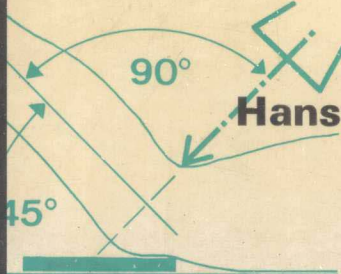
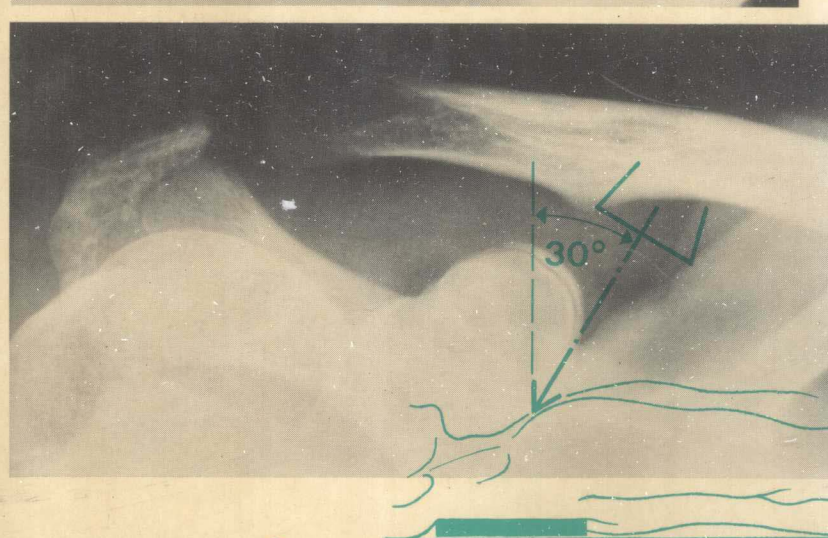
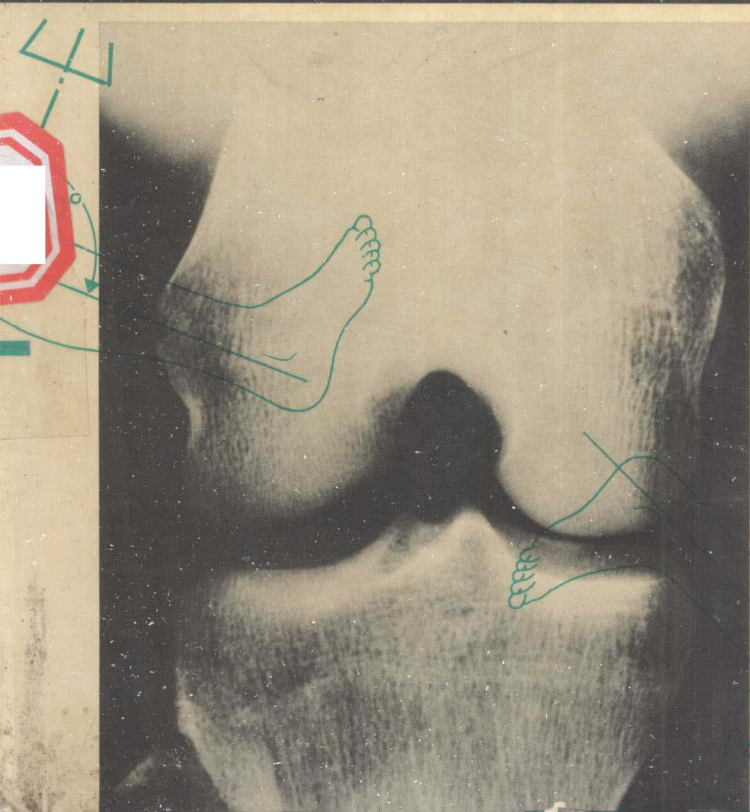
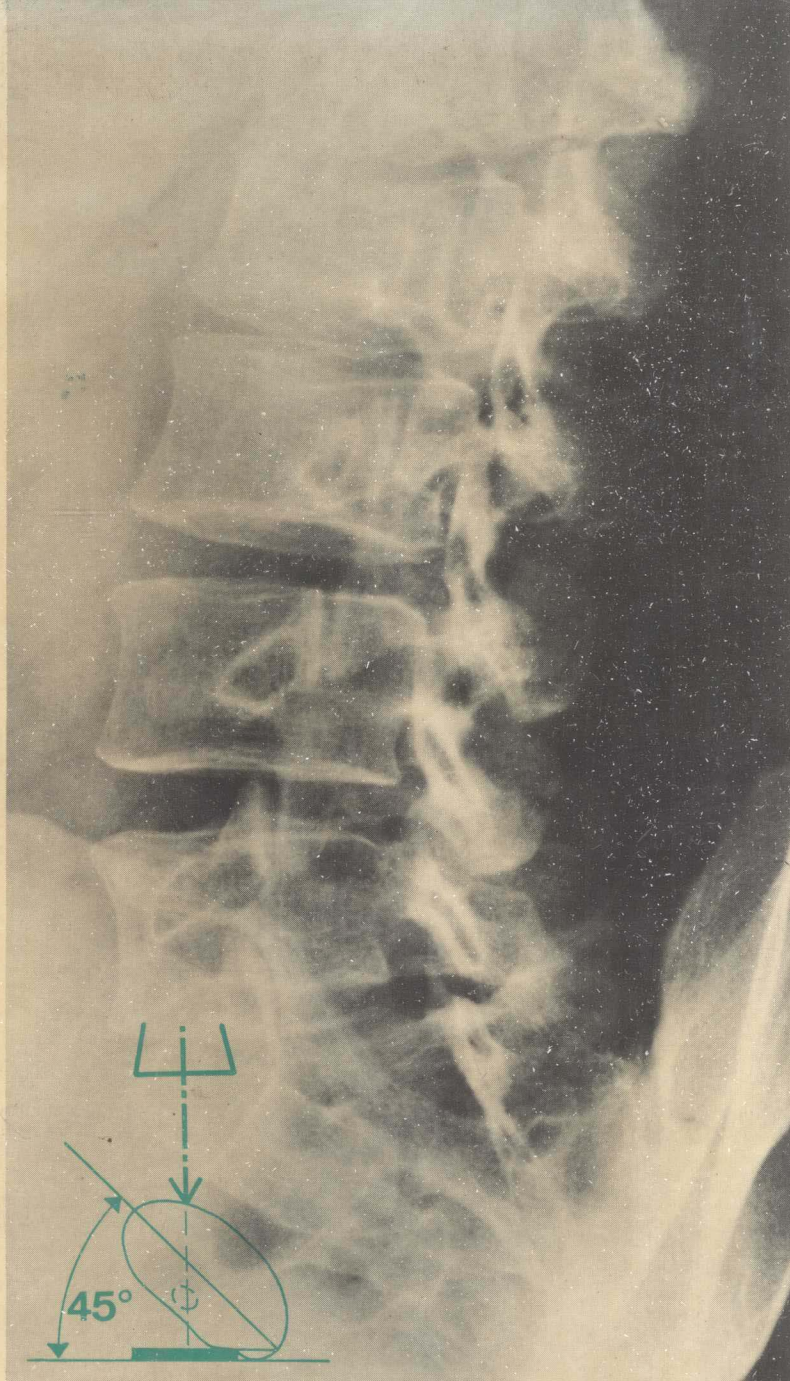


E. Hafner / H. Ch. Meuli

Radiologic Examination in Orthopaedics

Methods and Techniques



Hans Huber Publishers Bern
Stuttgart
Vienna

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With Forewords by
Professor Dr. med. W. A. Fuchs and
Professor Dr. med. M. E. Müller



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Foreword

In the elucidation of injuries and diseases of the locomotor system radiology occupies a central position. For a clear presentation of pathologic changes and for the choice of therapeutic measures, technically faultless taking of X-rays is absolutely essential. Of the greatest importance here is the standardization of the techniques of examination and therefore of the quality for reproduction purposes. This atlas of methods and techniques in the radiology of the locomotor system forms an important basis for the fulfillment of these requirements. My former colleague, Dr. E. Hafner, together with Dr. H. Ch. Meuli, the orthopaedic surgeon, have gathered together the most important radiographic techniques in a precise schematic fashion, using the experience of many years' collaboration at the Clinic for Orthopaedics and Surgery of the Locomotor System and the X-ray-diagnostic Department of the Central Strahleninstitut of the University of Bern.

Through this collaboration of diagnostic radiologist and orthopaedic surgeon an important gap has been closed because of their knowledge of the problems arising in orthopaedics. Strict observance of the methods of examination described will make it possible in future to avoid taking the uneconomical repeat X-rays of the skeleton occasioned by technical inadequacies, and to improve the quality of radiologic diagnosis of injuries and diseases of the locomotor system.

One can only congratulate both authors on their thorough, clear, and didactically excellent work.

W. A. Fuchs

The discovery of the X-rays shortly before the beginning of the 20th century threw a ray of light upon the dark side of the skeleton and represents a milestone in the history of orthopaedics. The specialty, 'blind' up to then, was presented with a torch by the light of which definite diagnoses could be made and results of treatment could be objectively evaluated and followed up over decades.

Increasingly refined operative methods of bone and joint surgery have evolved during the past 20 years. These methods not only aimed at correcting or curing displacements, advanced diseases or residual post-traumatic states by early prophylactic intervention, but increasingly attempts were made frequently to influence the course of most joint diseases for decades, even for life.

In order to diagnose minor congenital, acquired, or traumatic disturbances of the locomotor system that lead to arthrosis later, the radiologist was expected to turn out X-rays that could be compared and which were reproducible. In addition, these had to be of a quality that made the making of a series of angle determinations and of congruence checkings possible in the most exact and simple way. Some of these radiographic techniques now in common use have become well publicized during the last ten years but have never been collected in book form.

My colleague of many years, Dr. H. Ch. Meuli, and Dr. E. Hafner, the radiologist, have filled this gap by the present book. All surgeons who deal with the locomotor system will be grateful to them for their assiduous work over the years. We congratulate them!

M. E. Müller

Preface

Radiologic examinations are essential to the work of the orthopaedic surgeon. Along with the progress of orthopaedic therapeutic measures the methods of radiologic examination have also become more refined and demanding. The orthopaedic surgeon demands a special X-ray technique because he must not only diagnose bony changes but also appreciate displacements and limitations of function. Exact angle measurements are only possible on comparable, well-defined X-rays. The examination techniques should be as simple as possible so that controls of progress, position, and function by reproducible X-rays can be obtained at any time. For this reason it meets a demand when we describe methods and techniques of orthopaedic radiography irrespective of the fact that the individual techniques have already been published in various papers.

Through our presentation, we have aimed at putting order into the radiography of the locomotor system for the use of orthopaedic surgery, to describe it as a whole, and to standardize it as far as possible. A measure of schematic description was necessary. Not all possible methods of examination were included but we catalogued those techniques that are decisive in practice and that are generally applicable. Descriptions of special techniques (arthrography, tomography, etc.) have been omitted because they would have been beyond the scope of this work: individual monographs should be consulted where required. Our intention has been to use a unified nomenclature and we based ourselves on the 'Nomina anatomica' valid at the time. For angle measurements we used the Neutral-Zero method. The decimal classification is meant to make the index of radiographs as lucid as possible.

We hope that by confining ourselves to essentials the patients may be saved from many unnecessary exposures. A standardized technique makes taking multiple X-rays in different hospitals unnecessary and thereby reduces to a minimum the degree of diagnostic radiation received by the population at large.

Our work could hardly have been accomplished without the initiative of Professor M. E. Müller, for whose help we are sincerely grateful. Our thanks are also due to Professor W. A. Fuchs. As radiologist he fully recognized the importance of radiology in orthopaedics and has supported our efforts at the Radiological Institute of Bern University. We thank all those unnamed helpers,

both orthopaedic surgeons and radiologists, who have stimulated us in conversation and discussion. Special thanks are due to our artist, Mr. K. Oberli, who has drawn the sketches with great sensitivity. We thank Mrs. G. Ganz-Gyger for her skillful and professional taking of the radiographs and Miss S. Donati for typing the manuscript. Hans Huber Bern, the Publisher, has spared no effort in producing this book. We are extremely grateful.

E. Hafner/H. Ch. Meuli

Introduction

This manual is intended to aid the physician and the radiographer and to demonstrate the possibility of universally producing good and comparable, i. e. equally focused, X-rays of the individual parts of the skeleton.

We recommend that the following basic rules, which apply in general to the radiography of the locomotor system, be observed:

- The indication for a radiologic examination must be in fulfillment of the requirements of orthopaedic treatment.
- The contralateral side should also always be X-rayed for comparison.
- In orthopaedic radiology functional units must always be kept in mind. For example, in examinations of the knee joint the hips and ankles have to be included in the examination as neighboring joints.
- An X-ray taken in one plane produces only a two-dimensional image of a skeletal segment. Therefore for a picture in space two or three ray directions are necessary.
- Survey exposures serve as first orientation. According to their result a coned-down detailed examination is to be ordered.
- As a matter of principle the long bones should not be taken without the joint, since exposures of the diaphysis alone are misleading and unsuitable for the assessment of fractures and displacements. The survey picture with inclusion of *both* neighboring joints serves as general orientation.
- Stress X-rays should be made with the assistance of the surgeon in charge of the case, since only he knows what he requires. Occasionally, specially constructed holding implements may be used for the purpose (Noesberger et al.). In all stress X-rays, films for comparison of the opposite side should be taken under the same conditions. The various radiographs are schematically ordered and precisely marked. The numbers in the 'Index of Radiographs' correspond to the numbers in the descriptive text and to the numbers of the illustrations. In this way each desired picture can be found in the 'Index of Radiographs' and at once on the book page indicated. Because even today individual pictures or groups of pictures are in daily parlance called by a particular name, these expressions were added here without any claim to completeness. We are, however, of the opinion that it would be preferable if only an anatomical nomenclature were used.

General Technical Hints

For each picture the radiographic technique is completely described; this may be repetitive but is meant to save the reader any annoying searching and turning of pages.

The data on positioning concern mostly the part to be taken and are confined to the essentials necessary for the taking of the X-ray. The instructions are kept as concise as possible, but the individual positions are illustrated by sketches for better understanding. For certain special positionings immobilization is required and the usual aids available in an X-ray department, e.g. rubber foam wedges, bandages with slits etc., are used for this. These will not be individually mentioned since they are available in every X-ray department. The patient should always be positioned as comfortably and painlessly as possible. The usual rules concerning radiation protection have to be observed as a matter of course, especially since it has been established that of all sources of artificial radiation it is the radio-diagnostic examinations that contribute the most to the radiation burden the population has to bear. During all exposures the parts of the body not concerned and especially the gonads must be shielded by lead protection. However, this must not be superimposed on diagnostically important bony parts: the first pelvic survey film must be taken *without* protection of the gonads as the bony structure of the *entire* pelvis has to be surveyed. But with all following control exposures the gonads must be protected as far as possible. New quantitative research by G. Poretti gives information on experimentally determined mean dosages to the gonads.

In all examinations cassettes are used, partly with a high definition screen but no individual packs.

In the radiography of shoulder, pelvis, and most of the spine the Bucky grid is employed.

The film-focus distance is 1.20 m for the extremities, 1.45 m for individual parts of the spine, and 2 m for exposures of the total vertebral column.

Centering is done over an exactly determined anatomical landmark marking. Ray direction is related to the axis of body or extremities. The terminology used is explained in the sketches (figs. 1–5).

The central ray must always be directed vertically onto the middle of the film, marked in the sketches by ✱. In order to avoid uncertainties or possible misunderstandings we occasionally

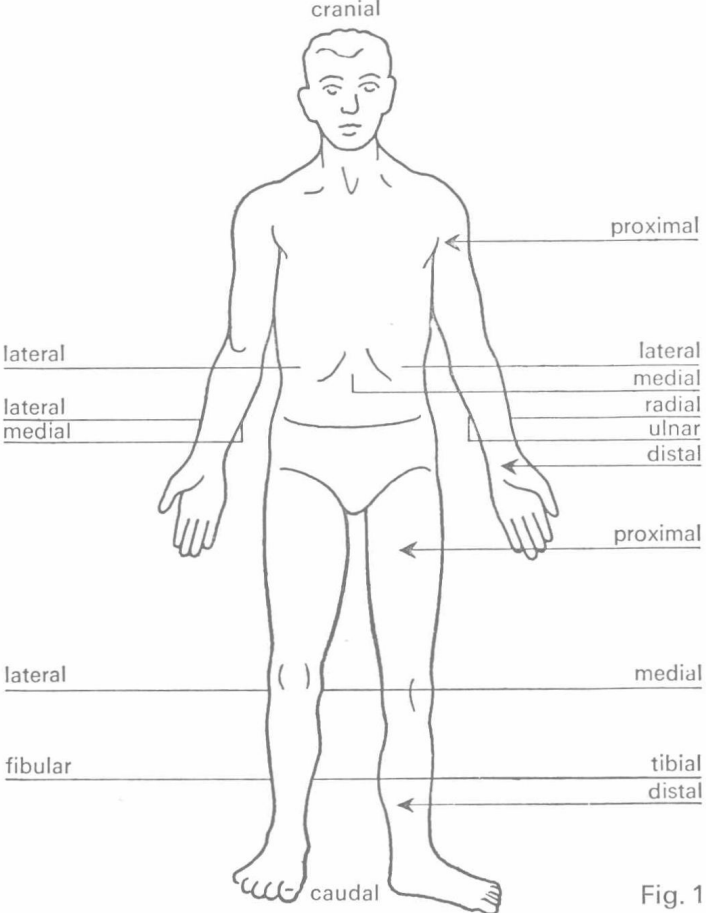


Fig. 1

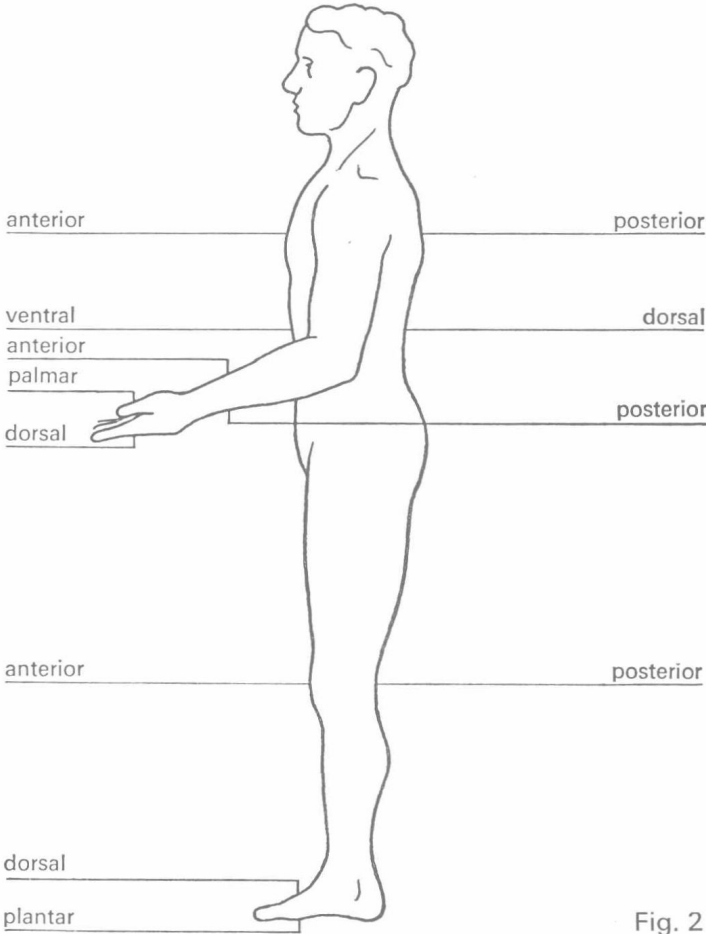


Fig. 2

add the passage 'central ray vertical onto cassette'. If a different ray angle is required for the taking of a desired radiograph this has been clearly defined by indicating tilt of the tube and position of the cassette and is marked in the sketches by ➤.

Fig. 3

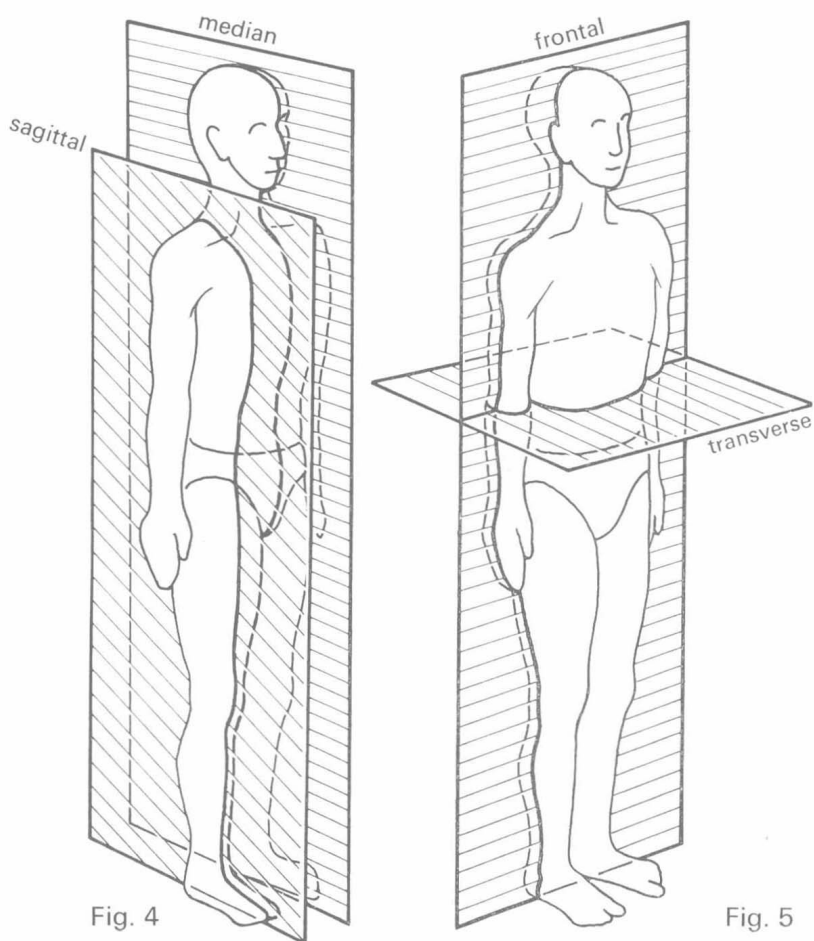
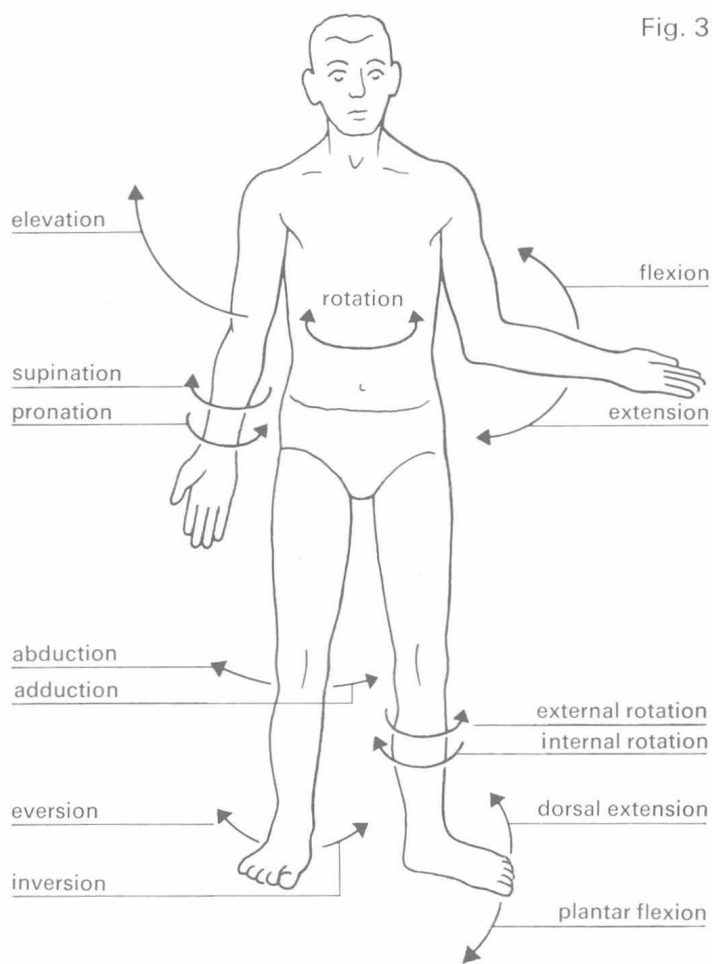


Fig. 4

Fig. 5

Upper Extremity, Shoulder Girdle, and Sternum