

# **Diagnostic Radiography**

**A CONCISE PRACTICAL MANUAL**

**THIRD EDITION**

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**Glenda J. Bryan**

FOREWORD BY

**J. H. Middlemiss**



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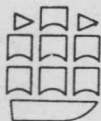
### FOREWORD BY

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### THIRD EDITION



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## Foreword

Miss Glenda Bryan is an experienced Superintendent Radiographer on the staff of the University of Bristol Teaching Hospital which has traditional links with many overseas countries, and during the absence of the proposed Jamaican Principal Teacher she was seconded to the School of Radiography in Jamaica, which has been associated with Bristol for some years and which trains students for the English qualification, the M.S.R. [now D.C.R.].

She had been intimately concerned for several years with the daily supervision of the practical work of students but when she became responsible for classroom teaching and the organisation of students' curricula, she found a real gap in the available textbooks. There is available a superb, monumental and heavy reference book on radiography. There are books on physics and equipment and on radiographic anatomy and darkroom procedures. But there was no satisfactory handbook of moderate cost to which the ordinary student could refer in everyday work and which would provide information on the routine activities which the radiographer has to undertake. And so, in Jamaica, she had to prepare her own notes and lecture material.

On returning to Bristol she developed and systematised the notes which she had prepared and used to considerable effect. The process of elaborating her original notes has gone on now for nearly two years in the department in Bristol with frequent and lengthy discussions among the staff, radiographers and radiologists alike, with trials and practical experiments, with drafts and redrafts of sections and chapters.

What has emerged will, I hope and believe, fulfil a need in practical everyday radiography—a handbook, of modest cost and reasonable size, written by a practising radiographer, providing technical details and practical advice on routine procedures. There is a wealth of experience and commonsense in this book. I commend it to all practising radiographers, junior and senior, and to all student radiographers in the United Kingdom and overseas. The illustrations,

both radiographs and line-drawings, have been carefully selected to demonstrate, without being too elaborate, those points of greatest importance in the busy life of a general department. Many specialised departments will have more sophisticated and detailed procedures in certain fields. In this book, however, there is presented a standard practice and a simple approach to most fields of work which, if followed, will provide most departments, most radiologists and most clinicians with the diagnostic criteria required in dealing with the problems that present on most days in every department.

Bristol, 1970

J. H. Middlemiss



## Preface to the Third Edition

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Since the publication of the second edition, new techniques have been evolved and new equipment has been introduced. In this edition, as in the previous one, the aim has been to deal with these without losing sight of the original concept of the book as a concise practical manual. The descriptions of simple methods and apparatus have of course been retained, as in many departments the latest equipment and instruments are not available.

The text throughout has again been extensively revised and brought up to date and many recent publications will be found in the list of references. Several additional plates and figures have been included but these have had to be restricted in number so as to keep the book within the limits of its self-imposed objective.

In Part I, the chapter on patient care now includes separate sections on infants and children and on elderly patients. Radio-isotope scanning and ultrasonic scanning are becoming increasingly the responsibility of departments of radiodiagnosis and the chapters on these topics have been slightly expanded. At the date of the second edition, C.T. scanning (computerised transverse axial tomography) was in its early days and its use was confined to the examination of the head. Since then rapid progress has been made—now all parts of the body can be examined by this technique, so the short section in the second edition has been replaced by a separate chapter, though this important new technique is rapidly attracting a vast specialised literature of its own.

In Part II, the chapter on the vertebral column now includes a larger section on the cervico-thoracic vertebrae. The section on teeth has also been expanded.

In Part III, the chapter on the gastro-intestinal tract describes the newer methods of investigation but as some of these may not be current practice in some departments, descriptions of the conventional techniques also have been retained. The chapter on arthrography has been rewritten and many other chapters have additional sections, including one on coronary arteriography.

Several improvements in this new edition arise from comments made by colleagues and others who have been kind enough to

communicate with me, and from the constructive suggestions contained in the reviews of the second edition, all of which have been given very careful consideration. No change has been made, however, in the methods of centering described. Where appropriate, an anatomical centering point is given in accordance with conventional teaching, but there are many other cases where in practice it is more satisfactory first to place the cassette carefully in relation to certain easily palpable anatomical structures and then to centre the beam to the cassette. Experience shows that in such cases this is not only easier but often a more reliable method of ensuring that the required area is correctly sited on the radiograph.

Those to whom I gratefully acknowledge my ever-increasing debt of gratitude for their help, criticism and encouragement, for this edition and for the previous ones, include Dr H. Baddeley, Dr R. J. Burwood, Mr M. W. Cooksey, Dr E. R. Davies, Dr Z. Davies, Dr M. J. Gibson, Mr D. Gifford, Dr I. R. S. Gordon, Dr M. Griffiths, Dr M. Halliwell, Mr W. Harrison, Professor J. H. Middlemiss, Dr R. A. Mountford, Dr D. J. Nolan, Dr T. J. T. Privett, Dr F. G. M. Ross, Dr J. Roylance, Dr A. Sargood, Dr J. L. G. Thompson, and Dr I. Watt (all of the United Bristol Hospitals), Dr B. B. Beeson, Dr W. M. Park, Dr B. H. Phillips, Dr J. F. Ryan and many others too numerous to mention individually.

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I am also extremely grateful to Mr Martin Davies for his constant encouragement and for his help in drafting the manuscript, to Miss Carol Phillips for typing it and to the Publishers for their friendly advice and co-operation in the production of this book.

# Preface to the First Edition

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The purpose of this brief synopsis of diagnostic radiography is to provide a practical guide for the day-to-day work in an X-ray department (both plain film radiography and radiological procedures) and to instruct the student in practical as well as theoretical radiography. More detailed treatment of many aspects of the subject will be found in specialised works for which this book does not pretend to be a substitute.

Part I discusses general principles, applicable to many fields of radiography, and a brief mention of the diagnostic use of radioisotopes and ultrasound has been included in this section as these are becoming the responsibility of some diagnostic departments. Part II describes a basic technique for the radiographic examination of each region of the body, though in many cases alternatives are possible and may be employed in some hospitals. Part III deals with radiological procedures. For each of these there are wide possible variations in detail and the method employed will depend on the requirements of the radiologist. One standard method has been described in each case.

For reasons of size and cost, the illustrations have been deliberately restricted in number and basic views taken routinely in most departments have not been illustrated. A consistent order and method of description has been used throughout each section for easy reference and also to encourage the logical approach needed for answering questions on radiographic technique.

Bristol, 1970

G. J. B.



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## GENERAL RADIOGRAPHY

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## Patient care

The radiographer should make every effort to obtain the willing co-operation of the patient because without this it will seldom be possible to obtain maximum information from a radiographic examination.

By a calm and friendly manner and tone of voice the radiographer can often do a great deal to give the patient confidence that he is in efficient and sympathetic hands and that his examination is both necessary and being performed in a department where his well-being is of real concern and interest to the staff, but a loud, 'hearty' or over-familiar approach must always be avoided.

Patients arriving in an X-ray department are often worried or apprehensive and this may make it difficult for them to understand instructions or may produce an apparently aggressive attitude. In such cases, the radiographer must be especially understanding and tolerant.

At any examination in which the radiologist participates, for example venepuncture, it is often helpful for the radiographer to introduce the patient and the radiologist to one another by name. This will reassure the patient that he is regarded as an individual and not just 'the next case', and that there is no mistake as to his identity or as to the procedure that is being carried out.

**Identity.** Before any examination is performed, the identity of the patient must be checked by the radiographer (even though in certain cases the radiologist will also do this) as experience shows that occasionally a patient will answer to a name not his own. This is always important but is especially so when specialised radiological procedures are being performed, particularly those involving contrast media.

**Waiting.** Nearly every patient who attends an X-ray department has to spend some time waiting, if not for the actual radiography then for checking or reporting on the films. An efficient appointments system is essential for keeping the waiting time to a minimum. Wait-

ing is made less tedious if the patient has something to do, so a supply of recent magazines and newspapers, suitable for different tastes and age groups, should be available. Pictures (which are sometimes available on loan from art galleries), a small aquarium, simple toys and so on, all help to lessen boredom whilst waiting. When an appointment is made for an examination that is bound to take a long time, the patient can also be invited to bring something to help pass the time, for example a book or knitting. Patients should always be told in advance the approximate length of time that the examination will take and it is better to over-estimate than under-estimate this.

Flower arrangements in waiting rooms or corridors can have a favourable effect on the patient's peace of mind and contribute to the aesthetic attraction of the department. Such arrangements need not always be of fresh flowers, which are expensive to buy and time-consuming to arrange. An arrangement of dried flowers, leaves and grasses can be very attractive and will often need no further attention for months.

Whenever possible, separate waiting areas should be available for different types of patients, e.g. for the seriously ill or accident cases, for patients who have already undressed and those waiting to do so, for children and for patients waiting for further films. Obviously, the layout of the department determines whether these requirements can be met and in an old department compromises often have to be made. However, a patient should not have to wait for a long time in a small, relatively airless, changing cubicle. Lavatories must be available near the waiting room and their location indicated by clearly visible notices.

**Undressing.** A clean gown must be provided for each patient and a dressing gown also is required if the cubicle does not lead directly into the X-ray room. Instructions about personal matters, such as which clothes to remove, should be given as privately as possible. It is often helpful to have printed instructions displayed in the cubicle regarding undressing, what to put on and whether to proceed to another waiting room or wait until called. Often patients do not hear or fully understand instructions given too rapidly or too quietly. Some method of safe-keeping for money or valuables must be provided.

**Privacy.** Radiographic examinations should be carried out in as much privacy as possible. The door of the X-ray room should be closed and only the necessary persons should be present in the room. This is of particular importance in examinations such as hysterosalpingography and micturating cystography, where the patient is

required to relax but may find it very difficult to do so without sufficient privacy. The patient should be covered with a light-weight blanket or sheet whenever possible.

**Comfort.** If practicable, a foam mattress, encased in a polythene cover, should be placed on the X-ray table for the patient to lie on, particularly for any examination where the patient must remain in the same position for a long time. Moving the patient across the table during positioning is facilitated if the mattress (with its polythene cover) is encased in a cotton covering. Sufficient pillows, foam pads and sandbags should be used to make the patient comfortable. A patient who is uncomfortable, or who feels insecure, is likely to move during the exposure.

A sturdy platform, or preferably a small set of steps, must be available so that the patient can climb easily on to the X-ray table. During fluoroscopic examinations, when the patient must be moved from the horizontal to the vertical position, hand-grips and a firm foot-rest must be provided.

A patient must *never* be allowed to descend from a table without someone being at hand to steady him. A nervous patient may try to do so too quickly and fall over. The radiographer should not tell a patient that the examination is finished and that he can get down from the X-ray table unless the radiographer is near enough to assist. A patient with a condition such as Menière's disease or postural hypotension may need a few moments sitting up on the table before getting off. The radiographer must see that the X-ray tube is out of the way so that there is no risk of the patient's striking his head against it when sitting up or getting off the table.

A wheel-chair must always be steadied when a patient is getting into or out of it, and the brake should be on. If there is no brake, the radiographer should put his or her foot behind the wheel to act as a chock. Some modern wheel-chairs are so designed as not to tip up even if someone stands on the step, but others will tip if the patient just puts one foot on the step.

**Hygiene.** The X-ray room should be tidied immediately after use so that it is clean and tidy when the next patient enters it. If it is not possible to have a clean sheet and pillowcase for each patient who is radiographed lying on the X-ray table, then use should be made of tissues, paper towels or, preferably, large sheets of tissue paper placed over the sheet and pillow and changed for each patient.

There should be a vomit bowl in the X-ray room, visible and within easy reach, particularly for accident patients and for some ward patients for whom a change in position may cause vomiting.

**Immobilisation.** The patient must remain absolutely still in the required position while each exposure is being made. Any movement during the exposure will cause blurring of the film, necessitating a repeat exposure.

For radiographic examination of the skull, head-clamps or head-bands are used to immobilise the patient's head. For radiographic examination of the extremities, foam pads and sandbags should be used for support and immobilisation. The patient must be made as comfortable as possible because if he is in pain or in an uncomfortable position, it is unlikely that he will be able to keep still for long.

**Radiography.** The radiographer must see that everything, including any special equipment that must be tested before use, is ready before the patient is brought into the X-ray room. Clear instructions regarding position, respiration, etc. must be given to the patient in advance and it is often advisable to have a practice run without radiation to make sure that the patient arrests respiration for the required length of time.

Positioning of the patient should be efficient, speedy and gentle. The palm of the hand and the palmar surface of the fingers (not the tips of the fingers) should be used for positioning and centering. The patient's skin may be tender as a result of radiotherapy or a recent operation.

**Explanation.** Although it is usually unnecessary (and often contra-indicated) to give the patient a detailed explanation of the examination to be performed, most patients appreciate being given some information, particularly as to how long the examination will take.

If the procedure is going to cause any pain or discomfort, warning should be given to the patient (usually by the radiologist) so that he will not be surprised or alarmed by it and will be able to keep still when required. But if the examination is unlikely to cause pain or other unpleasant effect, the radiographer should never specifically tell the patient this, as occasionally a procedure (e.g. venepuncture) does unexpectedly cause pain or some other unpleasant effect. If this happens after the patient has been reassured to the contrary, his confidence may be destroyed. This is particularly relevant in the case of a child. Furthermore, the mere mention of some specific sensation may make the patient apprehensive when he would not otherwise have thought of it and the slightest sensation will tend to be magnified.

If apparatus that makes considerable noise is about to be used (as, for example, in rapid serial radiography) or if the X-ray tube is going