note that the screw penetrated both cortices of the coracoid and that abundant callus formed in the region of the torn ligaments. Five months result: A₄—E₄—F₄.

Case 10.—(From Dr. G. Kenneth Coonse, Boston, Mass.) N. B., a manual laborer, presented an acromioclavicular dislocation that was more than four months old (Fig. 9A). Screw reduction was performed in April, 1941, and the patient returned to fairly heavy labor two months later. At the last examination six months after operation Doctor Coonse reported "a very satisfactory end result. At present time there is less prominence on the affected side than on the normal side." Roentgenograms (Fig. 9B) taken one month postoperative show reduction maintained by screw in good position.

COMMENT: This was an old persistent acromioclavicular separation successfully treated with screw suspension. Note again that the screw was made to penetrate both cortices of the coracoid, and that callus formed in the ligaments. Six months result: A4—E4—F4.

Case 11.—(From Dr. F. W. Slobe, Chicago, Ill.) "H. H., age 59, was injured 10-1-1945, the outer end of the clavicle projecting into the muscles and skin posteriorly (Fig. 10A). He was operated upon 10-4-1945. Recovery was uneventful, and he was singularly free from pain and discomfort during convalescence. He returned to his work as a teamster six weeks later. Roentgenograms (Fig. 10B) taken in December, 1945, show some upward displacement, with the screw pulled out partially." Five months after operation "there has been no increase in the deformity as indicated on his last roentgenograms. He has very little discomfort in the shoulder and has full range of motion.

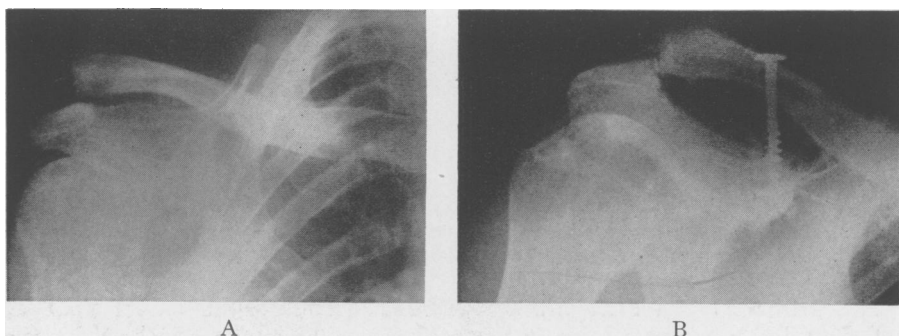


FIG. 10.—Case 11: H. H., teamster, age 59. (Courtesy of Dr. F. W. Slobe, Chicago, Ill.)
A. Complete acromioclavicular dislocation.
B. Five months result. Screw not inserted deeply enough. Excellent function. A3—E4—F4.

COMMENT: This was an industrial case and he has made no claim for compensation which, I think, is quite indicative of how he feels about the result. I feel also that functional impairment is minimal.

Case 12.—(From Dr. F. W. Slobe, Chicago, Ill.) "A. S., age 43, 1-22-1946, was injured in an automobile accident and suffered a complete acromioclavicular dislocation on the right side. We did not see the patient until a few days later, when he was sent to the hospital and was operated upon. It appeared that we had a good fixation and reduction in the operating room, but roentgenograms taken the following day showed that the screw had only contacted part of the coracoid (Fig. 11A), so a few days later the procedure was performed again, this time being checked by an anteroposterior roentgenogram. This worked very well, and we obtained an excellent reduction (Fig. 11B)."

COMMENT: These two cases illustrate the superiority of roentgenograms over fluoroscopy as a means of checking screw position during operation, as well as the necessity of sinking the screw firmly into the coracoid so that its threads grasp the under cortex of that bone. Five months result in Case 11: A3—E4—F4. It is too early to give an end-result in Case 12.

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Case 13.—(From Dr. W. F. Cotting, Boston, Mass.) "A young man fell off a traveling crane, and I was able to insert one of your screws and obtain a very excellent result. He was immobilized in a double sling for about two weeks, and within four weeks had normal motion. It is now 12 weeks since he was injured, and he shows today perfectly normal shoulder motion with no loss of function." Neither the roentgenograms nor the patient can be located.

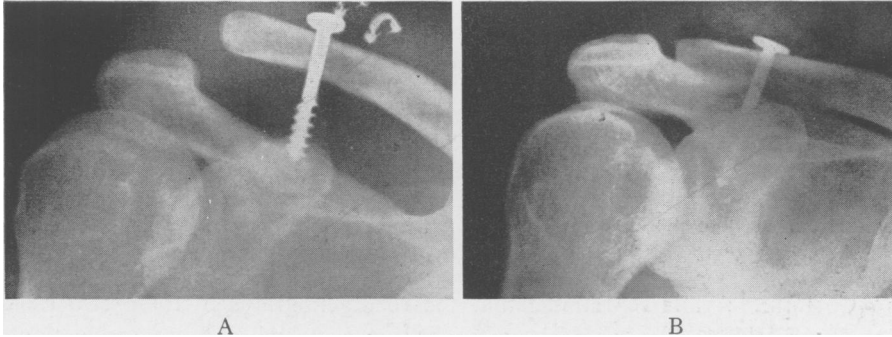


FIG. 11.—Case 12: A. S., occupation (?), age 43. (Courtesy of Dr. F. W. Slobe, Chicago, Ill.)

A. First attempt at reduction using fluoroscope. Screw not inserted deeply enough.
B. Reoperation, using roentgenologic check-up. Screw solidly implanted. Case too recent for end-result.

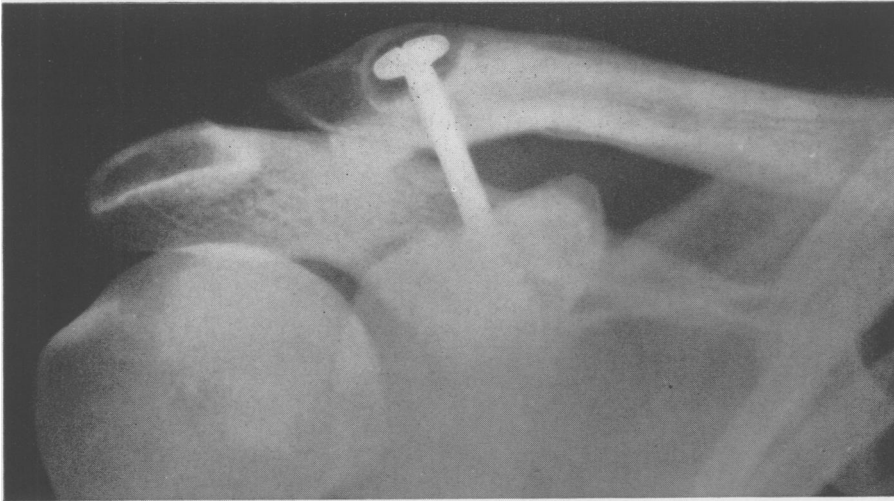


FIG. 12.—Case 17: (Courtesy of Dr. S. A. Bernstein, Brooklyn, N. Y.) Four-year result. A4—E4—F4.

Case 14.—(From Dr. W. F. Cotting, Boston, Mass.) "I operated upon G. M., 10-25-1941. He was a truckdriver and made a good recovery. He had normal range of motion in the shoulder and no appreciable mobility at the acromioclavicular joint. He made his last postoperative visit on 11-17-1941. I heard no more from him until 3-9-1942. Examination then showed a foreign-body reaction manifested by some local tenderness and inflammation. On 3-16-1942 (five months after the original operation) I

removed the screw under local anesthesia, and last saw him postoperatively on 4-6-1942. He was back at work and had no symptoms. The wound was fully healed and he had normal motion and function. I have been unable to locate the roentgenograms."

COMMENT: Removal of the screw in Case 14 apparently did not weaken the repair. Although roentgenograms in both the foregoing cases can not be located, reliable clinical examination indicates the end-results at three months in Case 13 and five and one-half months in Case 14 as: A4—E4—F4.

Cases 15 and 16.—(From L. E. Gilje, Capt., M. C., U. S. N., Chief of Surgery, U. S. Naval Hospital, Bethesda, Md.) "I used the acromioclavicular screw on two cases. In the first case, the screw broke loose from the coracoid process after about six to eight weeks and had to be removed because it was producing pressure on the surrounding area. In the second case, the screw was utilized to fix the distal end of the clavicle to the coracoid process and a portion of the short head of the biceps was brought up and anchored to the clavicle. The screw was only left in place until the tendon of the short head of the biceps was firmly adherent to the clavicle."

COMMENT: It is regrettable that the roentgenograms in these two cases are unavailable. Also, there is no indication as to when these two patients resumed heavy work. However, the end-result in the first case was an obvious failure and that in the second case, although apparently successful, is immaterial since the screw was used as an adjunct in the operation and not depended on for sole support.

Case 17.—(From Dr. S. A. Bernstein, Brooklyn, N. Y.) "I operated upon my patient 4-6-1942. He had a full range of motion four weeks after the operation. Examination 3-22-1946: Patient states that the right shoulder does not bother him except for a slight grating noise on certain motions of this joint. He uses the arm very freely and does not spare it. He was discharged from the army after two and one-half years of service in an engineer outfit. His discharge was not predicated on any disability. The right shoulder shows no elevation of the outer end of the clavicle as compared with the left. There is a full range of active motion in all directions. No weakness of the muscles of the right shoulder girdle. Good power of both hands. There is no tenderness over the outer end of the clavicle." Roentgenograms (Fig. 12) show that the screw has not moved, and that reduction of the acromioclavicular joint has been maintained.

COMMENT: Two and one-half years of service in an engineer outfit during the recent war is a good test of any method used in repairing an acromioclavicular dislocation. Four-year end-result: A4—E4—F4.

SUMMARY

Detailed end-results have been presented of 17 cases in which a suspension screw was used by seven different surgeons in the treatment of acromioclavicular dislocation. Eight of these are the first consecutive cases in which the operation was used. Modifications of the operative technic are presented.

CONCLUSIONS

The long-term end-results of screw suspension in the treatment of acute and chronic dislocation of the acromioclavicular joint have been very satisfactory. In addition, disability of the patient has been minimized, early

mobilization of the extremity has been assured, and convalescence shortened. Experience has shown that dangers inherent in the operation are negligible.

REFERENCES

- ¹ Bunnell, S.: Fascial Graft for Dislocation of Acromioclavicular Joint. *Surg., Gynec. & Obst.*, **46**: 563, 1928.
- ² Birkett, A. N.: Acromioclavicular Dislocation: Operative Repair. *Brit. J. Surg.*, **32**: 103, July, 1944.
- ³ Murray, Gordon: Fixation of Dislocations of the Acromioclavicular Joint. *Canadian M. Ass. J.*, **43**: 270, 1940.
- ⁴ Phemister, D. B.: Acromioclavicular Dislocation: Treatment by Open Reduction and Threaded Wire Fixation. *J. B. J. S.*, **24**: 166, January, 1942.
- ⁵ Bloom, F. A.: Wire Fixation in Acromioclavicular Dislocation. *J. B. J. S.*, **27**: 273, April, 1945.
- ⁶ Gurd, F. B.: Treatment of Complete Dislocation of the Outer End of the Clavicle: An hitherto undescribed Operation. *ANNALS OF SURGERY*, **113**: 1094, June, 1941.
- ⁷ Mumford, E. B.: Acromioclavicular Dislocation: New Operative Treatment. *J. B. J. S.*, **23**: 799, October, 1941.
- ⁸ Bosworth, Boardman M.: Acromioclavicular Separation: New Method of Repair. *Surg., Gynec. & Obst.*, **73**: 866, 1941.
- ⁹ Watson-Jones, Sir Reginald: *Fractures and Joint Injuries*. 3rd edition. E. & S. Livingstone, Ltd. Edinburgh. 1946. Volume 2, page 434.
- ¹⁰ Mazet, R., Jr.: Migration of Kirschner Wire from Shoulder Region into Lung: Two Cases. *J. B. J. S.*, **25**: 477, April, 1943.

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Bronxville, N. Y.