

THE USE OF THORIUM DIOXIDE AS AN AID TO CLINICAL DIAGNOSIS

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THE diagnosis of intra-abdominal tumours has always been a perplexing problem to the clinician. Even with the help of the radiologist in visualization of the gastro-intestinal tract it is often difficult to determine the type, origin and progress of the palpable abdominal mass. Out of this have grown efforts to produce some contrast medium which, when injected intravenously, will render certain essential organs visible in anatomical detail under x-ray. Research workers have shown that the widely distributed reticulo-endothelial system is capable of picking up in a specific manner finely particulate substances injected into the blood stream. Given that such a substance were opaque to the x-ray and without general toxic or local irritative effect, the accurate roentgen visualization of certain organs thus becomes possible.

Latest of these, and with which this communication is concerned, is thorium dioxide. According to available literature, this substance was first used clinically in the early part of 1931 by Radt and Krynski. Since this time many reports concerning its use in small series of cases have appeared, mainly in the German literature. Although laboratory work shows that it is picked up in appreciable amounts by the reticulo-endothelial system everywhere, its main use, clinically, has been in visualization of the liver and spleen—hepatolienography. Thorium has also proved valuable in the hands of certain investigators as a contrast medium in the roentgenograph of hollow viscera and blood vessels. Injected into the carotids, it serves as an excellent means of arterial encephalography, and it is equally valuable in making arteriograms of the extremities. The field of usefulness of thorium dioxide in roentgen visualization may be listed as shown opposite.

The experience of other investigators, as reported in the considerable foreign literature now available on the subject, was reviewed with reference to possible untoward sequelæ following the intravenous injection of thorium. The commercial preparation "Thorotrast" has been the only one employed. The dosage commonly

accepted as producing satisfactory visualization is 0.8 c.c. per kilo. of body weight. Kadrnka and Rossier, giving doses of the dioxide much larger than this, found no ill effects other than a transient hæmoglobinuria and a mild decrease in erythrocytes. Kadrnka remarks that its use is contra-indicated where there is co-existent hepatic and renal insufficiency. Radt observed a slight elevation of temperature following the injection of thorium in patients who were previously toxic or markedly cachectic. Severe icterus he considers a contra-indication. Randerath performed two autopsies on patients who had received thorium. He found the inert metal present in the same distribution as found in experimental animals, with no evident reaction. One of his patients had received more than twice the ordinary dosage.

Since November, 1931, 18 cases in which thorium has been given intravenously have come under observation at the Toronto General Hospital, mainly from the medical and surgical services. The commercial preparation, "Thorotrast", has been used. This is a 25 per cent solution of thorium dioxide as a highly dispersed sol in serum. The technique has been the same in each case. Three injections of 25 c.c. are given, with two days between each. The thoro-

A. BY INTRAVENOUS INJECTION

<i>Indication</i>	<i>X-Ray Appearance</i>	<i>Information Obtained</i>
1. Masses in hypochondrium	Displacement of spleen or liver shadow.	Association of liver or spleen to mass.
2. Cirrhosis Leukæmia	General diminution or absence spleen or liver shadow.	Degree of involvement.
3. Tumours Cysts Abscesses	Localized area or areas in liver not visualized.	Presence of metastases. Position of abscess, cyst, etc.
4. Splenic thrombosis	Absence of splenic shadow.	

B. AS A LOCAL CONTRAST MEDIUM

1. Fistulæ.
2. Empyemata.
3. Body cavities.
4. Genito-urinary tract.

trast may be given warmed to 37 degrees, but must be given slowly, taking at least five minutes on each occasion. Plates are not taken until 24-48 hours after the last injection, and should be preceded by a high enema. The same radiological technique is used as in taking stereoscopic plates with any contrast medium. The films obtained are simple of interpretation.

Of the 18 patients who have come under observation, 10 were closely followed, before and after the use of the drug, for periods varying from three weeks to five months. Urinalyses were done at frequent intervals, the blood picture contrasted with that before the use of thorium, and in certain cases a blood Van den Bergh determination was done. None of these showed the slightest indication of change consequent upon the intravenous administration of thorium. Only one patient manifested an immediate reaction. This individual developed a moderate febrile reaction following the first injection. This subsided promptly, and after three days' delay the remaining injections were given without further disturbance. This occurred in a patient who had been ill for many weeks. Such a febrile reaction may well be due to the presence of serum-proteins in thorotrast

As in the majority of reports in the literature, this series of cases has been mainly concerned with the detection of hepatic metastases from intra-abdominal carcinoma. A comparison of the x-ray plates with the anatomical findings at operation in at least three cases showed conclusively the accuracy with which the metastases were shown radiographically. On two occasions also the contrast of the x-ray plate with the gross appearance of the liver demonstrated how few metastases one could actually see on the surface

of that organ compared to the number seen in the film. At the moment, this appears a most valuable addition to the investigation of patients suspected of having malignancy of the gastrointestinal tract, for many futile abdominal explorations will be avoided when the presence of metastases has been thus established. In two cases of this series exploratory operation was denied the patient after visualization of multiple hepatic metastases.

The citation of one case will serve also to illustrate the value of hepato-lienography as an aid to diagnosis. A forty-year-old woman presented a tumour mass in the hypochondrium, without definite diagnosis, and concerning which there was considerable variance in opinion. Radiological evidence and other investigation presented contradictory findings. Her appearance was that of early cachexia due to carcinoma. Visualization of the liver showed one large and multiple small metastases.

None of the patients in this series has yet come to autopsy.

From the clinical and laboratory evidence to date one cannot detect any disturbance consequent upon the use of thorium *per se* intravenously. Febrile reactions when present are probably due to the serum-vehicle. The advantages of hepato-lienography are as definite as they are obvious, and its field of usefulness should constantly widen with increased experience in its administration.

This work has been carried out in association with the Radiological Service of the Toronto General Hospital, and particularly with Dr. H. W. Dickson, Associate Director of the Department. The clinical material has been obtained from the services of Prof. W. E. Gallie and Prof. D. A. L. Graham.

For full bibliography see papers in this issue by Drs. Dickson and Irwin.

COMPARATIVE STUDIES ON MERCUROCHROME AND OTHER ANTISEPTICS.—W. F. von Oettingen and others describe experiments which indicate that mercurochrome, when once fixed on the surface of the tissue, develops no bacteriostatic action in contact with bacterial cultures. It penetrates only into the dead or dying mucous membranes of different organs, such as bladder, vagina and digestive tract, and it may diffuse through the cornea when in contact for a sufficient period. It does not penetrate the living skin but is fixed in the most superficial layers of the epithelium, and it does not penetrate or stain normal muscular tissue. It penetrates necrotic and dead tissue and stains them deeply and permanently. The tissue toxicity of mercurochrome is relatively low, but the 5 per cent aqueous solution is distinctly injurious as judged by excised ciliated mucous membranes. The authors believe that mercurochrome cannot be relied on to destroy bacteria that have penetrated into the living tissue of a wound or of the skin; it could do no more

than disinfect the surface and the necrotic tissue. This limitation is shared more or less by all antiseptics so that no substance can be properly called a safe and certain wound antiseptic. No antiseptic takes the place of thorough cleansing and surgical treatment. When these are not practical, for "first aid" or for very superficial wounds, antiseptics are probably better than no treatment at all. The antiseptic efficiency of mercurochrome is not outstanding, and for skin disinfection the aqueous solution is distinctly inferior. The absence of irritation may be an advantage, especially with open wounds, and for prolonged treatment; but its limitations should always be borne in mind.—*J. Am. M. Ass.*, 1932, **99**: 127.

If you desire to know a man's sentiments towards you, consult him upon something which interests you; his reply will reveal to you his whole heart, and whether he is your friend or your enemy.—Plato.