Degenerative Changes in the Sternoclavicular and Acromioclavicular Joints in Various Decades

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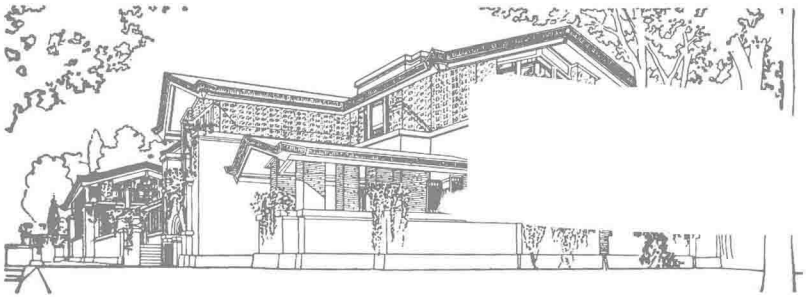

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Dedication

It is with great pride that I dedicate this monograph to my Resident Staffs of the Jefferson Medical College Hospital and of the Philadelphia General Hospital. The technical aid they provided and the loyalty they demonstrated during the pursuance of this project made it possible for me to complete this work.

PREFACE

THE SHOULDER JOINT comprises three true joints, the glenohumeral, the sternoclavicular and the acromioclavicular joints. All three joints share in the overall functional mechanism of the shoulder. As the investigation of the degenerative changes in various decades of the glenohumeral joint reached completion, it soon became apparent that a similar study of the sternoclavicular and acromioclavicular joints would add much information to our present day knowledge of the alterations that occur from decade to decade in these joints and also shed some light on the enigmas relative to the shoulder as a whole that confront us. That such an investigation was a timely one was further emphasized when the literature, dealing with the sternoclavicular and acromioclavicular joints, was reviewed. The paucity of information on this subject is striking; only one work, masterly done, appears in writing. It was recorded by Langen in 1934 in the German literature. This worker confined his investigation to the microscopic study of the changes that occur in the elements comprising the sternoclavicular joints in various decades, no mention of the gross alterations which are of great clinical significance was made. A similar study of the acromioclavicular joint, prior to the one recorded in this text, has never been undertaken. On the other hand, the literature abounds with numerous articles dealing with different methods of conservative and surgical treatment of these two joints.

The anatomical factors which are supposedly responsible for the stability of these joints have been dogmatically handed down from one generation to another and except for one instance have never been challenged. This study reveals that these concepts need revision and some of the operative procedures designed previously to stabilize these joints when disrupted, should be discarded and others adopted.

The observations made in this study establish the normal for the sternoclavicular and acromioclavicular joints in each succes-

sive decade. This information, together with the knowledge gleaned from the study of the degenerative alterations which occur in the glenohumeral joint in various decades, permits one to form a comprehensive picture of the norm for the shoulder as a whole. It provides an explanation for the infrequent implication of the sternoclavicular joint resulting from wear, tear and senescence and from trauma; also, it provides a logical explanation for the frequent involvement of the acromioclavicular joint resulting from the aforementioned factors. It will be shown conclusively that the anatomic construction of the sternoclavicular joint is such that it is capable of resisting for many decades the ravages of stresses incident to function. Such an architectural design is denied the acromioclavicular joint; hence, it is unable to meet the arduous demands of function of a prehensile limb and therefore shows early and severe regressive abnormalities. Such extensive alterations in the acromioclavicular joint render this articulation vulnerable to minor traumas. This sequence of events is responsible for pain so frequently encountered in this joint. That the acromioclavicular joint is a frequent site for a painful and stiff shoulder has been greatly underestimated. In the shoulder clinic of the Jefferson Hospital, this last observation became more and more apparent since, in seeking the agent responsible for pain in the shoulder, this articulation is being examined more meticulously than prior to the completion of the study recorded herein.

It is the hope of the author that the observations recorded in this text will be of value to the surgeon, the general practitioner, the rheumatologist and all those disciplines which seek basic comprehension of the regressive changes that occur uniformly with aging in the component articulations of the shoulder. It is further hoped that this knowledge will lead to a better understanding of the pathogenesis of some of the painful disorders that affect this region and that the sternoclavicular and acromioclavicular joints, especially the latter, be given more consideration when seeking the etiologic factors producing a painful shoulder.

The author acknowledges with gratitude the help of Dr. E. Davis, who collected most of the gross specimens; Dr. W. Davidson, who dissected the greater majority of the specimens and Dr. H. Snedden, Dr. J. Hunter and Mr. B. Sawyer, who worked so

diligently in mounting many of the specimens in plastic blocks. I also thank Dr. G. A. Bennett for making available to me many specimens from the anatomic laboratory of the Jefferson Medical College. I am indebted to Miss E. Nesser for preparation of the microscopic sections; to Mrs. E. Malloy and Miss G. McGowan for their secretarial services and the many hours spent in assembling the final manuscript. Finally, I thank Mr. A. Hancock, the photographer, for the painstaking and meticulous work and for his cooperation which was far beyond the demands of his office.

A. F. DePalma

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INTRODUCTION

In 1950, the study of the variational anatomy and the degenerative changes in the glenohumeral joint in various decades was completed and published. During the pursuance of this investigation, it soon became apparent that a similar study of the sternoclavicular and acromioclavicular joints should be conducted. When one considers the intimate relationship of all the three aforementioned articulations in the overall complex functional mechanism of the shoulder, the need for such an investigation becomes obvious. Hence, such a project was undertaken and in this context are reported the gross and microscopic alterations encountered in the various components of the sternoclavicular and acromioclavicular joints in successive decades. An attempt has been made to establish the norm for each joint in different age periods.

The material used provided an excellent opportunity to study in detail the variational anatomy of the articulations and the varying intensities of the alterations of the components of the joints which are compatible with good function. Some light was shed on the role and significance of the disk in the sternoclavicular joint and on the pathogenesis of the degenerative abnormalities encountered. In addition, this study provided an explanation for the rarity of clinical manifestations in the sternoclavicular joint which is one of the most active joints in the body and the frequency of unfavorable clinical features in the acromioclavicular joint.

One is keenly aware of the numerous contributions dealing with alterations of joint tissues associated with wear and aging made by many brilliant workers. Nevertheless, the many conflicting views on basic issues warrants further investigation. An extensive review of the literature revealed only one detailed study of the sternoclavicular joint. It was published in 1934 by Paulheinz Langen. This worker concerned himself with the microscopic changes in the various joint components in different age

periods and was less concerned with the gross anatomical changes which were not recorded. Langen's study comprised a serial investigation of some 200 pairs of joints obtained from subjects ranging from premature infants to persons 85 years of age. He noted that after the age of 25, 63 per cent of the joints studied were very severely affected by degenerative changes and only 8 or 9 per cent were intact. After the age of 40, this ratio was 74 to 0.7 while after 50 all joints were affected and 82 per cent of the cases exhibited severe alterations. After 60 years, 10 per cent revealed medium-severe alterations and 90 per cent showed severe changes. After 70 years all joints were severely implicated.

It is hoped that the observations recorded herein together with those noted in the glenohumeral joint will clarify in a large measure the complex anatomy of the shoulder joint and permit the clinician and surgeon to place the correct evaluation on the abnormalities noted in all articulations comprising the shoulder joint in various decades. This information permits one to form a composite picture of a normal shoulder joint for each decennium.

MATERIALS AND METHODS

TWO HUNDRED TWENTY-THREE sets of sternoclavicular and acromioclavicular joints were obtained post-mortem from individuals ranging in age from premature infants to 94 years. Only subjects were included in this study whose hospital records on routine questioning revealed no clinical manifestations indicative of joint involvement and physical examination elicited no joint abnormalities. The joints were removed intact without disturbing the enveloping soft tissues.

Each sternoclavicular joint was prepared for study by removing all soft tissues down to the fibrous capsule by sharp dissection. The anterior and posterior portions of the fibrous capsule together with the superior attachment of the disk were severed close to the clavicle. Again, by sharp dissection, the anterior, superior and posterior portions of the fibrous capsule were cut close to the sternum. This dissection mobilized completely the disk except at its inferior border where it blends with the fibrocartilage of the sternum. The only connection between the clavicle and the sternum was the inferior-posterior portion of the fibrous capsule which was used as a hinge upon which to rotate the clavicular head upward, backward and away from the midline, thereby bringing into view the entire articular surface of the clavicle. Displacement of the clavicular head also permitted adequate visualization of the articular surface of the sternum and both surfaces of the disk (Figure 1).

The acromioclavicular joints were also prepared for study by sharp dissection. In each instance, all overlying soft tissues were cut away down to the fibrous capsule. On the superior aspect of the joint, the capsule was divided along its line of insertion into the clavicle on the inner side and the acromion on the outer side. The inferior portion of the capsule was used as a hinge to open the joint. If a disk was present, it maintained a position midway between the articular surfaces of the opened joint (Figure 2).

All joints were placed in a 10 per cent solution of formaldehyde where they remained until studied macroscopically or micro-

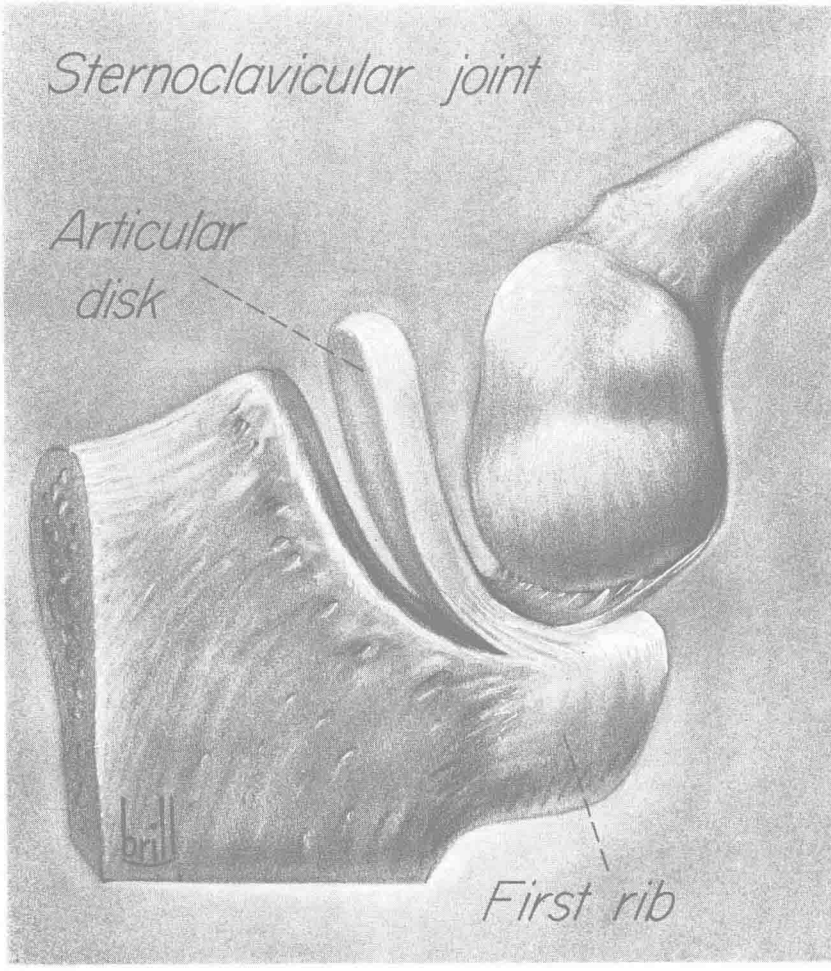

Figure 1. Drawing of a sternoclavicular joint prepared for study. The disk is mobilized and the head of the clavicle is rotated upward and backward; all articular surfaces are readily visualized.