Thorough familiarity with normal variations and insignificant anatomic deviations is essential to the practice of clinical pediatrics. Through constant observation and experience differentiation from disease becomes possible. In radiology this same problem exists and is probably more significant, as roentgenograms record only the situation as of a particular moment—an inherent weakness of the method. In radiology many standard procedures are established so that results may be duplicated and progress of disease evaluated. Deviations from standard procedures often simulate disease. In addition to this pitfall, there are many anatomic variations to plague the radiologist at the time of interpretation.

The following are examples of roentgenograms which have simulated disease but upon investigation proved to be normal:

1. The gaseous pattern in the infant differs from the adult. Ordinarily, we are taught that gas in the small bowel suggests obstructive ileus. In the infant under 2 years of age, gas in the small bowel is normal. After this age or after the child begins to walk the gas in the small bowel disappears and its presence then assumes significance. Improved intra-abdominal circulation, better co-ordination of diaphragmatic movements is responsible for greater absorption of gas in the small bowel after this age (Fig. 1).

Large amounts of air in the stomach are not necessarily due to obstruction. A very hungry baby will swallow huge amounts of air to a point of distending the abdomen. We know this occurs and is without significance, as we use this phenomenon for diagnostic pyelography. In this procedure, the ravenously hungry child is given a bottle of formula after the intravenous or intramuscular injection of contrast material is administered. The fasted child takes the bottle eagerly and swallows gross amounts of air. The stomach pushes the transverse colon down and the kidneys visualize well through the air-distended stomach. It is truly remarkable how large the stomach will distend with this method (Fig. 2).

2. Variations of kidney anatomy are many and confusing. One of the most baffling to interpret is the depressed kidney, as seen on the pyelogram. By use of presacral injection of air we have proved that a lobulated kidney can simulate a suprarenal mass (Fig. 3A and B).

3. The variable growth of the skeleton is forever suggesting disease. Symmetrical epiphyses will show different growth patterns and irregularities. The femoral head in young infants may have small radiolucent defects along the articular surface due to incomplete ossification. The infants are asymptomatic and a repeat examination in a month will reveal complete ossification and is therefore of no significance.

The acetabular angles in infants vary considerably. Increase of acetabular index does not indicate dislocation or hypoplasia. Other more important roentgen signs must be present for the diagnosis of congenital dislocation of the hip.

Difference in size of the femoral heads of a given individual can also occur normally. Progress films show that they both eventually become the same size. No therapy is necessary (Fig. 4A and B).

The epiphyseal-metaphyseal junction in young children is a zone of active growth and therefore this zone is more dense than the surrounding bone. The line of increased density at the distal end of the metaphysis is normal and should not be confused with heavy metal poisoning.

Bowlegs in the past was frequently thought to be subsequent to rickets. Vitamin D-deficient rickets today is rare, yet frequently we

---

Presented at the Clinical Session of the American Academy of Pediatrics at the Children's Memorial Hospital, Chicago, October, 1958.

ADDRESS: 707 Fullerton Avenue, Chicago 14, Illinois.
Fig. 1 (Left). Normal abdomen in an infant, with gas in both small and large bowel.

Fig. 2 (Right). Gastric dilatation resulting from feeding a hungry baby a bottle of formula after intramuscular injection of radiopaque material for pyelogram. The kidneys are seen through the gas-distended stomach.

see bowlegs in young children; usually the parents are also bowlegged. It also is surprising the degree of straightening that results as these children grow. All clinical studies are normal and no therapy is indicated (Fig. 5A and B).

4. The history of trauma at times unduly influences the interpretation of anatomic variants as significant effects of injury. A notable example of this is the cervical spine. In the normal child, if a lateral roentgenogram is taken in

Fig. 3. (A, left) Pyelogram reveals depressed left kidney suggesting suprarenal mass. (B, right) Presacral injection of air reveals normal suprarenal space with lobulated kidney.
Fig. 4. (A, upper) Infant’s pelvis; right femoral head has defect in center. Joint spaces outlined by gas. (B, lower) Months later; femoral heads are normal and symmetrical.

Partial flexion the body of C2 appears to ride slightly forward on the body of C3. If a child injures himself in the region of the neck a torticollis usually develops because of muscle spasm and as a result the head and neck are held in partial flexion. Roentgenograms taken in this position reveal an apparent slip of C2 on C3. With the history of trauma this is falsely
interpreted as a dislocation. By gentle traction the head can be placed in position for proper examination and this mistake can be avoided. As soon as the muscle spasm is relieved, roentgenograms always show normal position of the vertebrae (Fig. 6A and B).

Fig. 6. (A, left) Lateral cervical spine in flexion, normal child. The body of C2 appears slipped forward on body of C3. (B, right) Same child, head slightly extended; alignment of vertebrae normal.
Fig. 7. Normal child; trachea deviated to right because film was taken in expiration.

Variations of the skull also may present difficulties. Trauma to the skull is very frequent in children and knowledge of suture lines and vascular channels is essential in order to avoid embarrassing errors in diagnosis of fractures.

5. Probably one of the most frequent roentgenograms taken on a child is the chest and

Fig. 8. (A, left) Lateral view of the neck. Retropharyngeal space enlarged. (B, right) Same child moments later, with film in neutral position; retropharyngeal space normal.
upper airways. It is therefore extremely important that position and technique become standardized; otherwise, serious disease will be diagnosed. Precise frontal and lateral views must be obtained in inspiration. The trachea buckles easily on expiration, the heart becomes enlarged and the lungs appear cloudy. All are pitfalls for the unwary (Fig. 7).

Allowing a child to abnormally flex the head for roentgenograms of the retropharyngeal space will increase this area to a point of suspecting a retropharyngeal abscess. The head must be in a neutral position during the examination (Fig. 8A and B).

6. One can never stop cautioning our colleagues about the thymus. This gland has many bizarre variations and always brings up the problem of differential diagnosis. It is extremely rare for the thymus to produce symptoms. From wide experience we have recognized the many thymic variants and assume that an asymptomatic anterior mediastinal mass probably represents the thymus. At times extensive investigation may be necessary.

The preceding examples are but a few of the many technical and anatomic variations that offer a challenge to the diagnostic acuity of both the pediatrician and the radiologist.
CLINICAL CONFERENCE: Some Pitfalls in Pediatric Radiology
Harvey White

Pediatrics 1960;25;1077

Updated Information & Services
including high resolution figures, can be found at:

Permissions & Licensing
Information about reproducing this article in parts (figures, tables)
or in its entirety can be found online at:
/site/misc/Permissions.xhtml

Reprints
Information about ordering reprints can be found online:
/site/misc/reprints.xhtml
CLINICAL CONFERENCE: Some Pitfalls in Pediatric Radiology
Harvey White
Pediatrics 1960;25;1077

The online version of this article, along with updated information and services, is located on the World Wide Web at: