AN ILFORD MANUAL

Positioning in Radiography

K. C. CLARK

EIGHTH EDITION

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Positioning in Radiography

K. C. CLARK, M.B.E

EIGHTH EDITION

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FOREWORD

The author, K. C. Clark, completed training in radiography at Guy's Hospital, London, in 1921 and in the following year obtained the diploma of the Society of Radiographers (MSR) since when she has been engaged in practising, teaching and writing about radiography. Subsequently, Miss Clark was in charge of radiographic departments in provincial hospitals until in 1928 she was responsible for establishing one of the earliest training schools for radiographers at the Royal Northern Hospital, London.

During her early years in radiography there was little published information on radiographic technique to assist students in studying for the MSR qualification, and a personal need for a book of reference led Miss Clark to begin the initial work on which ultimately *Positioning in Radiography* was based.

Miss Clark's interest in teaching led to an invitation from Ilford Limited in 1934 to prepare a textbook on radiography, and in 1935 to become the first Principal of the Ilford Department of Radiography and Medical Photography at Tavistock House which was established as a service and instructional centre. In addition to becoming an important rendezvous for X-ray workers at home and from overseas the department, because of its unique facilities for experimental and confirmatory work, provided the essential background for compiling the vast range of material for *Positioning in Radiography* which was first published in 1939.

From 1935 to 1937 the author was President of the Society of Radiographers and was awarded the Honorary Fellowship of the Society, having been a member of the Council for several years and on which she continues to serve, in addition to being a member of the examining body. During the war years 1939 to 1945 Miss Clark played a notable part in the development of mass miniature radiography for which she was awarded the MBE in 1945, and in 1947 the Liberty Cross of Norway was conferred by King Haakon for organizing the mass X-ray examinations of Norwegian service personnel based in the United Kingdom.

In 1958/9 during a visit to Australasia the author was awarded the Honorary Fellowship of the Australasian Institute of Radiography and Honorary Membership of the New Zealand Society of Radiographers (Inc.). Also, in 1958 Miss Clark was elected an Honorary Member of the British Institute of Radiology and a member of Council in 1962. In 1959 she was elected to Honorary Membership of the Faculty of Radiologists and to the Vice-Presidency for Europe and Africa of the International Society of Radiographers and Radiological Technicians. In 1958 Miss Clark obtained the Fellowship of the Royal Photographic Society.

The position of Principal of the Ilford Department of Radiography and Medical Photography at Tavistock House, 1935 to 1958, was followed by the appointment as Consultant in Radiography, with the commission to prepare this, the eighth edition of *Positioning in Radiography*.

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FIRST EDITION

In acknowledgment of my indebtedness to the many interested in radiography who have generously contributed toward the production of this book, I would express my thanks to the following for the advice, the loan of films, and for the many facilities which have been given me for seeing certain work in progress in various hospitals, and also for the use of apparatus and for many kindnesses and encouragements:—

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K. C. CLARK.

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With so many developments in techniques it was inevitable that considerable revision and enlargement would be necessary to bring the seventh edition of *Positioning in Radiography* into line with modern radiographic practice.

Accordingly, this new edition has been increased by over 100 pages and 600 new illustrations have been brought in to raise the total to 2150. Many blocks have been remade, the exposure factor tables have been extended and new techniques have been added together with a section on Macroradiography and a supplement on Radiation Exposure.

This work would have been impossible without the generous assistance of a very large number of X-ray workers and I am very pleased indeed to be able to acknowledge the contribution of many original radiographs, of invaluable advice and the most helpful encouragement from Dr. G. M. Ardran, Dr. W. E. C. Astle, Mr. Hamilton Bailey, Dr. L. M. Billingham, Dr. L. G. Blair, Dr. S. J. Boland (Eire), Dr. James Bull, Mr. H. Jackson Burrows, Dr. Reginald J. Carr, Dr. Maurice Cernès (France), Mr. F. B. Cockett, Dr. Hugh Davies, T.D., Dr. A. L. Deacon, Dr. S. J. H. Douglas (Eire), Dr. D. A. N. Drury, Dr. A. J. Eley, Dr. A. Elkeles, Dr. Walter Frommhold (Germany), Dr. F. Campbell Golding, Dr. G. L. Gryspeerdt, Dr. R. A. Kemp Harper, Dr. J. Blair Hartley, Dr. Kenneth E. Hodge (Canada), Sir Harold Graham Hodgson, K.C.V.O., Dr. S. Holesh, Mr. J. I. P. James, Professor Dr. R. Janker (Germany), Professor A. S. Johnstone, Dr. D. Hector-Jones, Dr. D. Wallace-Jones, Sir Reginald Watson-Jones, Dr. M. H. Jupe, Dr. K. D. Keele, Dr. F. H. Kemp, Dr. Peter Kerley, C.V.O., C.B.E., Dr. R. I. Lewis, Dr. J. W. McLaren, Dr. S. A. Maddocks, Dr. B. S. Manford, Dr. Mansfield, Mr. N. M. Matheson, Dr. W. Paton Philip, M.C., Dr. J. W. Pierce, Dr. L. J. Rae, Dr. Sheila Sherlock, Professor A. C. Singleton (Canada), Dr. J. Hillyer Smitham, Dr. V. H. Springett, Dr. D. C. Staveley, Dr. J. J. Stevenson, Dr. J. Campbell Tainsh, Dr. C. E. Vaughan (Canada), Dr. G. N. Weber, Professor Sölve Welin (Sweden), Mr. A. Emlyn Williams, V.R.D., Dr. G. J. Wilson, Dr. Franklin G. Wood, Dr. M. C. Wood. Also from Mr. O. M. Alexander, Mr. H. W. Anderson (Australia), Mr. D. J. Macdonald Brown, Mr. C. Butler, Mr. L. J. Cartwright (Canada), Mr. W. H. Coombs, Sister E. P. Cooper, Miss A. Cumber, Mr. John Ely (Australia), Miss A. Stirling Fisher, Mr. J. E. Forsyth, Miss M. Frank, Mr. D. R. Gould, Miss P. Hadrill, Mrs. H. M. Harrott, Miss E. M. Haworth, Mrs. P. Heineke (Denmark), Miss A. R. Hendry, Mr. A. W. Holder, Mr. E. Hudson, Mr. M. J. Jackson, Mr. S. Morris, Miss E. P. Mount, Miss E. Okell, Mr. W. F. Phillips, Miss B. Robins, Miss B. G. Robinson, Mr. John Scott, Miss Eileen Sheridan (Eire), Miss Joan Smith (Kuwait), Mr. Leslie Smith, Mr. William E. Smith, Miss G. Stephenson, Mr. W. J. Stripp, Mr. F. Jaundrell-Thompson, Mrs. H. M. Thynne, Mrs. M. Turner, Miss F. M. A. Vaughan, Miss K. Walsh, Mr. W. Watson, Mr. J. F. Weale (Canada), Mr. R. J. Whitley, Mrs. O. Wilkinson; also the Departments of Radiology of the University of Toronto and Toronto General Hospital, Canada, and the Ortopædisk Hospital, Copenhagen.

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K. C. CLARK.

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exposure technique for cardiac angiography, page 624.

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May 1957, No.353, page 280, Fig.1 from Protection of the Male Gonads in Diagnostic Procedures,
G. M. Ardran and F. H. Kemp, **(495a)**;
June 1958, No.366, page 335, Fig.1 from Gonadal Protection from X Radiation for the Female,
E. Abram, D. M. Wilkinson and C. J. Hodson, **(495b, 495c)**.

THE BRITISH JOURNAL OF RADIOLOGY (*continued*)
June 1960, No.390, page 345, Figs. 2 and 3 from
A Stereotaxic Apparatus for Use in Cerebral Surgery, A. M. Hastin Bennett, **(1539b, 1539c)**;
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WOMEN'S COLLEGE HOSPITAL, TORONTO, CANADA
Dr. M. E. Forbes, Dr. Jean Toews and Mrs. Elizabeth Mills, **(1903a, 1903b, 1904, 1905, 2148)**.

Also illustrations from Mr. A. Collis **(1934)**; Mr. John E. Forsyth **(2030)**; Mr. E. O. Goss **(405, 406)**; Mr. D. R. Gould **(1804, 1805, 1844)**; Mr. R. Greenway **(2123a, 2123b)**; Mr. R. M. Leman, M.B.E. **(262)**; Mrs. H. M. Thynne **(2118)**; Mr. D. S. Wilkinson **(891** (2)). Mr. J. W. Brown in connection with **(2458)**.

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I have reason to be grateful to the manufacturers of opaque media for their assistance toward keeping this phase of the book up-to-date and summarized in Supplement 1, Contrast and Opaque Media — Bayer Products Company; British Drug Houses Ltd.; Damancy & Co. Ltd.; Glaxo Laboratories Ltd.; May & Baker Ltd.; Pharmethicals (London) Ltd.; Schering A. G., Berlin.

On occasion I have received illustrations which for various reasons have not been used, nevertheless I am most grateful for the interest and trouble taken by the following: Dr. Douglas Gordon, Richmond, Surrey, and for his advice on ultrasound; also Mr. J. Blackburn, O.B.E., Pontefract, Yorkshire; Mr. W. H. J. Coombs, Sheffield, Yorkshire; Mr. Eric Hammond, Boston, USA, and Mr. J. Hill, Birkenhead, Cheshire; Mr. George Nixon, Presbyterian Hospital, New York, USA, for considerable trouble in producing transparencies of tomograms.

Also in a special group, a very interesting collection of radiographs and photographs illustrating beam therapy

direction localization, all of which were provided at my request with a view to including a brief outline of this diagnostic aspect of radiotherapy. Subsequently it was decided that as the procedure was so much more concerned with the actual planning of treatment it was therefore outside the scope of this book. However, I am very grateful for the prompt and interested response from Mr. N. I. Baldock, Royal Northern Hospital, London; Miss W. Copcutt, Mount Vernon Hospital and The Radium Institute, Northwood, Middlesex; Mr. D. R. Gould, Swansea General Hospital, Glamorgan; Mr. E. R. Hutchinson, Radiotherapy Hospital, Whitchurch, Nr. Cardiff, Glamorgan; and to Miss L. M. Craig of the Middlesex Hospital, London, for helpful advice.

Again, my past and present colleagues at Tavistock House have been most generous in many directions: Mrs. W. H. Johnson in the painstaking reading of proofs with a special check on anatomical terminology and the preparation of the index; Mr. W. Watson, who has been most helpful in advising on the more specialized subjects—Tomography, Stereography, Cineradiography and Foreign Bodies—and for the preparation of drawings and provision of radiographs, illustrations (**713, 806, 1267, 1534, 2032b, 2194, 2303, 2304, 2305, 2307, 2308, 2309, 2312, 2313, 2316, 2410, 2491, 2497a, 2497b, 2497c, 2530a, 2530b, 2531, 2532, 2533a, 2533b, 2538**), in addition to making modifications to some existing illustrations; I am much indebted to Miss E. Okell in always reminding me of the needs of student radiographers and of their problems, for revising Supplement 1 on Contrast and Opaque Media to accord with current procedure, and in supplying illustrations (**9, 452, 2164**); to Mr. J. McInnes and Mr. J. Harris for undertaking to modernize the exposure factors and for their very helpful advice and suggestions on many occasions, together with assistance in obtaining illustrations already acknowledged to various hospitals, with in addition from Mr. J. McInnes illustrations (**705** (3), **1452**); to Mrs. E. P. Fieldhouse and Mr. A. S. Dilling for their able assistance on photographic matters. To Mr. K. H. Gaseltine and his staff for the preparation of the radiographic prints; and to my secretary, Miss C. I. Leaphard for a constant watch for inconsistencies and meticulous care in reading and correcting proofs.

As for all previous editions of *Positioning in Radiography* Mr. George Dorman has been responsible for the design and production of the book and for the editing of the text, and I am most grateful for his valued co-operation over the many years during which we have worked together.

Finally, I am extremely grateful to the directors of Ilford Limited who have made this eighth edition possible and for their generous attitude in allowing the continued sale of the book at a very reasonable cost.

K. C. CLARK

April 1964

PRELIMINARY NOTE

In compiling this eighth edition of *Positioning in Radiography*, additions and modifications have been made to **embrace** developments in technical procedure and with **due regard** to radiation protection in the care of the **patient.**

Some deletions from previous editions have been necessary, but little change has been made in the essential basic material. Indeed, the term BASIC is now included to indicate essential techniques for the benefit of student radiographers, and this is supplemented by the GUIDE TO APPROPRIATE POSITIONS at the commencement of earlier sections.

As previously, the object of this book is to present in as concise and practical a form as possible to the student and to those practising radiography the essentials of radiographic technique. It is not claimed to be a complete treatise and, since the aim has been to make it a practical book, theoretical considerations have been omitted as far as possible and the subject discussed from the point of view of the practical worker.

Positioning is, perhaps, the all-important feature in radiography. Correct positioning has been illustrated photographically, and the radiographs resulting from such positioning have been included, together with occasional line diagrams and photographs of the dry bones. Suitable exposure factors are shown for each position.

The factors contributing to the success of an X-ray Department are equipment, technical procedure and the interpretation of the radiograph. This book does not enter into any but brief discussion on electrical equipment and then only concerning the more specialized X-ray apparatus, with reference also to the various accessories most commonly used. A systematic method in technical procedure is defined. Radiographers are not concerned with the interpretation of radiographs, and are not expected to express an opinion upon, still less to assume responsibility for, medical diagnosis; that phase, therefore, is not within the scope of this book. Radiographers must, however, have a sound knowledge of basic anatomy and an appreciation of the tissues portrayed in a particular radiographic projection, referred to variably as radiographic appearances or radiographic anatomy. A knowledge of physiology is also important for an appreciation of the function of the alimentary tract and the differential excretion of the various organic iodine compounds used to show certain organs and tracts.

Although it is not within the province of radiographers to study pathology in any detail, nevertheless in order to work intelligently it is essential to know what is entailed for a specific pathological condition as named on a request form for radiographic examination, and thus to be able to translate what may often be very brief instructions into radiographs of the necessary quality, with correct location and positioning. This knowledge, of particular importance in the investigation of progressive bone abnormalities, also ensures that examination is limited to what is essential. For example, in a case of rickets where all long bones are requested, single anteroposterior projections from shoulder to wrist, and from hip to ankle, may be found to give all the information required, and what might have appeared to be a somewhat extensive examination may be carried out with economy of time and material and a minimum of exposure to the patient. Over a limited range, suitable illustrations of abnormal conditions are included with appropriate references in the text to modifications in positioning and/or exposure technique.

It need hardly be mentioned that the care and comfort of the patient should be considered at all times. General comfortable relaxation in the desired position for the examination, encourages local relaxation and tends to promote a natural immobilization. Adequate warmth in the X-ray Department should never be wanting, and an apprehensive patient may very often be reassured by a brief explanation, and particularly on being asked to co-operate in the examination.

Care in the identification of radiographs to the individual concerned cannot be overstressed—by name, X-ray and/or hospital serial number and date; the use of body markers for right and left sides is imperative for every exposure and also, as applicable, the posture of the patient and the time intervals at which films are exposed.

ANATOMY REFERENCES

Terminologies change from time to time and although the terminology in vogue during an individual's initial training period tends to be retained, it is necessary to know the most common alternative terms employed; for instance, as concerned with the carpal and tarsal bones, where alternatives for this eighth edition are included on pages 14 and 76. Originally, anatomical references followed the Basle Nomina Anatomica (BNA) 1895 and the Birmingham Revision of the BNA (BR) 1933 terminologies, and particularly the latter from the fifth edition onwards. For the eighth edition only minor changes have

been necessary to conform to the Nomina Anatomica, Paris (NAP) 1955 terminology included in the Centenary Edition of *Gray's Anatomy* published in 1958.

A more recent development is the jointly anatomical and radiological terminology recommended by the World Federation of Neurology Problem Commission of Neuroradiology, Milan 1961. This provides a common terminology for the planes, lines and landmarks (Section 17, page 404), with positioning, for the radiological examination of the skull and admits of the use of the two controversial base lines, orbito-meatal (OMBL) and anthropological (ABL). It also avoids the use of eponyms (proper names) using instead anatomical terms with only one exception. It is anticipated that this may lead eventually to the replacement of eponyms generally. Such was the policy adopted from the inception of *Positioning in Radiography* (first edition 1939), with a few exceptions in which the prevailing opinion demanded that certain proper names be used, but few such references remain.

Although there has been some reticence in accepting any approach to anatomy based on X-ray appearances, there is now a definite interest in the study of living anatomy as recorded radiologically, combined with the study of basic anatomy. In the practice of radiography it is essential to appreciate the living anatomical structures as seen in a particular X-ray projection, also the differences arising from change of position such as prone, supine to decubitus, and the various positions from horizontal to erect, etc. It is obvious that eventually radiological, or radiographic anatomy will find its proper place in the teaching of anatomy generally.

For the purpose of this book the term RADIOGRAPHIC APPEARANCES has been used and such references are accompanied by annotated radiographs of the principal joints and of certain specific regions.

APPARATUS AND TECHNIQUE EMPLOYED

A considerable number of radiographs have been exposed in the Ilford Department of Radiography and Medical Photography. Others have been obtained from various sources and due acknowledgment is made in the previous pages. These radiographic illustrations have been reproduced from negative prints in order that their appearance, except of course in respect of size, may approach as nearly as possible to that of the actual radiographs.

Every factor concerned with exposure technique is a variable due to the wide range of equipment and photographic conditions prevailing, ranging from the electrical mains supply to the final viewing of radiographs and/or cine recordings. Thus it is impossible to compile exposure factors which can be applicable to every unit. This is quite apart from the widely variable factor of the patient and of diagnostic requirements.

The exposure factors provided from page to page are based chiefly on the use of a typical four-valve unit with full wave rectification, using a dual-focus tube 0·3 and/or 1- and/or 2-millimetre foci with the conventional 2-millimetre aluminium filter at the tube aperture, and a standard 10:1 to 16:1 moving or stationary grid. For a three-phase constant potential type unit the exposure factors can be reduced by 20 per cent. Reference is also made to the use of mobile, portable and dental units (usually self-rectified), each unit having been carefully tested for output to ensure the reliability of the exposure factors as applied to subjects of average size and type. For each position shown, complete exposure data are given, namely, kilovolts (peak), milliampere-seconds, focus-film distance (FFD), intensifying screens (when used), film, and type of grid (when used). It is assumed that all films will be developed under recognized standard conditions for manual or automatic processing.

Since the relative exposure factors given in each section are correct for a subject of average physique, they may be generally adjusted to the individual patient in any similar investigation. Where alternative conditions are given, they are such as will result in a radiograph of suitable quality. On applying the exposure tables initially, from unit to unit, when it is found that a certain percentage increase or decrease in density is required, this same percentage can be applied for the necessary change in exposure to each table throughout the book to provide satisfactory results.

The focus-film distance has been varied according to position of subject and to unit employed—for grid exposures it ranges from 30 to 48 inches; for the rarely used short-distance technique it has been reduced to 15 inches, and for teleradiography it has been increased to 60 or 72 inches. On occasion, an arranged relative air gap between subject and film has tended to increase the focus to film distance. Non-screen technique has been applied wherever possible, use being made of Ilfex films, these being specially prepared for use without intensifying screens. Selected non-medical Industrial films are also included for specific purposes (Supplement 2).

A Potter-Bucky diaphragm having a 10:1 grid ratio has been used for kilovoltages up to 100 and a 16:1 grid ratio reciprocating grid, including the cross-hatch grid for biplane radiography for kilovoltages up to 150. Combined moving and stationary grids in cross-hatch arrangement are also included. The stationary grid has been introduced wherever suitable. In using this equipment it is

understood that, as compared with the duration of exposure applicable under similar conditions without the grid, three to four times the exposure is required when using the stationary grid, depending on type, and also usually a factor of four for the standard Potter-Bucky diaphragm. The high-speed Bucky grid is essential for short exposure work, also the fine-lined stationary grid (100 lines per inch), in which the grid lines are barely visible. Mention is made of the use of a thin sheet of lead (0·0015 inch) to further eliminate the scatter effect.

There are references to the use of the image intensifier with television attachment, appropriately for visual screening and for photofluorography. This equipment, now an integral part of the X-ray installation, is convenient for both direct viewing and for near and distant television monitoring, providing a significant economy in radiation exposure to both patient and personnel.

Collimating cones or rectangular diaphragms have been used throughout in the preparation of the illustrations, although they are not shown when the inclusion of tube and subject at the correct focus-film distance would have resulted in an unduly small image of the subject. It is essential to restrict radiation to the smallest possible area of the region under examination and to protect the genital organs by employing protective lead shields of suitable size and shape. In the screening stand, the flat variable diaphragm replaces the localizing cone or adjustable light-beam diaphragm, and it should be used at the smallest suitable aperture for both screen examination and radiographic exposure. The conventional 2-millimetre aluminium filter at the tube aperture reduces radiation exposure to the patient very considerably. Every possible care must be taken to minimize radiation hazards to both patient and operator. Radiation exposure to the patient is discussed in Supplement 3, pages 751 to 760.

White lines have been drawn on the photographs to indicate the direction of the central or normal ray, peripheral rays also being sometimes shown, and in many instances a black spot on subject and radiograph indicates the tube centring point.

In Supplement 2, Note on the Exposure Tables, pages 745 to 749, the materials employed and the variable conditions affecting the exposure tables are discussed and whatever the unit concerned these related factors will remain unchanged until such time as modifications in sensitized materials, intensifying screens and processing chemicals are made.

From a summary of the many variables involved, the conditions applying to a particular unit or from one unit to another in a department and from one department to another, will show the complexity of providing generalized exposure factors. It is usual, therefore, to produce an appropriate exposure technique chart for each unit in order to cater for changing personnel as may be involved in a rota system of duties. The use of automation for radiographic exposure applies only to a particular selected region and not universally to all regions on the one unit.

In a general way, the requirements for the individual patient may also be included in a specified unit exposure chart, such as a complete scale of age or size variation with the possible condition of patient—muscular, non-muscular, etc.

In referring to kilovoltage there are perhaps three phases of application—(1) the osseous system, (2) the soft tissues and (3) on using contrast media.

(1) There is a limit to the kilovoltage that can be used to advantage for the osseous system, excepting the question of thickness and density when the penetration may need to be extended, otherwise up to 80 to 100 kilovolts is regarded as the limit for recording bone detail satisfactorily.

(2) For the soft structures generally, having a wide range of regional density, using a grid, high kilovoltage is usually preferred, possibly up to 100 to 140 kilovolts when excessive contrast is reduced to a minimum to produce an all-over satisfactory diagnostic radiograph. For regions of low intimate contrast such as the mammary glands, where the maximum tissue differentiation is important, the kilovoltage may be reduced to from 25 to 40.

(3) The high degree of contrast in a radiograph from the presence of an opaque medium may at its maximum effect allow the highest kilovoltage in the diagnostic range to be employed.

QUALITIES DESIRABLE IN A RADIOGRAPH

Density and contrast, perhaps the first qualities to be noticed on viewing the radiograph, should always be adequate. The flat negative, lacking depth, may fulfil its purpose in certain circumstances but it may not show all that should be seen. On the other hand, excessive contrast, particularly undue regional contrast, is to be avoided and the aim should be to adjust exposure factors in such a way that undue variation in regional densities is eliminated, so that the radiograph shows an acceptable degree of contrast over the whole field.

Definition, essential in every radiograph, is perhaps the one quality which may be said to be affected by each component and factor in its production. Of first importance, however, is the size of the tube focus; the smaller the focus area the finer the detail obtained, with, of

course, the proper control of immobilization of the patient.

While with the broader focus tube there is a certain degree of enlargement with accompanying loss of definition, these effects may be reduced by avoiding a short focus-film distance whenever possible and by minimizing the relative subject-film distance. Actual distortion, on the other hand, may be prevented by correct alignment of film, subject and anode.

Enlargement technique is made possible up to $\times 2$ or more by the use of a 0·3-millimetre, or even smaller tube focus to give satisfactory definition with the selected subject region possibly midway between tube focus and film. The extended use of this tube with its limited current $\times$ exposure time for both screening and radiography is made possible by the use of the image intensifier.

All these qualities are affected by practically every factor in the production of the radiograph—high-tension generator and its control, tube focus, collimation of X-ray beam, focus-film distance, exposure in terms of kilovoltage, milliamperage and time, subject immobilization, grid, intensifying screens, type of film, developer and development; each plays its part, and the careful worker will, therefore, be acquainted with the characteristics of his apparatus, balancing values one with another as the circumstances of each examination demand.

Adequate and uniform illumination for viewing radiographs is essential and a spotlight is an important part of viewing room equipment. At this stage records and radiographs of previous related X-ray examinations should be available.

SOME TECHNICAL ADDITIONS

In each section careful note has been made of current requirements and developments. The wider use of tomography and macroradiography is important, also developments in the use of angiography and the application of subtraction to emphasize radiographic recording. The techniques for autotomography, panagraphy, rotography, stereotaxis, and other new or expanded techniques are also included.

With regard to radiation hazards, for particular purposes investigation by ultrasound, although not an X-ray procedure, is nevertheless in the care of the radiological department for operation and maintenance and thus this inclusion is deemed to be justified.

Gamma ray scanning in neurology is also included as again this procedure for specified regional investigations tends to be in the care of the specialized diagnostic department.

Particular thought has been given to the techniques to be included in the Female Reproductive System, Section 27. Firm advice on the limited use of certain projections is given and particularly for pelvimetry, nevertheless these positions are included to allow for any special requirements. For the *student*, pelvimetry provides an exercise in three-dimensional technique when practised on the dry pelvis.

This applies also to the Localization of Foreign Bodies, Section 35, where actual localization of depth is another exercise in three-dimensional technique which, as applied to a suitable phantom, including localization within a sphere (the eye) again provides an informative exercise for the student. Although these techniques for actual localization may be considered as superfluous, nevertheless, they are retained for reference purposes.

Contrast Media, Supplement 1, pages 737 to 744, has been completely revised, but with continuous changes made by the manufacturers in the various preparations of opaque media, it is extremely difficult to maintain an up-to-date record and constant reference to current literature is recommended.

Radiation Protection, Supplement 3, pages 751 to 760, has been rewritten to provide an up-to-date summary of this all-important subject.

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