

21.4.21

THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report  
of  
Committee on Thesis

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Frederick A. Olson for the degree of Master of Science. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science.

W. F. Braasch  
Chairman

E. J. Guld

W. H. Shochauer

R. D. Carman

June 1 1918

231286

MS 24-1918 13185

THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report

of

Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Frederick A. Olson final oral examination for the degree of Master of Science in Surgery. We recommend that the degree of Master of Science in Surgery be conferred upon the candidate.

Minneapolis, Minnesota

June 1, 1918

W. F. Broesech

Chairman

E. S. Judd

W. S. Thachauer

F. C. Mann

R. G. Rowntree

UNIVERSITY of  
MINNESOTA  
LIBRARY

THESIS

A STUDY OF THE ROENTGENOGRAPHIC FINDINGS  
IN RENAL TUBERCULOSIS

Frederick Adolf Olson

Submitted May 15, 1918, to the Faculty of the Graduate School  
of the University of Minnesota as part of the Requirements  
for the degree of Master of Science in Surgery (Urology).

MCM  
DP22  
8

A STUDY OF THE ROENTGENOGRAPHIC FINDINGS  
IN RENAL TUBERCULOSIS.

The practical value of the earlier and more accurate clinical diagnoses is so uppermost at all times that this work was undertaken to make available in a more systematized and amplified manner a seemingly but little appreciated fact, namely, that the x-ray is of great aid in the examination of this condition and has been utilized by a few men for a number of years. That it should be more commonly used is very evident.

Early in 1915 Dr. W. F. Braasch directed my attention to the study of this problem with the request that it be taken up in all its angles. The literature shows the first report of the roentgenological diagnosis of a tuberculous kidney to have been published by Strater in 1910. Following that a considerable number of papers appeared from time to time in foreign periodicals. The principal observer was Burchard who brought the literature up to date and added some cases of his own. In the English literature and especially in American journals only one article has appeared to date. Krotoszyner reviews the foreign reports and adds one case of his own. All but one of his illustrations are borrowed from the European.

In renal tuberculosis early recognition of the condition is paramount. As it has been estimated by various observers that over one-third (33 1/3 to 50 per cent) of all suppurative diseases of the kidney are due to the tubercle bacillus, its recognition and this percentage in the future is apt to be even increased.

Miliary tuberculosis is not of especial interest here while chronic localized renal tuberculosis is of interest to the internist because he is usually the first to see the case, and to the surgeon because it is curative

## A Study of the Roentgenographic Findings in Renal Tuberculosis -2.

by surgery only. As Albarran had said a good many years ago, "Early diagnosis, early nephrectomy." In the early 70s Bryan and Peters did the first nephrectomy for tuberculosis. In the last decade and especially in the last five years the greatest strides have been made in diagnosis so that now there is no department of genito-urinary surgery in which the application of new methods has been crowned with more success and consequent benefit to patients. We have reached the position where it is generally possible to lay down the facts with regard to the condition of the urinary tract before operation with an accuracy which is nearly absolute.

In renal tuberculosis the x-ray furnishes important information as to the presence or absence of pulmonary lesions which occur in 6 per cent of the surgical cases and also in the patients with osseous complications where 7 per cent have joint changes, 3 per cent of these being active. However, our chief interest in this investigation is in the findings of local shadows within the renal and ureteral areas which are cast by calcareous deposits and caseous areas in tuberculous kidneys and ureters.

This review is based on the records of over 700 surgical and medical cases of renal tuberculosis on file at the Mayo Clinic. In this number a great amount of roentgenographic material was available. Approximately one case out of every five showed shadows in the kidney area that were of definite diagnostic importance. To be more exact, in 1916 and 1917 131 patients were operated on for this condition. Shadows of diag-

A Study of the Roentgenographic Findings in Renal Tuberculosis -3.

nostic value were found in 30, making a percentage of 22. The procedure now is routine.

While at times these shadows are indistinct and unfortunately occasionally do not lend themselves well to reproduction, in the original roentgenograms, they serve to put the observer on the right track, so that now a diagnosis of a tuberculous kidney can frequently be made from the roentgenogram above. The shadows seen have a peculiarity of irregular contour and varying density which is almost pathognomonic. They quite naturally group themselves into seven classifications. The first four are renal; the other three, ureteral, prostatic and the shadows obtained by pyelography.

Group 1. Group 1 contains those most commonly seen and includes irregularly rounded shadows, 1 cm. or more in diameter, situated usually in one or the other polar areas. It is cast by a caseated mass or a calcium deposit around about the wall of an abscess cavity. This group is most frequently confused with the ordinary renal stone. (Figs. 1 and 2) At this point it may be stated as Fenwick, Braasch and others have said that true renal stone is a rarity in this condition. When found it has been pre-existent. Only two cases were found in this series.

Group 2. This group includes larger, rounded, often lobulated shadows of varying density which show the kidney outline entirely or in part. They are cast by the dense caseous material of a typical "putty kidney" or by kidney substance densely infiltrated with lime salts. These roentgenograms frequently make very dramatic representations and reproduce well (Figs. 3 and 4).

A Study of the Roentgenographic Findings in Renal Tuberculosis -4.

Group 3. In this group are included those cases in which there are multiple punctate shadows scattered in one or several areas or throughout the kidney. The shadows vary from one to several millimeters in breadth and thickness. (Figs. 5 and 6).

Group 4. Group 4 includes cases very similar to those in the first group but are the least commonly found of all. The shadows are of varying dimensions,  $\frac{1}{2}$  to  $\frac{3}{4}$  cm., and present a peculiar filigree, streak-like striation. (Fig. 7).

Group 5. In Group 5 are the ureteral shadows, which are stick-like tube shadows most often in the lower third. When typical they are unmistakable, but at times may be confused with calcareous glands, atheromatous vessels, calcification in abdominal tumors and other things which usually can be eliminated by various means. In the interpretation of urinary tract shadows it shows that any definite classification would be of great aid in increasing the accuracy of our work. (Fig. 8).

Group 6. Group 6 includes the multiple, usually smaller, 2 mm. to 1 cm., shadows which occur scattered through the prostate. They are apt to be interpreted as genuine calculus especially where the tuberculous lesion has become very chronic or healed. (Fig. 9).

Group 7. Group 7 includes the shadows obtained by means of injections of thorium or other material into the kidney, pelvis, ureter and bladder. A pyelogram, ureterogram or cystogram while made only when absolutely necessary, frequently give all the necessary information (Figs. 10 and 11).

## A Study of the Roentgenographic Findings in Renal Tuberculosis -5.

Pyelography would naturally be employed with more definite value in the cases under consideration in which the roentgenogram demonstrates a shadow which does not fall into any one of the above groups and in which the characteristics as to location, contour, and density may be atypical.

4

As Braasch has pointed out the changes in outline in the injected roentgenogram regarded as diagnostic of tuberculosis consist of one or more of, (1) irregular inflammatory dilatation of the pelvis, (2) areas of cortical necrosis, and (3) stricture of the ureter. The technique of injection in these cases requires some care and should not be done indiscriminately.

The interpretation of the finished pyelogram requires experience and must be collaborated with all the collected data obtainable in the given case.

In conclusion it must be emphasized that:

1. A routine x-ray examination in suspected cases of renal tuberculosis should be a recognized procedure. Definite values are obtained in 20 per cent of the cases.
2. Use of shadow grouping could be made more universal with a considerable increase in accuracy of diagnosis.
3. The method is applicable especially to the more difficult cases. In patients in whom the disease is double, bilateral shadows frequently may be all that is necessary to eliminate useless surgery.
4. When a complete cystoscopic examination can not be made, the finding of a shadow will conclude the diagnosis. A typical shadow falling into one of these groups will demonstrate absolutely that the condition is a case of so-called "autonephrectomy".
5. The finding of a shadow of one of these types will classify



A Study of the Roentgenographic Findings in Renal Tuberculosis -6.

at once any doubtful suppurative or "surgical" kidney.

I desire to express my appreciation to Dr. W. F. Braasch, Dr. R. D. Carman and Dr. A. B. Moore of the Mayo Clinic for their aid in making this study possible.

A Study of the Roentgenographic Findings in Renal Tuberculosis -7.

REFERENCES

1. Burchard, A., Fortschr. a. d. geb. d. Röntgenstrahlen, 1913, xx, 244-288.
2. Krótoszyner, M., Jour. Am. Med. Assn., 1914, lxiii, 2006-2009.
3. Fenwick, E. H., The value of radiography in the diagnosis and treatment of urinary stone. Lond., Churchill, 1908, 157 p.
4. Braasch, W. F., Pyelography, Philadelphia, Saunders, 1915.

ADDITIONAL REFERENCES

5. Cabot, H. The difficulties and limitations of diagnosis in advanced cases of renal tuberculosis. Boston Med. & Surg. Jour., 1911, clxiv, 634-638.
6. Fletcher, E. A. Renal tuberculosis - History and pathology, symptomatology and diagnosis, treatment and results. Urol. and Cutan. Rev., 1915, xix, 558-562.

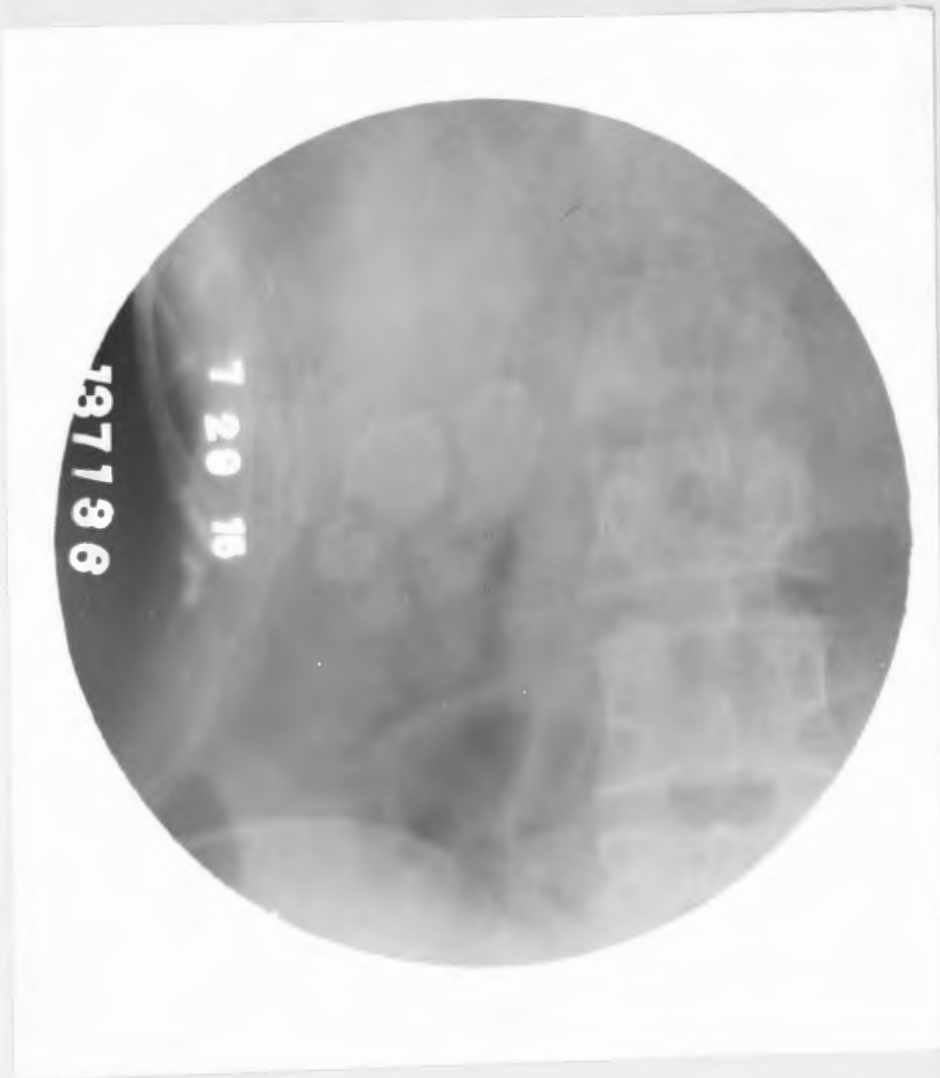


Fig. 1. (137136) Multiple irregularly rounded shadows from 1 to 2 cm. in diameter in the lower pole of the kidney caused by caseated areas, simulating renal stone.

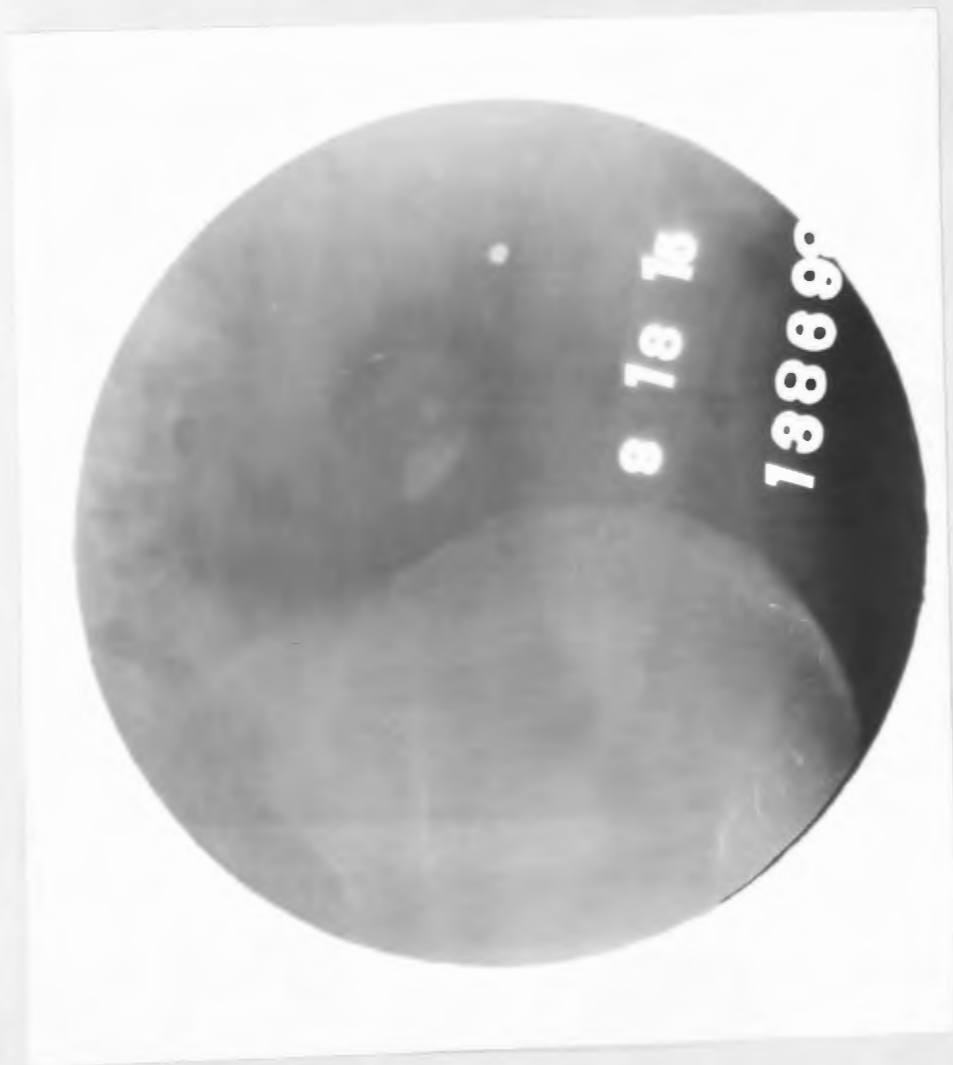


Fig. 2. (138698) Two areas of calcareous deposit in the lower pole of left kidney with marked renal ptosis.



Fig. 3. (10082) Cast of kidney caused by complete caseation - typical "putty kidney".

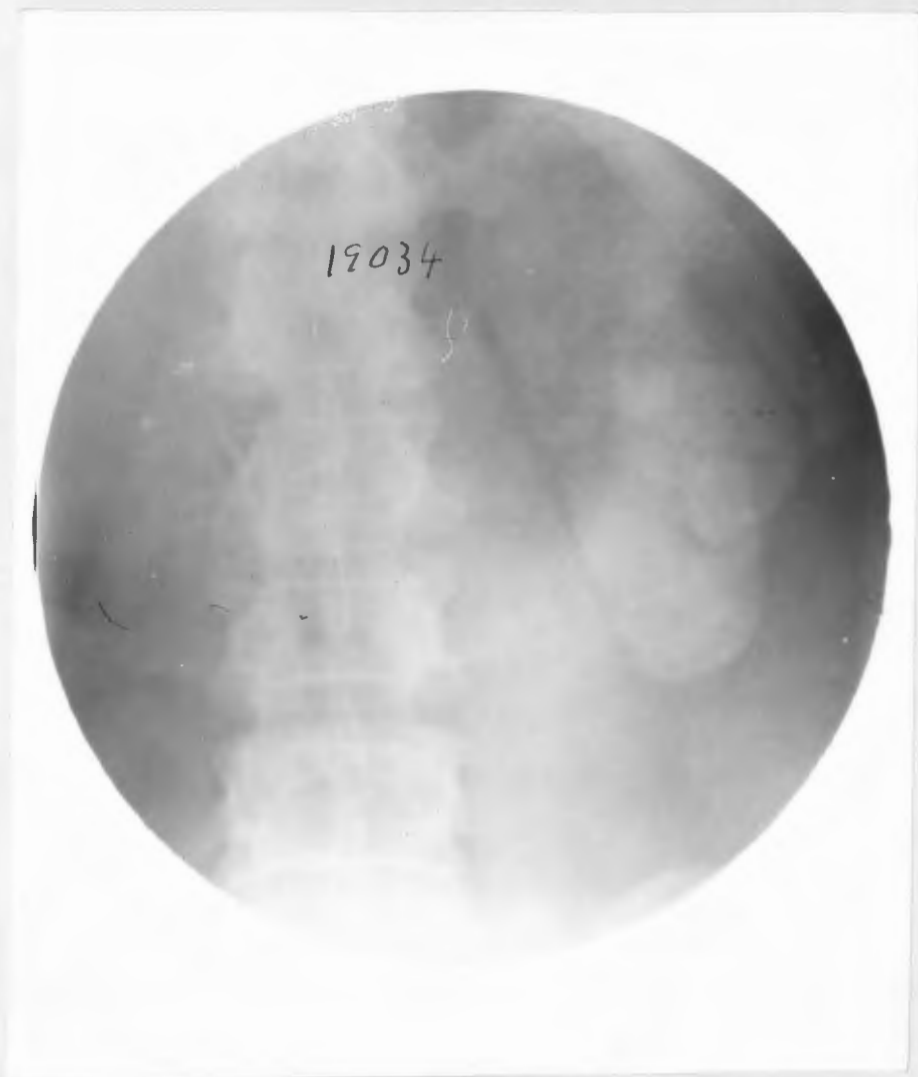


Fig. 4. (19034) Extensive caseation of the lower two-thirds of kidney.

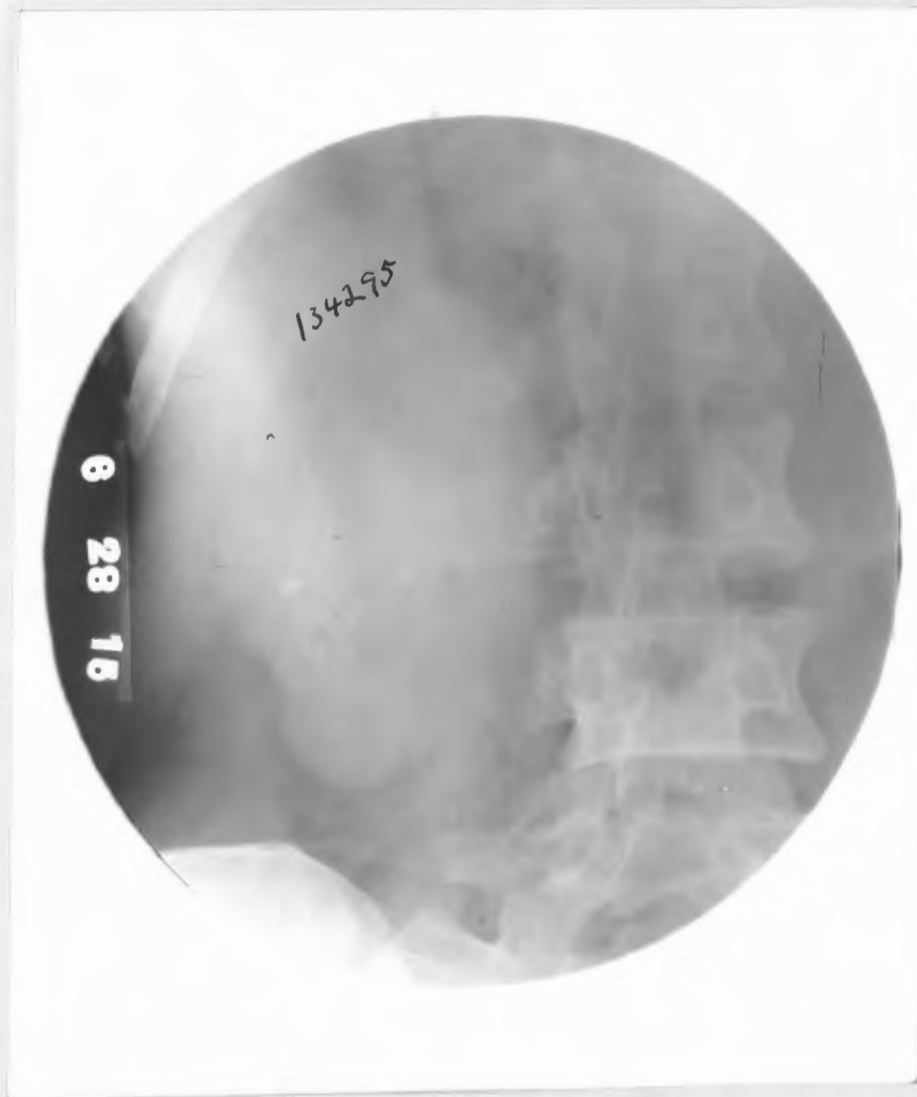


Fig. 5. (134295) Multiple punctate areas caused by deposits of lime salts.

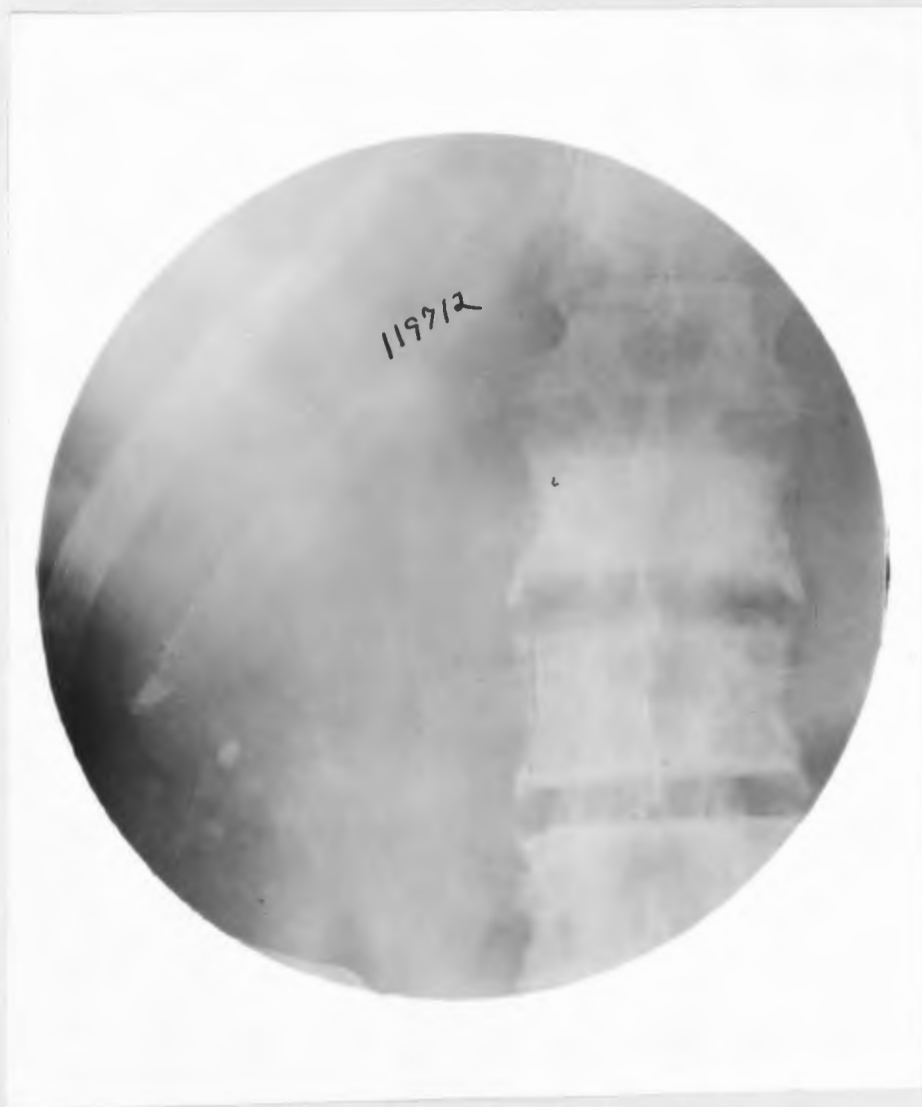


Fig. 6. (119712) Multiple punctate shadows scattered in the lower lateral portion of the kidney.





Fig. 7. (132702) Typical filigree shadow caused by calcium deposits of varying densities.



Fig. 8. (17737) Caseation of ureteral wall.

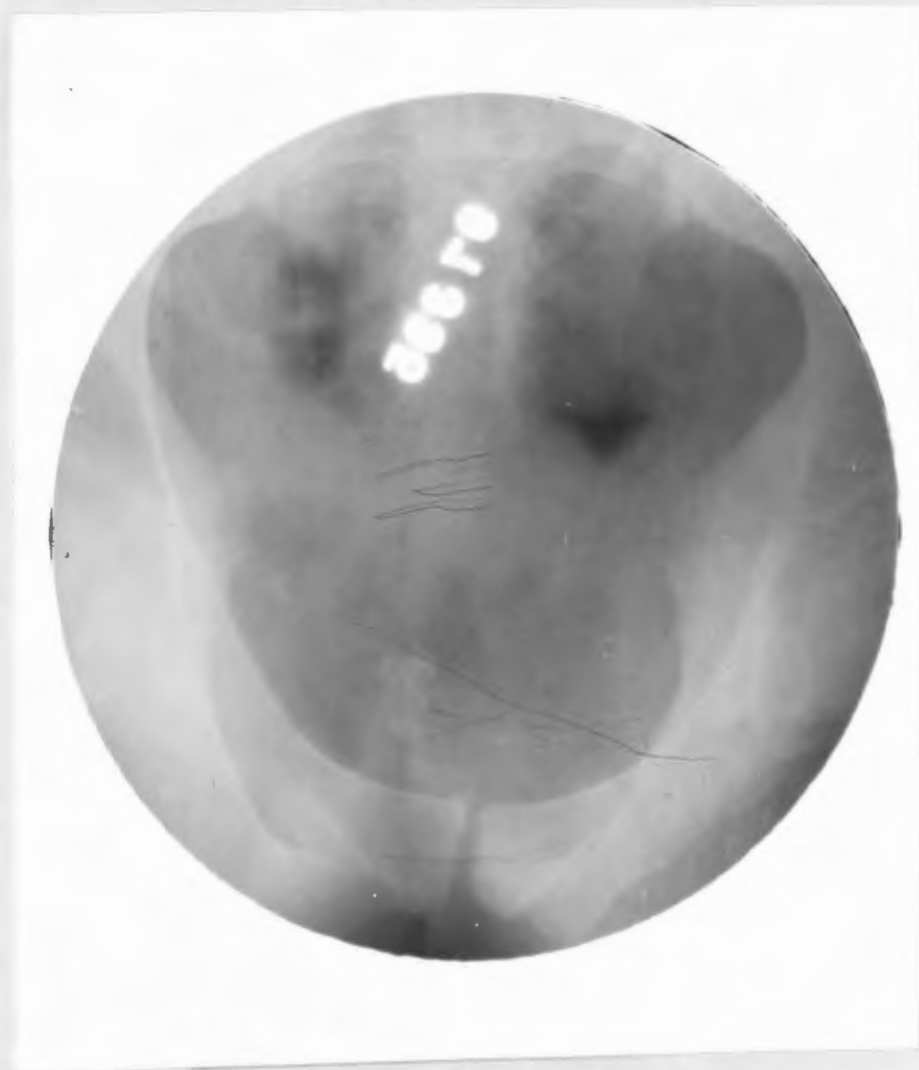


Fig. 9. (97335) Calcareous deposit in prostatic area suggestive of prostatic stone.



Fig. 10. (137136) Pyelogram of case illustrated in Fig. 1, showing irregular elongated outline of pelvis and upper ureter, suggestive of tuberculosis and identifying shadows as tuberculosis.



Fig. 11. (102874) Pyelogram showing necrosis of lower calices with irregular necrotic outline of same.

A Study of the Roentgenographic Findings in Renal Tuberculosis -19.



Fig. 12. (110864) Caseated areas with bilateral tuberculosis, a filigree shadow of Group 4 in the right kidney and a single caseated area of Group 1 in the left kidney.