A Technique of Bronchography with Visciodol:  
A New Contrast Medium

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Since the first bronchography was performed by Chevalier Jackson\(^1\) in 1918 with the use of bismuth powder insufflated through a bronchoscope, there has been a constant search for more satisfactory bronchographic contrast media. The procedure did not gain widespread acceptance until the epoch making discovery by Sicard and Forestier\(^2\) in 1923, that Lipiodol made a satisfactory contrast medium for this examination. Other iodized oils were subsequently introduced, but none was able to surmount the following common objections to their use for this procedure:

1) Retention within the alveoli obscures any accurate follow-up for long periods of time, as elimination from the lung is slow.

2) The retained iodine interferes with any subsequent radiation therapy.\(^5\)

3) Delay in any contemplated pulmonary surgery due to an increased incidence of post-operative atelectasis in cases having had recent bronchography with alveolar penetration.\(^4\)

4) Alveolograms are far more difficult to interpret than bronchograms.

5) Reported formation of iodized oil granulomas.\(^5\)

6) Prolongation of reactions in iodine sensitive individuals due to slow liberation of iodine.

7) Repeat bronchograms impossible for long periods of time due to obscuring shadows of alveolar oil.

These objections led to the introduction of water-soluble contrast agents. Ioduron B and Umbradil Viscous B were introduced in 1948. More recently Dionosil Aqueous in a carboxymethylcellulose base has become available. These agents are not without their own particular group of inherent objectionable qualities. We feel, as do other workers,\(^6,7\) that these objectionable qualities makes their use as undesirable as the use of the unaltered iodized oils for this procedure. The chief objections to the use of these water-soluble agents are:

1) They produce severe local irritation and require deep topical anesthesia.\(^6,7\)

2) The radiographic images produced by these agents are less dense than those produced by the iodized oils due to lower iodine content. This is particularly important on the lateral projection.\(^8\)

3) Undue haste must be employed during the procedure due to their rapid absorption.

4) The carboxymethylcellulose present as the base of these agents has

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been shown to produce an inflammatory response which may be severe and irreversible.

5) Large quantities of these agents are required to produce adequate filling of the bronchial tree, usually 20 or more cc. per lung.

6) The miscibility of the carboxymethylcellulose with the bronchial secretions may produce secretions so viscid that a respiratory emergency ensues. An emergency bronchoscopy with bronchial suction may be necessary as a life saving procedure.

Recently, Dionosil in an oily base has become available. This preparation is an improvement over the water-soluble agents, however, it too has some inherent objectionable qualities. The most common objections to the use of this agent are:

1) Greater tendency to alveolar penetration than the water-soluble agents.

2) A large amount of this agent must be used in order to obtain a satisfactory outline of the bronchial tree, usually 20 cc. per lung.

3) In spite of its arachis oil base, this preparation is still more irritating that the iodized oils, requiring deeper anesthesia.

4) The iodine content of this agent is 34 per cent, the iodine content of Lipiodol is 40.

5) The fate of the radiolucent arachis oil base has never been completely studied. Some of the oil undoubtedly remains in the lung, although not visible on the radiograph, and could possibly give rise to any of the known complications due to oil in the lung. However, to date, no such complications have been reported.

6) There is a tendency for Dionosil Oily to drain from the upper lobe bronchi during the procedure.

Material

During the past nine months, the authors have had the opportunity to perform 35 bronchographies with Visciodol, a Lipiodol-sulfanilamide suspension (E. Fougera & Co., Inc.). The formula of this preparation as given by the manufacturer is:

Sulfanilamide 0.32 gm.
Sodium sulfite 0.002 gm.
Lipiodol, 40 per cent q.s. to 1 cc.

The finely divided sulfanilamide is added as an inert agent in order to increase the viscosity of the Lipiodol, thereby practically eliminating alveolar penetration. The bland properties of Lipiodol are retained and all the problems associated with alveolization are eliminated. The small amount of sodium sulfite is added to prevent any liberation of free iodine on contact with air thus insuring a non-ionic iodine complex.

Premedication

Our routine pre-bronchographic orders have been:

1) No lunch.
2) Demerol 50 mg. at 1:00 P.M.
3) Nembutal 100 mg. at 1:00 P.M.
4) Atropine 0.4 mg. at 1:00 P.M.
5) To the Radiology Department at 2:00 P.M.

Following the procedure, we have not permitted eating or drinking for three hours in order to prevent possible aspiration.

**Technique**

All bronchographies in this series were carried out with the use of Xylocaine topical anesthesia. The rapidity of action and great potency of this agent makes it particularly suitable for use in conjunction with this procedure. A minimum of anesthetic agent is required in order to obtain a satisfactory degree of anesthesia.

This series was carried out using the catheter intubation method. In all but one case the catheter was inserted by using the Haight maneuver.12 Our routine consists of coating the sides of the distal portion of the catheter with a small amount of xylocaine jelly. The catheter is inserted into the larger of the two nares. When the patient no longer has any discomfort due to the presence of the catheter, the head is tilted slightly forward, the tongue pulled forward, and the catheter advanced as far as the arytenoids. The presence of the catheter at this level stimulates the cough reflex. When this occurs the catheter is withdrawn slightly and is quickly advanced simultaneously with the expiratory phase of the cough or during the deep inspiration which follows. Should the patient tend to swallow the catheter, this can be avoided by withdrawing the catheter slightly, and advancing and withdrawing it in quick succession, stimulating the cough reflex. This method eliminates the necessity of anesthetizing the oropharynx, and also eliminates the use of the laryngeal mirror, and special instruments for inserting the catheter.

The one case in which the catheter could not be inserted using this
method occurred in a patient with an unusually large tongue. A laryngeal mirror and anesthetization of the oropharynx was used in this patient.

Once the catheter enters the trachea a paroxysm of coughing is encountered. Immediately 8 to 10 cc. of a 2 per cent Xylocaine solution is injected through the catheter. Within less than a minute the cough response will be suppressed. Following this the patient is placed on the fluoroscopy table in the supine position and the remainder of the examination carried out under fluoroscopic control. The catheter is advanced into the desired main-stem bronchus by having the patient turn his head as far lateral away from the side desired. The catheter is then advanced and will usually enter the desired bronchus; occasionally this maneuver may have to be repeated one or more times. The catheter is then positioned to rest just above the orifice of the upper lobe bronchus. The side which is most suspected for pathology is examined first.

The Gianturco technique with minor modifications is used for the actual outlining of the bronchial tree. The patient is placed in the lateral decubitus position, the side to be filled dependent. An additional 1 cc. of Xylocaine solution is injected through the catheter at this time in order to fully anesthetize the upper lobe bronchi. This step is of paramount importance in suppressing the cough reflex during the procedure. The patient is then instructed to breathe deeply and slowly and over the course of several respirations the medium is injected. Although the Visciodol is injected fairly rapidly, the patient does not experience any sensations of drowning. The amount of Visciodol used varies inversely with the patient's ability to breathe deeply—8-10 cc. is usually necessary. In one cooperative 19 year old patient (Fig. 1) we were able to achieve excellent

FIGURE 2: Post-operative examination, patient had previous lower lobectomy and lingulectomy. Note high density shadow produced on the lateral as well as the oblique projection.
coating of the entire bronchial tree with the use of 5 cc. for each lung.

We have found it necessary to turn the patient into the prone position and inject an additional 1 or 2 cc. to completely outline the middle lobe or lingula. After the examiner decides that filling appears adequate, spot films, as deemed necessary are made. The patient is then taken to the radiography room and six foot postero-anterior, lateral and posterior oblique projections are made. The films are checked in the wet state and the degree of filling assessed; if necessary, more contrast material can be injected at this time and further films made. We have found this necessary in only one case. The patient is then returned to the fluoroscopy room and the catheter is inserted into the opposite bronchus and positioned as previously described. The patient is then placed in the opposite decubitus position, 10 cc. of contrast medium is injected exactly as before except for the fact that it is done without fluoroscopic control. The filled bronchi of the opposite side cast too many interfering shadows on the fluoroscopic screen to make fluoroscopy in the lateral position of any real value. After this 10 cc. has been injected, the patient is obliqued slightly so as to separate the two bronchial trees and the filling checked with the fluoroscope. When it is decided that filling is satisfactory, the patient is taken to the radiography room and a routine postero-anterior or a stereo-postero-anterior projection as well as a posterior-oblique projection is made. Our findings confirm those of Dapra14 that the high density of the shadow cast by the Visciodol makes stereo projections practical as well as informative. The posterior-oblique projection is preferred since it places the bronchi closer to the cassette, diminishing the magnification, and increasing the clarity of the image.

Every effort should be made to keep the exposure time under 1/10 of a second in order to avoid blurring of the basilar bronchi due to transmitted cardiac motion. In exceptionally large patients it may be necessary to

![FIGURE 3: Minimal retention within the major bronchi, no evidence of alveolar penetration in a patient having minimal bronchiectatic changes in the right base.](image-url)
reduce the tube-cassette distance to 40 inches to keep the exposure time within acceptable limits.

In every case the patient is instructed to cough vigorously as soon as the procedure is completed. Most of the Visciodol is eliminated at this time. Postural drainage has not been ordered as a routine follow-up. A 24 hour film is routinely made. At this time a small amount of Visciodol is usually present in the larger bronchi, and none in the alveoli (Fig. 3, 4). The small amount in the larger bronchi is expectorated within the next few days. In only one case did any significant degree of alveolization occur. In this case the medium had been heated prior to administration which may have been a factor in the alveolar penetration. It is recommended that the medium not be heated prior to administration as this lessens the viscosity.

Product

As previously stated, this entire series was carried out with the use of Visciodol contrast medium. A Lipiodol-sulfanilamide suspension for bronchography was first used by Dormer and his associates\(^{15}\) in 1945. These workers were interested in any possible therapeutic effect; however, they did note the excellent quality of the bronchograms obtained with this suspension. Houghton and his co-workers\(^{5, 18}\) subsequently reported the use of up to 10 grams of sulfanilamide suspended in 20 cc. of Lipiodol without untoward results. These workers reported 7,000 bronchograms performed with Lipiodol-sulfanilamide suspensions. All reports in the literature,\(^{5, 6, 14, 15, 16, 17, 18}\) predominantly European, have been favorable, stressing the minimal alveolization and rapid elimination from the lungs. We have been particularly impressed with the minute degree of alveolar penetration, the high density of the image produced, the lack of irritation

![FIGURE 4: High density of the shadow produced on the lateral film, minimal retention within the major bronchi at 24 hours, no alveolar penetration. Esophagus outlined by swallowed medium.](image-url)
and the rapid elimination of the medium. We feel, to date, that Visciodol is the agent of choice for bronchography.

**Toxicity**

In one case previously known to be sensitive to sulfonamides, in whom we neglected to elicit this history, a transient sulfonamide reaction was encountered. This responded rapidly to anti-histamine medication. We now make an especial attempt to elicit any previous history of sensitivity. We have not administered prophylactic ACTH or anti-histamines prior to the procedure as has been recently reported.\(^8\)

**Discussion**

A full discussion of all the indications for bronchography is beyond the scope of this report, however, the following criteria are used as justification for performing the procedure by the authors:

1) Bronchiectasis suspected on the routine films with some associated clinical symptomatology.
2) Bronchiectasis suspected clinically regardless of the appearance of the routine films.
3) Pulmonary tuberculosis refractory to therapy, before or after thoracoplasty.
4) Evaluation of any cystic abnormalities of the pulmonary parenchyma.
5) Diagnosis of obstruction of the bronchi not accessible to the bronchoscope.
6) Any case of idiopathic hemoptysis where the source of bleeding is likely to be pulmonary. The value of having bronchiectatic areas mapped in advance, in such cases, is well substantiated.\(^9\)
7) Any case of carcinoma of the lung where a knowledge of the status of the bronchial tree is desired prior to surgery.
8) Any case of suspected alveolar cell carcinoma, in an attempt to confirm the impression by demonstrating narrowing of the bronchial tree.\(^9\)

With the use of the previously described techniques, the procedure becomes a rapid one (30 to 45 minutes), produces little patient discomfort, and yields a tremendous return in information gained. The use of Visciodol speeds the procedure, increases its safety by diminishing the amount of anesthesia necessary and provides higher quality radiographs.

**SUMMARY**

1. The authors' experience with Visciodol, a Lipiodol-sulfanilamide suspension, for use in bronchography has been presented.
2. This agent enables one to obtain excellent bronchograms and practically never penetrates the alveoli.
3. We feel Visciodol is the contrast medium of choice for bronchography.

**RESUMEN**

1. Se presenta el resultado de la experiencia de los autores usando el Visciodol, que es una suspensión de Lipiodol y sulfanilamida.
2. Este producto permite obtener excelentes broncogramas y prácticamente nunca penetra en los alvéolos.
3. Creemos que el Visciodol es el medio de contraste de elección para la broncografía.

RESUME

2. Ce produit permet l’obtention d’excellentes bronchographies et pratiquement ne pénètre jamais dans les alvéoles.
3. Les auteurs pensent que el viscidol es el produite de contraste de choix para la bronchographie.

ZUSAMMENFASSUNG

1. Es wurden die Erfahrungen der Verfasser mit Visciodol, einem Lipiodol-sulfanilamid-Suspension zum Gebrauch bei der Bronchographie vorgelegt.
2. Dieses Mittel ermöglicht es, ausgezeichnete Bronchogramme zu erhalten, und dringt praktisch niemals in die Alveolen ein.
3. Verfasser drücken die Überzeugung aus, dass Visciodol das Krontrastmittel der Wahl für die Bronchographie darstellt.

REFERENCES

15. Dormer, B. A., Friedlander, J. and Wiles, F. J.: Bronchography in Pulmonary Tuberculosis (Part III).