

The Classic

Arthroplasty of the Elbow

Willis C. Campbell MD (1880–1941)
The 2nd President of the AAOS 1933

Willis Cohoon Campbell was born in Jackson, Mississippi in 1880. He received his undergraduate training in his home state and medical training at the University of Virginia, Charlottesville, where he graduated in 1924 [5]. After serving a two-year internship, he went into private practice in Memphis, Tennessee. As with other prominent orthopaedic surgeons (Ryerson among them), he visited medical centers in Europe, particularly London and Vienna. He evidently then spent some time in postgraduate work in New York City prior to returning to private practice in Memphis. (Most formal residencies were not established until the 1930s coincident with the formation of the American Board of Orthopaedic Surgery in 1934, although many doctors took “postgraduate” work following one or two years of internship in general medicine or surgery.) In 1910, he was asked to organize a Department of Orthopaedic Surgery at the University of Tennessee Medical School as the first Professor of Orthopaedics, a post he held until his death.

In addition to forming a department for the university, Campbell helped establish one of the first hospitals for crippled children in the south, then the Willis Cohoon Campbell Clinic in 1920 [1], and finally in 1923 the Hospital for Crippled Adults. The Campbell clinic provided postgraduate training, meeting the requirements of the American Board for the Certification of Specialists. Dr. Campbell, while not one of the original nine board members of the American Board of Orthopaedic Surgery, was influential in establishing the Board in 1934. According to Wickstrom [4], a “...persistent rumor, repeatedly denied, held that Henderson (Melvin) and Campbell were the primary movers behind the establishment of both the American Academy of Orthopaedic surgeons and the American Board in Orthopaedic Surgery; their actions were said to be a retaliatory



Willis Cohoon Campbell, MD is shown. Photograph is reproduced with permission and ©American Academy of Orthopaedic Surgeons. *Fifty Years of Progress*, 1983.

response to their rejection by the orthopaedic establishment “in the East.” Be that as it may, Dr. Campbell served as President of a number of professional organizations [1]. He published many papers and three monographs, including the classic “Operative Orthopaedics” [3], which has gone through 10 editions, was the standard textbook for orthopaedic surgeons for decades and remains one of the most widely read references. Dr. Campbell was widely known as a kind, courteous man [5].

The article reproduced here describes arthroplasty of the elbow to restore motion to ankylosed joints [2]. In this article Campbell recognized some of the described resection arthroplasties (usually with interposition of various materials) left the elbow unstable and weak. He advocated creating a “double flap” of the triceps aponeurosis and underlying periosteum and suturing that to the anterior capsule of the elbow after resecting bone. This, he suggested, allowed

functional motion within 6 months in the two cases he described. Interestingly, in his “Operative Orthopaedics” published in 1939, he recommends covering the exposed bony surfaces with fascia lata, and does not describe attaching the flap of the triceps to the anterior capsule, but rather suggests attaching “at a lower point than its former attachment to permit free play of the joint in flexion” [3].

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5. Willis Cohoon Campbell 1880–1941. *J Bone Joint Surg Am.* 1941;23:716–717.

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The mobilization of an ankylosed elbow may be accomplished by simple excision, provided sufficient bone is removed, but such a procedure may render the part weak and unstable. To reconstruct a joint, with a wide range of motion and stability, which will stand the strain of average daily use, is a far more difficult problem. However, unless such a result can be secured a stiff joint in the most useful position is preferable.

In only selected cases should operative procedures for mobilization of an ankylosed joint be considered. The

following pathological conditions, which are encountered, decrease the chances of success or actually contraindicate surgical measures:

1. Tuberculosis: In no case should a joint be entered for the purpose of mobilization when tuberculosis was the causative agent in the production of ankylosis. Undoubtedly, it might be possible to obtain excellent results in some instances, but the probability of “lighting up” a latent tubercular process is well known and should be sufficient warning against surgical measures.
2. In those in which a destructive osteitis, in early life, has obliterated the epiphyses a materially shortened extremity is encountered, mobilization of such a joint would not be of sufficient advantage to justify the means.
3. Extensive scar tissue, binding the skin to the bone, may obviously render the procedure unsuitable.
4. Extreme muscular atrophy with reorganization of bone structure, as is seen when a bony ankylosis has existed over a long period of time and the medulla of the humerus and ulna have become continuous through the joint, making one canal from the wrist to the shoulder. In such an instance, which is fortunately rare in the elbow, sufficient base would not be found to reconstruct a functional joint, besides the open medullary canal might be a factor to be considered. The muscular apparatus would also be extremely atrophic and its restoration difficult.
5. Old dense eburnated bone, when found for a considerable distance on both sides of the joint, is not favorable soil for reproduction of a movable joint. Such a condition is usually caused by an extensive virulent osteomyelitis, the result of which is a bone tissue of low grade, bearing the same relation to normal bone that scar tissue does to normal soft tissues. In fact, healthy, spongy bone should compose the articular surfaces of the new joint, consequently, the chance

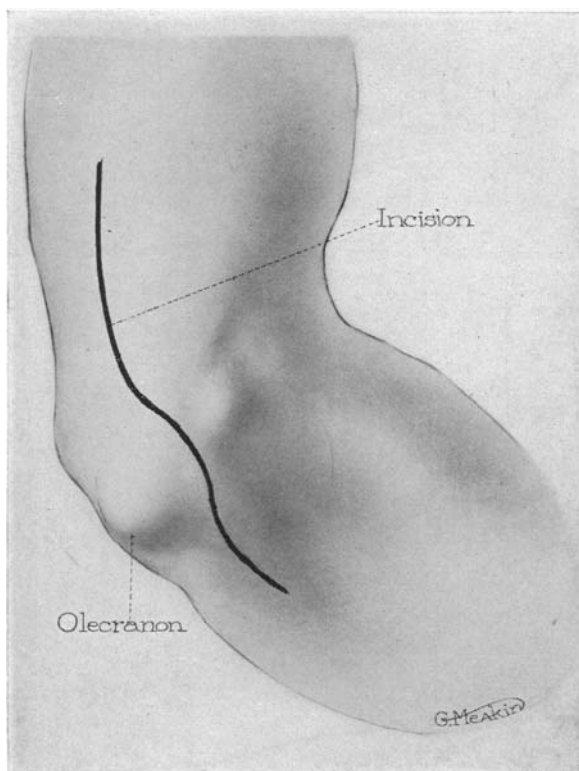


Fig. 1 External lateral incision for approach to elbow.

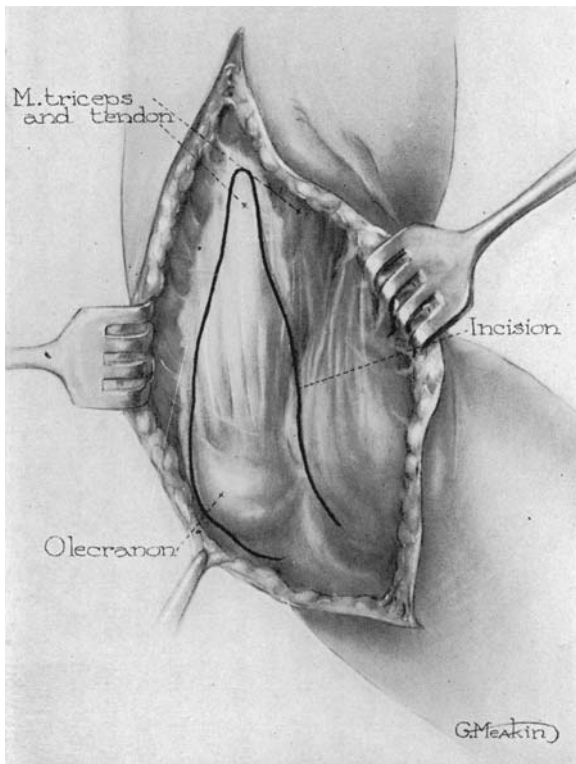


Fig. 2 Dissection of aponeurotic flaps from posterior aspect of triceps.

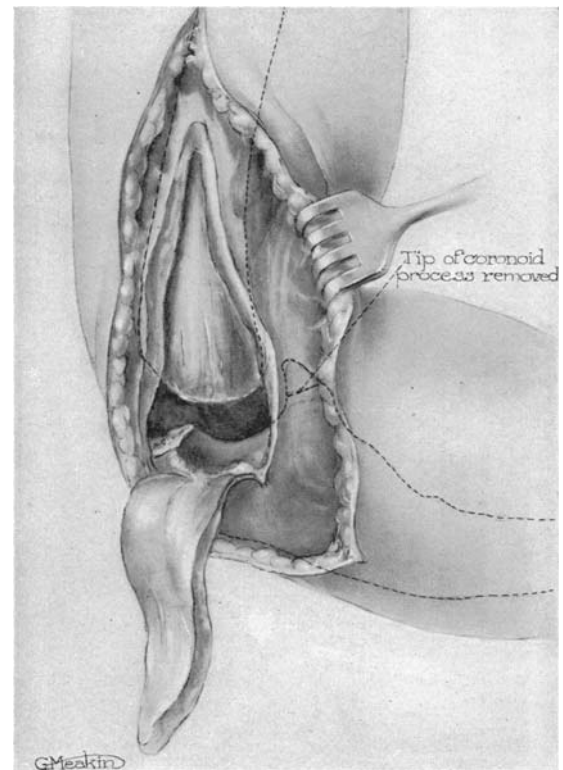


Fig. 4 Remodeled articular surfaces.

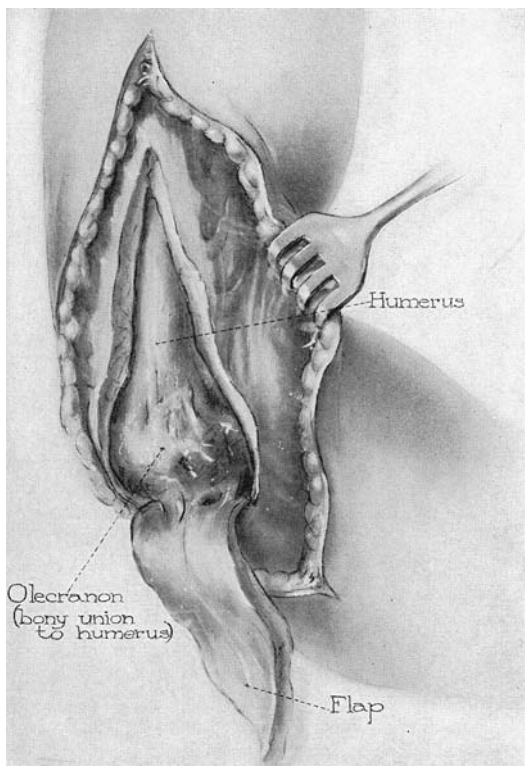


Fig. 3 Fibres of the triceps muscle through which median incision is made and muscle retracted with periosteum.

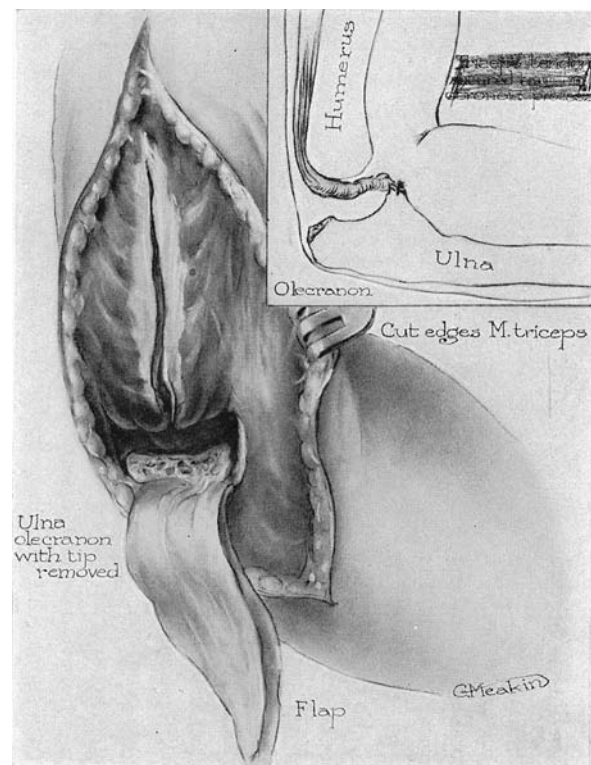


Fig. 5 Closure of median incision through triceps, with living muscle interposition between joint surfaces, the redundant soft tissues being stitched to anterior capsule, when not available aponeurotic flap is used.

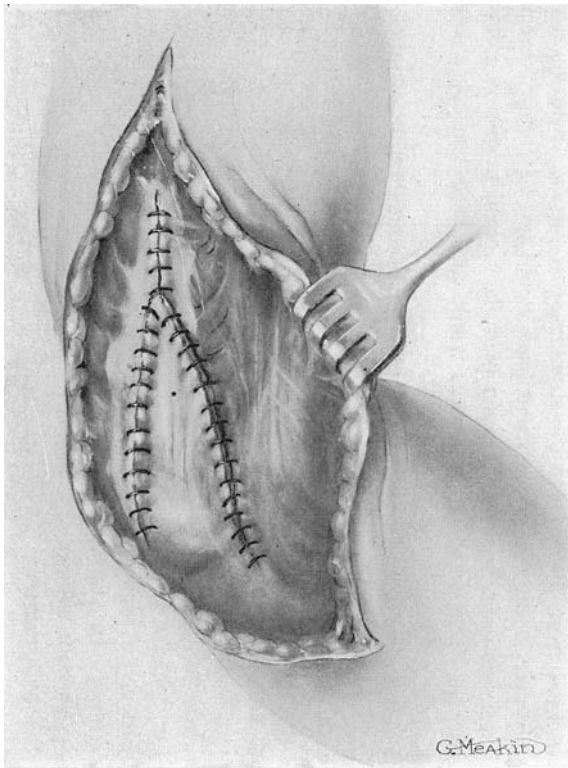


Fig. 6 Closure of muscle and flap relaxing posterior structures which are often contracted.



Fig. 7 Flexion six months after operation for bony ankylosis—arthroplasty.

of success is very slight when the structure of the bone has been transformed for one or more inches beyond the joint line.

There are, in reality, only two conditions in which open surgical procedures should be employed in ankylosed joints for the purpose of restoring motion: First, traumatism, causing a crushing of the joint surfaces with tear-ing of the periosteum or multiple fractures, followed by bony ankylosis. Second, acute infectious arthritis due to staphylococcus, streptococcus, pneumococcus, gonococcus, etc. These organisms erode and disintegrate the cartilages and the superficial bone, unless the infection begins in the shaft and then we have an extensive osteomyelitis and not a localized arthritis.

In no case should this operation be lightly undertaken. The social status, occupation and coöperative intelligence, or “grit” of the patient, must be duly considered. For instance, a young woman applied for treatment with ankylosis of the elbow at about 160 degrees flexion, with the forearm in pronation. She was a pianist and in her present state able to pursue her vocation. We declined to do the operation, though good function might have been secured, but, even if such was the case, we could hardly be sure of obtaining the required degree of pronation essential to successful performance on the piano.

A chronological survey of surgical procedures for the purpose of mobilization of joints with bony ankylosis has been omitted. However, there are five well-known methods practiced at the present time by various surgeons, as follows:

1. Wide excision of articular surfaces, which usually causes instability and should not be considered.
2. Pedunculated fascial flaps have been extensively employed between the articular surfaces, after remodeling or carving out a new joint. The procedure has been discarded by a majority of experienced operators in this field.
3. Interposition of animal membranes, specially prepared, such as cargin membrane, Baer’s pig bladder, Allison’s fascia, etc. While successes have been reported, the disadvantage is that foreign body irritation invites infection and the material is often excluded.
4. Transplantation of free fascia lata, extensively used by Putti, of Italy, and Russell MacAusland, of Boston.
5. Mechanical reconstruction of the articular surfaces with removal of sufficient bone to secure mobility without the interposition of any substance.

Recently we have employed a sixth method in elbows, which has been satisfactory in a limited number.

Our technic was evolved from our method for the reduction of old dislocations of the elbow, in which a posterior approach is used, the triceps aponeurosis

Fig. 8 Extension six months after operation for bony ankylosis—arthroplasty.



Fig. 9 Case II. Showing extension after hemiarthroplasty.

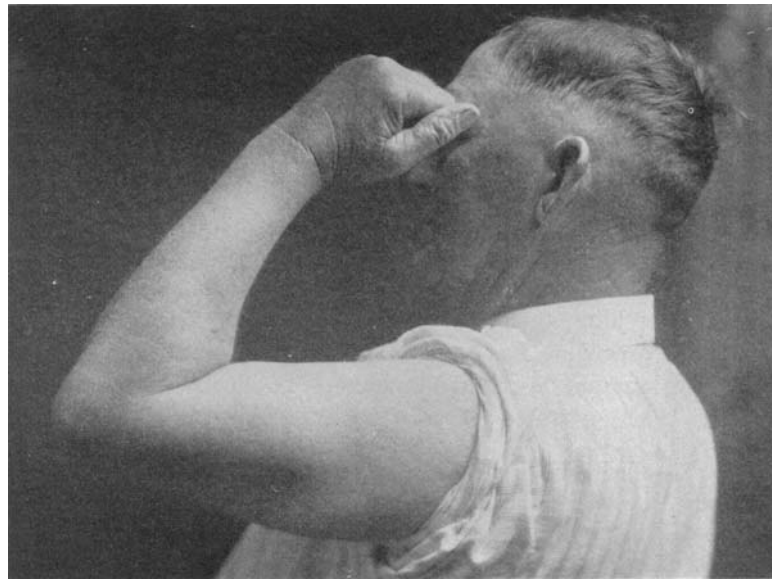


dissected free, the muscle and the periosteum incised directly down to the bone in the midline, and stripped off en masse from the lower end of the humerus. This method gave such an excellent exposure of the elbow-joint and so little damage to those structures vital to the function of the joint, that it was decided to use it as the basis for our arthroplasty operation, the details of which are as follows:

An incision is made, from six to eight inches in length, on the posterior aspect of the arm and forearm, just external to the midline, beginning above, about the middle of the humerus and ending about two or three inches below the elbow-joint. Skin, superficial and deep fascia are incised without separation, the deep fascia is dissected laterally, about one inch. This brings the broad

aponeurosis of the triceps into view. This structure is dissected from above downward, making a long tongue attached to the tip of the olecranon process below. A further incision in the midline passes through the muscular fibres of the triceps and periosteum to the humerus over the lower half. A periosteal elevator is now used to strip the periosteum from the lower third of the humerus. Scar tissue, callous and loose bony particles are removed. If dislocation exists, reduction is then accomplished without difficulty with periosteal elevator, scoop, or any blunt instrument.

There is no structure of consequence in the line of incision, no danger of vessel and nerve injury if one remains close to the bone; however, if ulnar nerve is

Fig. 10 Case II. Showing flexion after hemi-arthroplasty.

exposed it can be isolated and anchored into a position of safety. About one-half to one inch is removed from the lower extremity of the humerus, which is remodeled into a surface convex from before backward, no attempt being made to reproduce trochlea or capitellum. About one-half inch of bone is removed from the tip of the olecranon process. All scar tissue is dissected from the sigmoid cavity. With a sharp chisel the surface is removed to healthy spongy bone. The radio-ulnar articulation is not disturbed, but the surface of the head of the radius must be made the same level as the coronoid process. A rasp and file render smooth all surfaces. The periosteum and triceps muscle are dissected into a double flap, which is stitched to the anterior capsule, thus separating the raw bony surfaces by a living mass of tissue with abundant blood supply and no risk of pressure necrosis. In those cases where the radio-humeral articulation is normal with bony ankylosis between ulna and humerus, the radio-humeral joint is not destroyed, but a hemi-arthroplasty is done between the humerus and the ulna. In such cases it is not always possible to obtain sufficient posterior flap in lieu of which the aponeurotic broad tongue from the triceps is placed between the surfaces. This structure is also employed when, for any reason, the posterior flap cannot be secured. The capsule of the joint is stitched to the posterior aspect of the triceps muscle and deep fascia, thus closing off the new joint, the wound is then closed in layers with catgut and dermal for the skin.

Full flexion and extension has been secured in one case with no motion in the radio-ulnar joint, but this is well compensated by rotation in elbow and shoulder. The procedure has been employed in a limited number of cases, but sufficient to warrant description in detail. To illustrate the essential facts, two cases are briefly narrated:

CASE I.—Girl, married, age nineteen, acute infectious arthritis of right elbow, six weeks' duration, was seen in consultation with Dr. G. C. Conyers, of this city, October, 1920. Joint at right angles with supination of forearm, acute tenderness and swelling, no hope of mobilization could be offered as X-ray showed complete destruction of articular cartilage, with atrophy and erosion of adjacent bone. No suggestions were offered except to continue splint as acute process was receding. July, 1921, eight months after cessation of acute symptoms, there was no swelling or tenderness, arm and forearm at right angles, no motion apparent. X-ray showed bony ankylosis. July, 1921, operative procedure, above described, was performed with primary union of wound. In three weeks gentle passive motion was given and active motion encouraged by a physiotherapist. This was continued for three weeks, when patient left the city contrary to our instructions, but returned September, 1921, when extension was complete with flexion to 60 degrees. Physiotherapy was again instituted to increase flexion, the result of which is shown in the illustrations.

CASE II.—Man, age fifty, February 3, 1921, sustained a comminuted fracture of the left olecranon and coronoid process, which was followed by solid bony ankylosis between the humerus and ulna. The radiohumeral articulation was free and movable, rotation of the forearm normal, position 90 degrees flexion. October 10, 1921, hemi-arthroplasty of the elbow as above described, interposing triceps aponeurosis; about 50 per cent. of normal motion was obtained within six months.

The after-treatment is very important and must be under the direction of the surgeon with coöperation of a competent physiotherapist. However, active motion is most essential, and can only be done through the voluntary

efforts of the individual. In a few elbows and other joints I have seen excellent results by voluntary efforts of the patient, without the aid of anyone, except such instructions as could be given during an office visit, though the average patient will not make the effort without the constant attendance of the gymnast.

Operations for mobilization of joints or arthroplasties are far from 100 per cent. perfect, probably more

successful in the elbow than elsewhere. Young adults give the best prognosis, but this is true of all operations. Our oldest case was fifty years of age. In no case has the member been more impaired; our only permanent sequela has been a recurrence of ankylosis, but with larger experience the proportion of success is greater each year, consequently, we believe that joints with ankylosis should be mobilized by operation when feasible.