Illustrated Manual of Ultrasonography in Obstetrics and Gynecology

MITSUNAO KOBAYASHI, M. D.

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MITSUNAO KOBAYASHI, M.D.

Department of Obstetrics and Gynecology
Chiba University School of Medicine
Chiba, Japan

Former Assistant Professor
Department of Obstetrics and Gynecology
State University of New York
Downstate Medical Center, Brooklyn
New York, U.S.A.

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Preface

This book is an outgrowth of my attempts to present both scanning and interpreting techniques in obstetrical and gynecological ultrasonography with appropriate illustrations.

Although in preparing this manual both the ultrasound technologist who must know how to scan for ultrasonograms of high quality and the physician who interprets them have been kept in mind, this book is intended primarily for the former, who plays an increasingly important role in obstetrical and gynecological ultrasonic examinations.

The role of the ultrasound technologist cannot be overemphasized in the practice of diagnostic ultrasound. Since the interpreting physician cannot read the ultrasonograms beyond their pictorial presentations, the ultrasonograms obtained by the ultrasound technologist should be of such a high quality that all necessary informations are clearly presented on them for proper interpretation.

There can be no question about the important value of the lucid illustrations, which make for clearer understanding of the ultrasonographic presentations. I have tried to correlate the ultrasonograms with the pertinent anatomical or pathological illustrations. I hope that the illustrations in this manual will make it easier to understand the text.

For the sake of better appreciation of important diagnostic points, all ultrasonograms in this manual were drawn with white paint on the black papers as in real ultrasonograms. For clearer understanding of the positional relationship between the ultrasonogram and the real anatomy, all transverse ultrasonograms were so presented that their left sides refer to the right sides of the patients as in x-ray presentation. I sincerely hope that this manual will be a helpful guide in interpreting ultrasonograms as well as scanning patients in Obsterics and Gynecology.

I wish to express my deepest gratitude to Dr. LOUIS M. HELLMAN, Deputy Assistant Secretary for Population Affairs, Department of Health, Education, and Welfare, Washington, D.C. and Emeritus Professor, Department of Obstetrics and Gynecology, State University of New York, Downstate Medical Center, Brooklyn, New York, who had keen insight into the future of diagnostic ultrasound in Obstetrics and Gynecology and whose deep understanding and constant encouragement during my stay in his Department have made the publication of this book possible. To him this book is dedicated.

I am deeply indebted to Mr. LEWIS FILLISTI, an ingenious engineer, who contributed a great deal to the establishment of Ultrasound Laboratory in the Department of Obstetrics and Gynecology, State University of New York, Downstate Medical Center, Brooklyn, New York. I am sincerely appreciative of Mrs. ELLEN CROMB CAMPOS, a nurse ultrasound technologist, who exhibited an excellent skill and helped me a great deal in the above Ultrasound Laboratory.

I wish to acknowledge the invaluable help and continued encouragement offered by Dr. KAZUMASA MASUBUCHI, Chief of Gynecological Section, Cancer Institute Hospital at Tokyo, Japan.

My appreciation is also extended to Dr. JAMES H. NELSON, Jr. and his staff at the Department of Obstetrics and Gynecology, State University of New York, Downstate Medical Center, Brooklyn, New York, for their support and cooperation.

To my wife, HISAKO KOBAYASHI, who did all the ultrasonographic drawings and illustrations, I am most grateful.

Finally, it is my pleasure to thank the publisher, Igaku Shoin Ltd., for their understanding and help in the preparation of this manual.

MITSUNAO KOBAYASHI

Contents

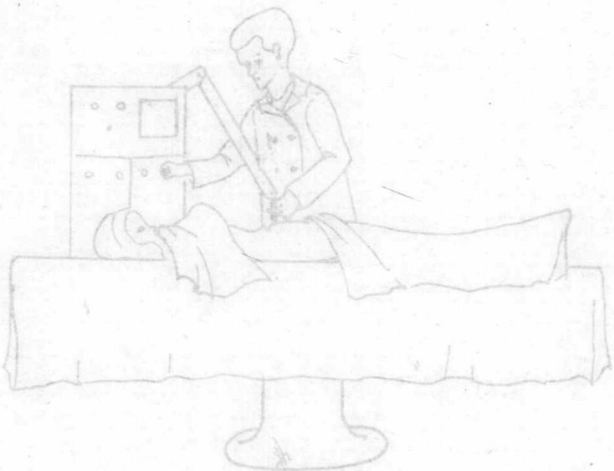
I. INTRODUCTION

The ultrasonic examination in Obstetrics and Gynecology includes A-scan and B-scan.

The A-scan is a uni-dimensional, linear presentation with the echoes recorded as vertical displacements of trace and their height proportional to the echo strength. This is used mainly for measuring the distance and the fetal biparietal diameter, and its use in Obstetrics and Gynecology is limited.

The B-scan is a two-dimensional presentation with the echoes recorded as dots and their size proportional to the echo strength. The B-scan shows the cross-sectional anatomy along the transducer path. The B-scan has extensive, important applications in Obstetrics and Gynecology, compared with the A-scan.

This book deals with the B-scan applications in Obstetrics and Gynecology.



Procedure of B-scan examination

No special preparation is necessary on the part of the patient except for a full urinary bladder. In an elective examination, this is accomplished by the patient's holding urine for 4 to 5 hours and drinking plenty of fluid prior to the scheduled examination time. In an emergency, the administration of about 250 ml of saline via a Foley catheter immediately accomplishes the full bladder. The necessity of the full bladder is explained by the fact that the enlarged bladder displaces the disturbing intestines out of the area anterior to the uterus and works as a natural water-tank for excellent ultrasonic propagation.

1. The patient lies supine on an examining table (Fig. 1).
2. The abdomen is exposed from the symphysis pubis up to the level just below the xiphoid process. Drapes or towels should cover the periphery of the examination area so that mineral oil (or olive oil) may not soil the patient's clothes.
3. Mineral oil (or olive oil) is liberally applied to the exposed abdomen for the purpose of securing direct contact between the tip of the transducer and the abdominal wall.
4. The examination, the contact compound scanning by manual operation, is started with a midline longitudinal scan. The purpose of the initial midline longitudinal scan is two-fold: to see whether the bladder is full enough for the obstetric and gynecologic examinations and to obtain the uterine outline.
5. Then follow multiple longitudinal and transverse scans.
6. Oblique scans are employed whenever necessary.
7. During this entire scanning procedure, at least several Polaroid photographs are taken from the storage oscilloscope for a permanent record.

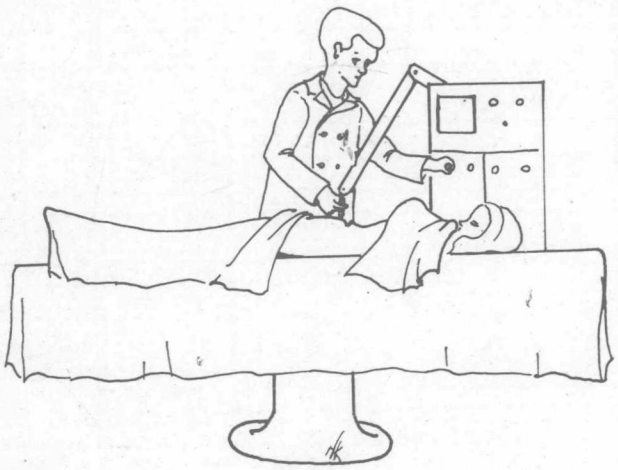


Fig. 1

1. Longitudinal and transverse scans constitute a basic diagnostic procedure. The combination of both scans is always necessary for the full understanding of the three-dimensional anatomy.
2. The longitudinal scan is the one performed along the long axis of the patient. The starting point of describing the scanning location in the longitudinal scan is the midline (M) of the patient (Fig. 2).
   Thus, a longitudinal scan at Y cm to the right of the midline is abbreviated as "L+Y". "L−Y" means a longitudinal scan at Y cm to the left of the midline. Routinely, all the pertinent scanning data are written on the back of the exposed Polaroid film for the future identification.
3. The transverse scan is the one performed at a right angle to the longitudinal scan. The starting point of describing the scanning location in the transverse scan is the umbilicus. Thus, the transverse scan at X cm above the level of the umbilicus is "T+X," and that at X cm below the level of the umbilicus, "T−X."
4. However, instead of these verbal descriptions, the diagrammatic designation is used in this book for clearer understanding of the sonogram.
5. The oblique scan is the one performed at an angle either to the longitudinal or to the transverse scan. Occasionally, this scan is needed in the diagnosis of multiple pregnancy, fetal presentation and so forth.

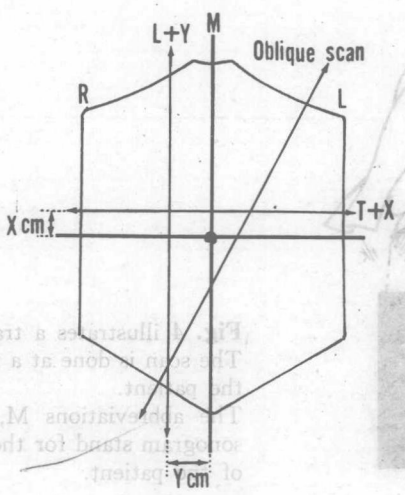
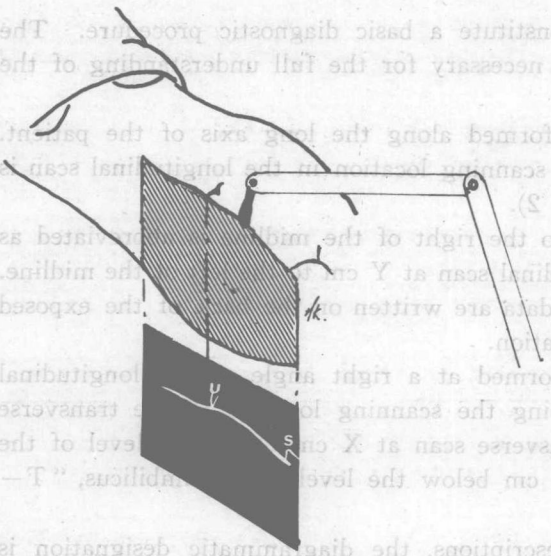


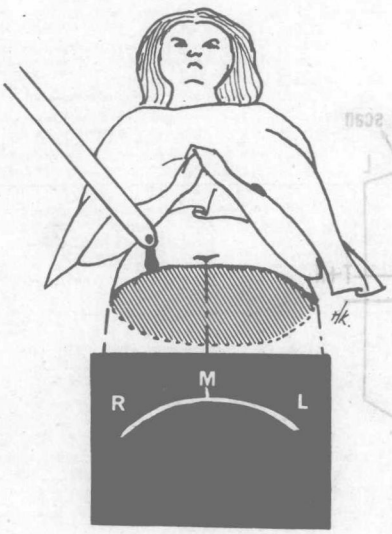
Fig. 2



LONGITUDINAL SCAN

Fig. 3 illustrates a longitudinal scan.
The scan is done in a plane parallel to the long axis of the patient. The abbreviations S and U in this longitudinal sonogram represent the symphysis pubis and the umbilicus, respectively. Also used routinely in the longitudinal scans is Bl, the bladder.

S : symphysis pubis
U : umbilicus



TRANSVERSE SCAN

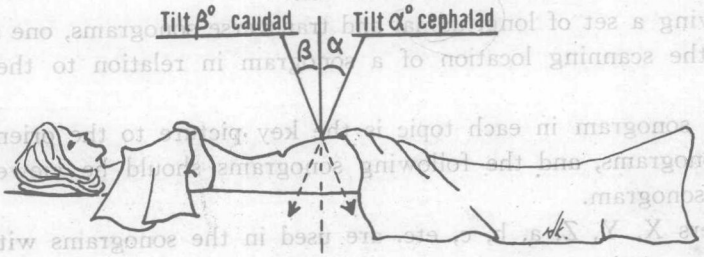
Fig. 4 illustrates a transverse scan.
The scan is done at a right angle to the long axis of the patient.
The abbreviations M, R and L in this transverse sonogram stand for the midline, right and left sides of the patient.

M : midline
R and L : right and left sides of the patient

The above mentioned abbreviations such as Bl, S and U in the longitudinal scan and M, R and L in the transverse scan, are used throughout this book as the important anatomic landmarks.

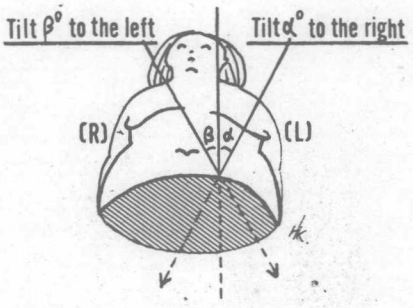
In each sonogram is inserted an approximate scale of 3 cm as a thick white line.

Tilt is the angle of the transducer forming with the vertical line and is described in degrees. The purpose of the tilt is to obtain the best possible angle for a particular scan.



TILT OF TRANSVERSE SCAN

Fig 5 illustrates the tilt in the transverse scan.
"Tilt $\alpha°$ cephalad" indicates the face of the probe directed toward the head of the patient with an angle of $\alpha°$ from the vertical line.
"Tilt $\beta°$ caudad" indicates the face of the probe directed toward the feet of the patient with an angle of $\beta°$ from the vertical line.



TILT OF LONGITUDINAL SCAN

Fig. 6 illustrates the tilt in the longitudinal scan.
"Tilt $\alpha°$ to the right" indicates the face of the probe directed toward the right side of the patient with an angle of $\alpha°$ from the vertical line.
"Tilt $\beta°$ to the left" indicates the face of the probe directed toward the left side of the patient with an angle of $\beta°$ from the vertical line.
R and L: right and left sides of the patient

How to use this book

To make the most of this book, thorough acquaintance with the following convention is recommended.

1. One can appreciate the size of any structure judging from the position of the symphysis pubis (S) and the umbilicus (U). Also provided in each sonogram is an approximate scale of 3 cm as a thick white line.

2. In reviewing a set of longitudinal and transverse sonograms, one should always keep in mind the scanning location of a sonogram in relation to the rest of the sonograms.

3. The first sonogram in each topic is the key picture to the orientation of the entire set of sonograms, and the following sonograms should be viewed in relation to this central sonogram.

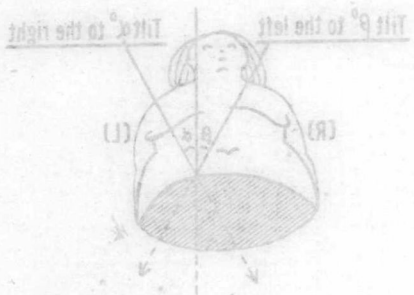
4. The letters X, Y, Z, a, b, c, etc. are used in the sonograms with the arrows showing specific scanning positions and directions.

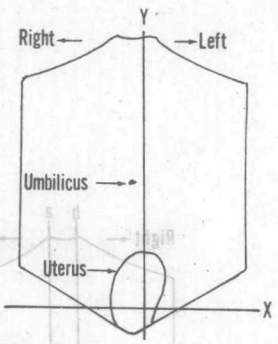
5. A set of sonograms should always be referred to one another before the three-dimensional concept of any intra-abdominal structure can be obtained.

6. The attached diagram of the abdomen is for the visual identification of the scanning location of longitudinal and transverse scans.

7. All the sonograms in this book were drawn with white paint on the black paper so that the finished drawing would simulate a real sonogram for clearer comprehension.

8. Sonograms vary with the sensitivity setting of the system. In this book, the sensitivity is not specified when normal, and most of the sonograms are presented at normal sensitivity.





Bl : bladder
S : symphysis pubis
U : umbilicus
Ut: uterus

Fig. 7-0 1. This is a diagram showing the actual scanning sites of the longitudinal and transverse scans.
2. The line X represents the location of the transverse scan (Fig. 7B).
3. The line Y represents the location of the longitudinal scan (Fig. 7A).

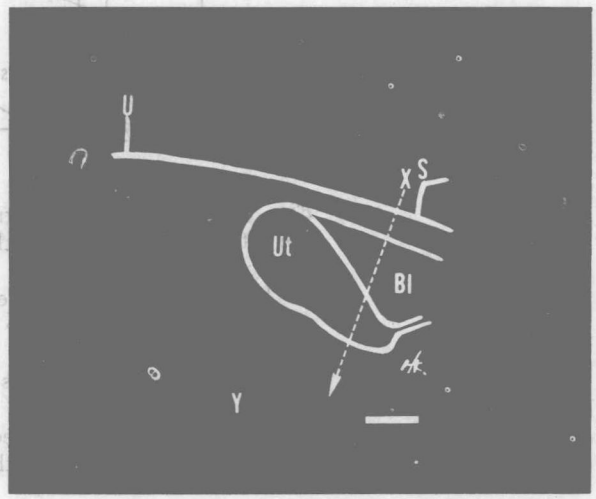


Fig. 7A 1. This is a longitudinal scan as indicated by S (symphysis pubis) and U (umbilicus).
2. The location of this longitudinal scan is shown as the line Y in the attached diagram (Fig. 7-0) and as the arrow Y in the transverse scan (Fig. 7B).
3. The arrow X indicates both the scanning location and the direction of the other scan (Fig. 7B).
4. The letter Y at the bottom indicates that this scan was done along the arrow Y in Figure 7B.
5. A thick white line at the bottom indicates an approximate scale of 3 cm.

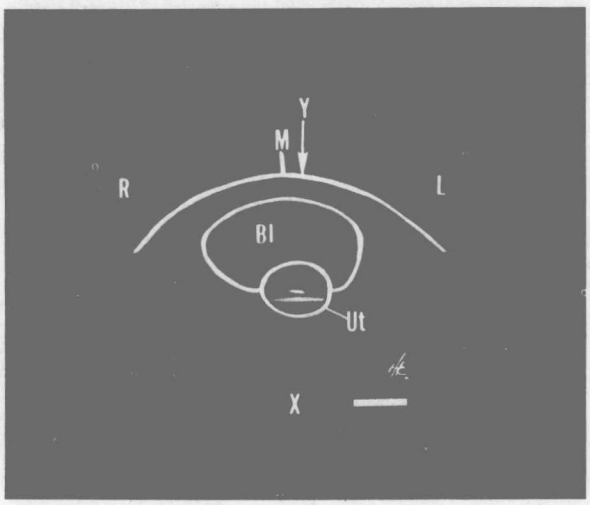


Fig. 7B 1. This is a transverse scan as indicated by M (midline), R and L (right and left sides).
2. The location of this transverse scan is shown as the line X in the attached diagram (Fig. 7-0) and as the arrow X in the longitudinal sonogram (Fig. 7A).
3. The letter X at the bottom indicates that this scan was done along the arrow X in Figure 7A.
4. The arrow Y indicates both the location and the direction of the other scan (Fig. 7A).
5. A thick white line at the bottom indicates an approximate scale of 3 cm.

NOTE: (1) With the diagram (Fig. 7-0) as a key to the clear understanding of the anatomy as well as the scanning sites (X, Y), the interpretation of the related sonograms is facilitated.
(2) X $\rightleftharpoons$ Y