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Metrizamide as a contrast medium for visualization of the tracheobronchial tree: its drawbacks and possible advantages

W. Smith and E. A. Franken

Department of Radiology, University of IA Hospitals and Clinics, Iowa City, Iowa, USA

Abstract. This report documents the use of metrizamide as contrast agent for studies of the tracheobronchial anatomy of two infants. In both cases, the contrast produced adequate diagnostic visualization of major tracheobronchial abnormalities even though surface coating was limited.

Bronchography has become an unusual procedure in infants [1]; however, positive contrast studies are occasionally necessary in delineation of anomalies of the trachea and major bronchi.

This report documents the use, safety, and limitations of metrizamide, a non-ionic contrast material, for evaluation of the trachea and major bronchial divisions in two critically ill infants.

Case reports

Case 1

BS was a 3570-g female infant, product of an uncomplicated gestation in a 21-year-old G1 P1 mother. Immediately after delivery, several anomalies were noted including single umbilical artery, lack of the thumb on the right hand, and imperforate anus. The infant clinically also appeared to have difficulties with excessive oral secretions and on day 2 of life, duodenal stenosis was diagnosed.

Because of progressive respiratory difficulties, bronchoscopy was performed revealing a high grade stricture of the trachea, approximately 3 cm caudal to the larynx. This stricture could not be traversed with the bronchoscope and a positive contrast study of the upper tracheobronchial tree was undertaken to define the anatomy. Metrizamide in a concentration of 220 mgm I/cc was injected trough a 3-French catheter introduced through the patient's endotracheal tube. Two initial injections of 1 cc each demonstrated the long segment stenosis and the anatomy of the left mainstem bronchus. The infant tolerated these well. A third injection of approximately 1.5 cc volume was successful in demonstrating a stricture at the orifice of the right mainstem bronchus (Fig. 1); however, the infant suffered a transient period of apnea after this injection. She responded rapidly to suctioning and the procedure was terminated. It should be noted that she had suffered several previous apneic episodes while no procedures were being performed and that she continued to have similar episodes after the study.

The metrizamide alveolarized in the lung and disappeared radiographically within 24 h of the procedure. The infant was cared for with supportive management but succumbed 4 days after the bronchogram. At autopsy, the lungs showed no evidence of residual contrast medium. There were minimal pneumonic infiltrates as would be expected in a child with poor tracheobronchial toilet but no inflammatory changes such as those described by Alford et al. [7] were present.

Case 2

ER was the 2600-g product of a term gestation. After birth, difficulties in feeding were encountered and a contrast study demonstrated a laryngeal cleft and common esophagotrachea to a distance of 3 cm above the carina. Tracheostomy and surgical repair using a fascial graft for the posterior bronchial wall was done on day 6 of life.

On day 20 of life, a metrizamide esophagram demonstrated persistence of multiple large connections between the trachea and esophagus. The patient tolerated the study despite the passage of several cc's of metrizamide into the trachea. The patient during her hospital course had six such studies with five demonstrating filling of the trachea.

At 3 months of age, a metrizamide tracheogram was performed to localize the reconstructed carina. This was necessary because of difficulties in maintaining the infant's tracheostomy tube. Two cc's of 190 mgm I/cc metrizamide were instilled through the tracheostomy tube and the carina was localized at the level of T-2 (Fig. 2). The infant tolerated the procedure without difficultly.

After a prolonged recuperative course and several revisions of the repair, the infant is currently doing very well and is at home.

Discussion

Non-contrast techniques, or fluoroscopy, are usually adequate for evaluation of the upper airways in chil-

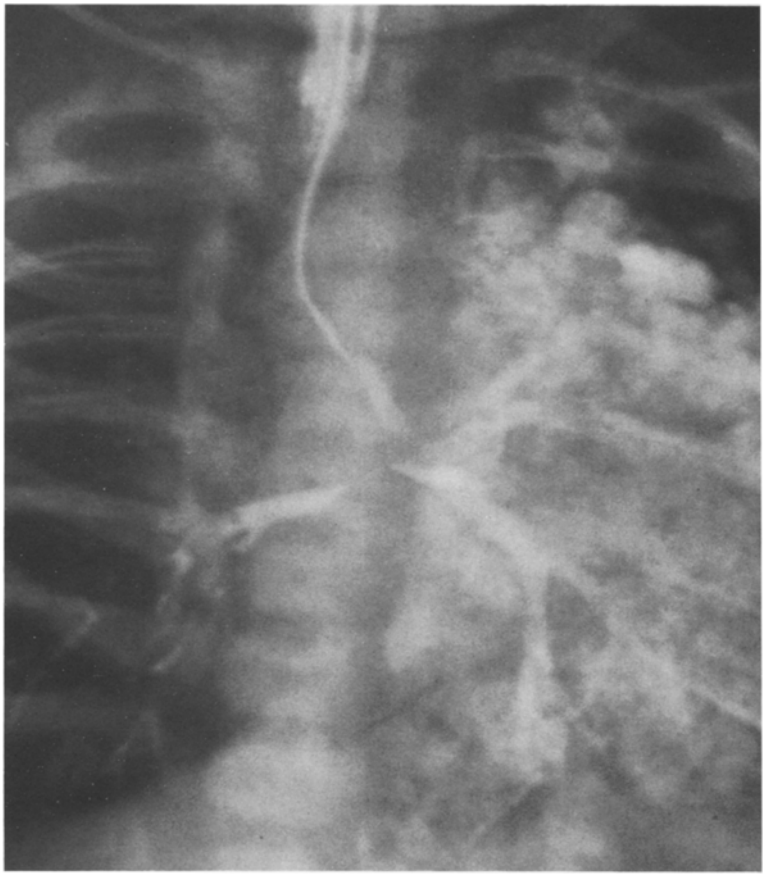

Fig. 1. Contrast outlines the strictured portion of the trachea and shows the high grade focal narrowing at the origin of the right main bronchus. The alveolarized contrast in the left lung disappeared within 24 h

Fig. 2. Metrizamide tracheography demonstrates good visualization of the reconstructed carinal area

dren. There are, however, occasional instances where positive contrast delineation of the upper tracheobronchial tree is needed for evaluation of the major congenital anomalies.

The choice of contrast material for these studies is limited. The oil-based contrast agents, both dionosil and lipiodol, produce undesirable reactions. On a gross level, these agents produce measurable diminution in pulmonary function and a high incidence of atelectasis [2]. Microscopically, both produce relatively long lasting pulmonary inflammatory responses in laboratory animals [3]. The use of ionic contrast materials, while avoiding atelectasis, can cause pulmonary edema. Barium preparations, especially those with additives, may cause an intense airway obstruction if a significant volume is instilled into the trachea [4].

Metrizamide is a non-ionic, water soluble compound with low viscosity. The drug has been used extensively for myelography, intravascular procedures, gastrointestinal imaging and arthography [5]. McAlister has studied the physiology and histology of experimental metrizamide aspiration in rats and dogs and has found it to produce milder and more transient changes in the lung than either barium or water soluble contrast [6]. These properties suggest that it would be useful for the study of the upper tracheobroncial tree.

Alford et al. [7] demonstrated intense inflammatory infiltrates after intratracheal installation of large doses of metrizamide in dogs. The microscopic slides of the lungs of Case 1 were carefully reviewed and none of the inflammatory changes documented in this report were present in our patient. This discrepancy could be due to several factors. The time course was different, in that our patient died about 90 h after the procedure whereas Alford's dogs were sacrificed closer in time to the procedure. The dosage of contrast employed for our patients was considerably less than in the animal study. Finally, it is entirely possible that the canine lung reacts to metrizamide differently than the human.

Case 2 tolerated several metrizamide procedures without any adverse effect. Case 1 had transient respiratory difficulties during the procedure probably because of the efforts to define the origin of the right main bronchus. The infant immediately returned to baseline status after suctioning and rewarming. It should be noted that this infant was very ill and had similar respiratory difficulties after any handling or removal from the isolette. The role of the metrizamide in her respiratory difficulties was probably only that associated with the installation of any fluid into the trachea.

Metrizamide tracheography has two principal disadvantages. Because of its low viscosity, the contrast flows rapidly and coating is poor, therefore, the study must be performed under fluoroscopic control and rapid filming is necessary. This poor coating makes visualization of anything but the larger tracheobronchial structures impossible. The low viscosity also results in rapid alveolarization of the contrast medium limiting peripheral lesion visualization. Metrizamide is more expensive than other contrast materials and as such must be used sparingly. One 6.5-g ampule (cost approximately $60.00) is adequate for most studies.

This report documents the use of metrizamide for positive contrast visualization of the tracheobronchial anatomy in two critically ill neonates. In both instances, the contrast was well tolerated and allowed sufficient visualization of the anatomy of the trachea and mainstem bronchi for diagnosis.

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Dr. W. L. Smith
Department of Radiology
University of IA Hospitals and Clinics
Iowa City, IA 52242, USA