

GOLDEN'S DIAGNOSTIC RADIOLOGY
Laurence L. Robbins, M.D., Editor



Section 15: PEDIATRIC RADIOLOGY

SECOND EDITION

Lawrence A. Davis, M.D.

Loretta T. Shearer, M.D.



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The Williams & Wilkins Co. Baltimore



First Edition, 1960

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The Williams & Wilkins Company
428 E. Preston Street
Baltimore, Md. 21202, U.S.A.

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Made in the United States of America

Library of Congress Catalog Card Number 72-13786

SBN 683-02342-0

Composed and printed at the
Waverly Press, Inc.
Mt. Royal and Guilford Aves.
Baltimore, Md. 21202, U.S.A.

GOLDEN'S DIAGNOSTIC RADIOLOGY

Section 15

**PEDIATRIC
RADIOLOGY**

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- Section 19: **Mammography and Breast Diseases** (*Egan*)

Editor's Introduction—1973

The editor welcomes the Second Edition of *Pediatric Radiology* (Section 15 of Golden's Diagnostic Radiology), authored by Drs. Lawrence A. Davis and Loretta T. Shearer. The authors have included much new material which should be of value to the reader. Many special personal techniques of the authors are presented—they are unusual and will be of extraordinary interest to all radiologists, as well as to pediatric radiologists and residents, and also to students.

Beginning with the 1973 Golden volumes the loose-leaf format will no longer be available, due to the extremely high cost of providing the material in this format. The new sections and new editions in the series will be provided in book format only, which we hope will add even more permanence and usefulness to the Golden series.

The editor is deeply indebted to the authors for their extreme cooperation and to the equally great participation from Mrs. Ruby Richardson of Williams & Wilkins.

LAURENCE L. ROBBINS, M.D.

Authors' Preface

This volume, greatly expanded from the edition of 1960, attempts to summarize the more important radiologic findings as they relate to infants and children. At this time with such a general subject, no volume or volumes can be inclusive.

We have attempted to stress the more common conditions which may be encountered by the radiologist, pediatrician, generalist, and student and to place particular importance on those conditions which are acute, treatable, and in which the radiographic examination plays an important role.

Emphasis has been directed to the techniques of obtaining an adequate examination, since the greatest problem among those who do not examine children frequently is an inability to obtain a good examination.

Our gratitude is expressed to K. Minhas, M.D., and F. Elbl, M.D., for help with the selection of appropriate angiocardiograms. Mrs. Ruby Richardson of The Williams & Wilkins Company was more than helpful in the preparation of this manuscript. Without the excellent secretarial help of Miss Radine Hadley, it would have been difficult to finish this volume.

Lawrence A. Davis, M.D.
Loretta T. Shearer, M.D.

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1

Pediatric Radiographic Technique

INTRODUCTION

Most radiologists and their technicians are defeated before they first meet their "adversary," the uncooperative infant or child. They are defeated mainly because of limited knowledge of the techniques of immobilization and, thus, rely on chance in obtaining the necessary films. The young patient senses this, and the battle is over before being joined. The resultant exposure is frequently a blurred mélange of intermixed infant and adult parts in one corner of a large film.

An adequate knowledge and some experience in the simple techniques of restraint will give confidence and good technical films will follow. Without these, there can be no intelligent roentgen interpretation.

Children who are removed from their parents are more easily handled than those whose mothers accompany them to the radiographic room. Not only does the child have an "ally," but the

interaction between patient and parent distracts the technician and physician. Inpatients, even those who have been hospitalized for only a few hours, will be visibly (and aurally) different from their fellow outpatients.

In many children of 2 years or so of age, it is amazing how suddenly the bellicose attitude disappears as soon as parents are left behind and rapid reunion promised as a reward for cooperation.

With some children and with inexperienced technicians, however, the examination may be facilitated by allowing the parent to accompany the child.

There is no substitute for a warm, friendly approach to the child by sympathetic technicians and physicians. Most radiographic examinations are painless, and the experience can be a maturing and satisfying one for the child if properly handled.

IMMOBILIZATION OF INFANT AND CHILD

It is rarely necessary for anyone (including parents, nurse, or attendant) to hold the infant or child during the film exposure. An exception

may be the occasional use of inverted positions in ventriculography.

X-RAY EQUIPMENT

Motion is the prime technical enemy of pediatric radiography. The minimum radiation dosage consistent with excellent radiographic technique is mandatory. At present, both of these requirements are best met with the use of 3-phase generators which allow exposure times as short as 3 msec with increased output per time unit. High kilovoltage techniques are readily obtainable on the larger child. Mobile x-ray

equipment should generate at least 300 ma and allow bedside and operating room films of appropriately short time exposures.

Fluoroscopic television monitoring is desirable. Besides allowing a more comfortable working position for the fluoroscopist, the room lights may be left in a fairly bright setting for reassurance of the frightened child. Monitors can be available for simultaneous distant viewing by

interested clinicians and students without crowding the fluoroscopic room or impeding the procedure.

Although not essential, video tape recording is

a useful adjuvant for review and teaching. At this institution, 70-mm film has been used, but its usefulness as yet has not been adequately evaluated.

IMMOBILIZATION EQUIPMENT

The equipment used is that available and present in all x-ray offices and hospital departments (Fig. 1). Required are: (1) adhesive tape and more adhesive tape (2- and 1-inch); (2) ordinary cotton face towels fastened into loops

with safety pins, or appropriate size orthopedic stockinette; (3) sandbags; (4) rubber nipples; (5) lollipops; and (6) lead rubber squares. Additional equipment used in special procedures will be listed under the respective studies.

VARIOUS TECHNIQUES OF IMMOBILIZATION

Chest Film

There is no need for upright films in the majority of patients. (When a child can stand

satisfactorily for his films, then upright projections are used. These are anteroposterior until the age of 4 or 5 years.) If there is suspicion that an air fluid interface exists in lung, pleura, or

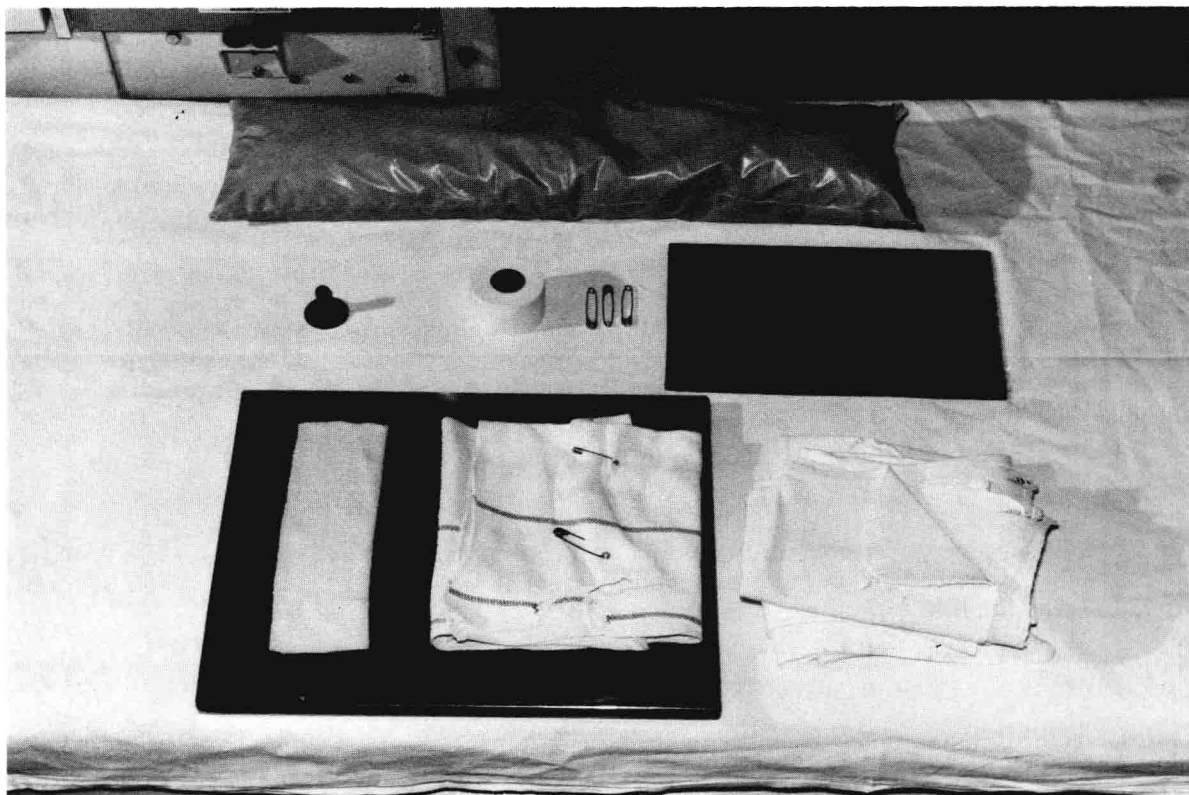


FIG. 1. EQUIPMENT USED IN PEDIATRIC X-RAY TECHNIQUE

Stockinette and the towel loop are on the cassette. The lead rubber (to the right of the safety pins) can be cut into any desired shape or size.

(Figures 1 through 8 are reproduced, through permission of the publisher, from L. A. Davis: "Standard Roentgen Examinations in Newborns, Infants, and Children: Techniques 'Portable' Films, Immobilization Devices, and Fluoroscopy," *Progress in Pediatric Radiology*, Vol. 1: *Respiratory Tract*, p. 3-7. 1967, Year Book Medical Publishers, Inc., Chicago.

pericardium, a horizontal beam film must be obtained.

The infant's arms are placed over and behind the head and maintained there by the previously adjusted towel loop or stockinette. This is done as follows. The technician, with the towel loop in position over the right forearm, grasps both of the infant's hands and positions them behind the head. She then slides the loop from the right forearm over the infant's arms using her left hand. By gradually pulling alternately on the left, then the right, the loop is positioned as shown in Figure 2. This effectively immobilizes the upper extremities and is quite comfortable. No fractures, dislocations, or other injuries have occurred in countless applications of this towel loop, though, when first attempted, dire consequences seem inevitable.

The lower thighs, just proximal to the knees, are then taped together with a strip of 2-inch adhesive. With the patient properly positioned on the cassette, the regular radiographic table restraining band (or additional strips of adhesive tape) is passed over the infant whose knees have been elevated by a small sandbag. A rubber nipple may be offered the child and held by another piece of adhesive if desired (Fig. 3).

The lateral exposure is obtained as shown in Figure 4. Folded towels are used as a pillow for the face and to keep the cheek level with the cassette. Additional straps of adhesive tape across the entire table are used if necessary. When they cross the face or hair, the adhesive is folded lengthwise on itself so none of the adhesive material actually touches the infant.

A large rectangular piece of heavy lead rubber is placed across the abdomen to protect the gonads if a collimating device with coincident light beam is not available. (In practice both collimating device and lead rubber are employed.)

A 6-ft target film distance is unnecessary since the infant's chest is thin and distortion is minimal. The fastest exposure time available should be selected and all other physical factors subordinated to the time. (See "Technique Chart Supplement": Davis and Davis, 1972.)

Oblique films are obtained by blocking the appropriate side up with nonopaque sponge blocks or towels (Fig. 5).

Upright films in the infant can be exposed with the infant propped against the foot board attached to the horizontally positioned radiographic table (Fig. 6).

Films on toddlers and older children are

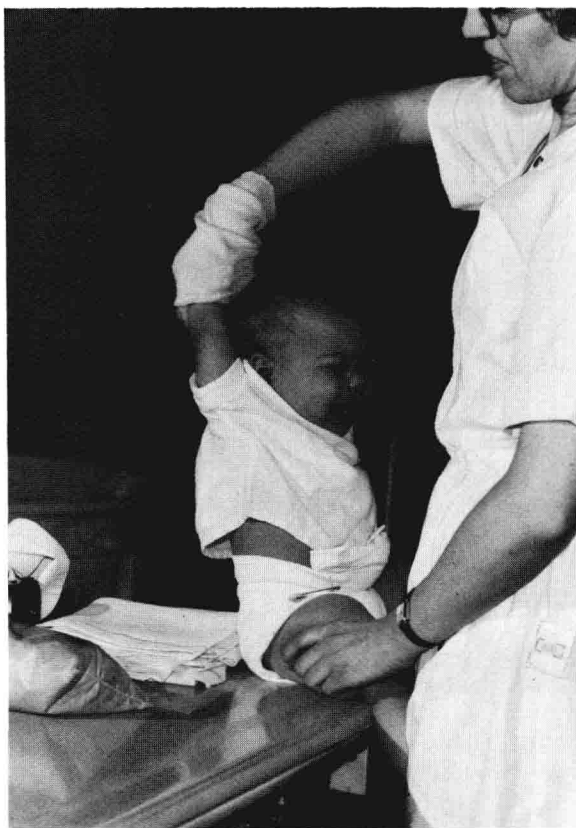


FIG. 2. ARM IMMOBILIZATION TECHNIQUE

The technician, with the stockinette (or towel loop) over her right forearm, grasps the infant's hands as shown. With the left hand the loop is worked around the baby's upper extremities.

obtained as in adults, with the exception that the anteroposterior projection may be preferable in the smaller child (Figs. 7 and 8).

The film should be exposed in full inspiration. A few seconds spent in calming the infant with quiet words and gentle patting prevents the necessity for many retakes.

Since infiltrates in the lingular segment of the left upper lobe and in the right middle lobe are often "buried" in the heart on the lateral film, an "upshoot" film is valuable in infancy and childhood. The central ray is directed in a cephalad direction along the plane of the major fissure, usually about 30° (Fig. 9). This "simulated" apical lordotic view throws the infiltrate into sharp relief (Fig. 33, p. 28).

If intrapulmonary fluid is suspected (particularly in nephritis or nephrosis) a lateral decubitus view is obtained (Fig. 74, p. 57).