It is evident from the above table that sufficient time has not elapsed, and that the number of cases is insufficient to justify any conclusions whether this method of irradiating the glands will increase the five-year survival rate, but the immediate results are satisfactory enough to encourage the author to persevere with this method.

APPENDIX CONCRETIONS OPAQUE TO X RAYS.

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(With Special Plate.)

A CONDITION to which very little attention has been directed in standard literature is that of appendicular concretions opaque to *x* rays, and large concretions in the appendix in general. Several points of very real interest to the surgeon are involved, and the case described here is sufficiently graphic to attract attention, first, as to the possible errors in pre-operative diagnosis arising from this cause, secondly, as to the embarrassment which may arise at operation, more particularly in an acute case, if we are not alive to the possibility of the occurrence of a really large appendicular concretion, and lastly, the troublesome sequelae which may be occasioned.

Case Report.

In April, 1929, a man, aged 39, was admitted to the Royal Southern Hospital in a condition typical of acute appendicitis with abscess formation. He stated that up to within a week of admission he had been perfectly well, when he had begun to feel pain in his right iliac fossa, which had, however, not prevented his working until twenty-four hours before his coming in, when it became very severe, and he vomited several times. An appendix abscess was obvious, and this was drained, with the escape of a concretion. The following day there came from the wound a calculus, the nature of which was not immediately recognized, the possibility of renal or biliary origin being entertained. This stone was analysed, and reported to contain calcium and magnesium phosphate, a slight trace of iron, a small amount of fibrin, and no bile pigments or salts. The pathologist remarked that it was of a very hard nature. As the wound failed to clean up in the usual time, lipiodol was injected up the sinus and a stereoscopic radiogram made, which demonstrated a track leading to a large round shadow, rather mottled in character. This was interpreted as a calcified gland acting as a foreign body in an abscess cavity, and exploration was decided upon. After a tedious dissection, a stone was disclosed lying in the lumen of the appendix, which was quite clearly traced in its entire length. The lumen at the centre was distended into a large bulbous swelling surrounding the calculus, which was removed from a cavity completely lined with mucous membrane. The appendix was then removed, its outer coats being densely adherent, but healing was rapid and uneventful.

Description of the Calculus.

In size, shape, and surface the calculus very closely resembled a walnut. It was a deep red-brown colour and extremely hard. On being cut across, the outermost shell only was found to be of this extremely hard consistency. Just within this layer was a second lamina of mineral salts slightly less hard, and the centre of the stone was occupied by a very much softer structureless mass. The hospital laboratory reported that the nucleus was composed of an amorphous debris most probably faecal in origin. The middle layer contained carbonate and phosphate of calcium and magnesium, the carbonate appearing to predominate. The outermost layer of all was composed almost wholly of triple phosphate with some calcium carbonate and earthy phosphate. Other writers have reported a similar composition^{1 2} and formation.³

Origin of these Calculi.

From this description it would seem clear that the stones in this instance were derived from local faecal accretions in the appendix. This method of origin

appears to be the common one, although foreign bodies⁴ have been described forming the nucleus, and the question has been raised⁵ as to the possibility of gall-stones finding their way to this position. Only one case is described in the article quoted, and this contained very many small faceted calculi about 2 mm. in diameter, containing calcium phosphate and organic matter, but no cholesterol, bile salts, or pigments. The writer quotes Howard Kelly⁶ and McAdam Eccles⁷ as subscribing to the belief that the majority of these bodies are faecaloliths formed *in situ* and not gall-stones. In one interesting case⁸ the calculus was formed chiefly of bismuth, which was traced to a bismuth meal taken by the patient for *x*-ray purposes two years previously. This stone measured $4\frac{1}{2}$ by $1\frac{1}{2}$ cm. O. T. Williams²² was struck by the observation that appendix concretions are commonly larger than the normal appendix lumen, and infers from this that they probably grow *in situ* as the result of salts being deposited on their periphery by the mucous membrane, the fact of the excretion of inorganic salts by the intestinal mucosa being recognized. He found support for this suggestion in the disproportionately large amount of calcium present in appendix concretions compared with enteroliths in general. He further found an increased quantity of fats, and suggested that the calcium occurred as a soap. Maver and Wells²³ agree that, as compared with enteroliths, concretions found in the appendix contain an excess of fats and of calcium, and support the suggestion that these are derived from the mucous membrane of the appendix itself, but they do not agree that the bulk of the calcium occurs as a soap.

DISCUSSION.

In the journals of the last twenty years references to this condition are sufficiently plentiful to make it abundantly clear that its interest is far from being purely academic, and is, in fact, of a highly practical nature.

Diagnosis: General Characteristics.—The *x*-ray appearance will, in most cases, be that of an irregularly calcified mass—that is, mottled. In the example quoted, the centre was faecal and the salts were deposited in the periphery, but the shadow was not particularly annular in form, and reference to the cases in the literature confirms the suggestion that this characteristic is not usually present. Although calcified chiefly in their outermost portions, appendicular calculi do not throw a ring shadow. Such a shadow has, however, been described with multiple nuclei. Gottschlich² and Fittig¹⁰ describe lamination. In this case the shadow is roughly circular in outline, and this appears to be the common form. Fusiform shadows are not described as a rule. Multiple shadows may occur; they are neither the rule nor the exception. When present, facets are found between opposed surfaces.¹ The largest number of calculi removed is reported as four, of which the biggest measured 2 by 1.5 by 1 cm.¹¹ Demonstrable movement of the shadow will depend upon the degree of inflammatory fixation, and must surely be limited as a rule. In practically all circumstances the respiratory excursion will be negligible. The size of the shadow is surprising. In the case described it measured 3.25 by 2.25 cm., and other instances have been recorded where the stones measured 2 by $1\frac{1}{2}$ cm.,¹² $4\frac{1}{2}$ by $1\frac{1}{2}$ cm.,⁸ and $2\frac{1}{2}$ by 3 cm.¹³ One observer reports his case as "unique in the annals of surgery." The appendix contained two tapering concretions measuring respectively 1.5 by 6 cm. and 4 by 1 cm.¹⁴ The pre-operative recognition of these stones seems to have been peculiarly rare. Writing in 1915 Pfahler and Stamin¹² state that they were able to trace only one case which had been correctly diagnosed before operation, this one having been discovered by Weisflog in 1906, when two stones were found in the appendix in the course of a radiological examination for ureteric calculi. Case, at Detroit, in 1916, reported two cases correctly diagnosed by *x* rays. In many of the cases reported there was an abscess formed in relation to the appendix, and a concretion lying free in the cavity.^{12 13} J. B. Murphy¹⁵ indicates the danger of all concretions in

the appendix causing sudden perforation without premonitory symptoms and producing an immediate acute peritonitis.

Differential Diagnosis from Urinary Stones.—The general characteristics just outlined should be sufficient to distinguish in most instances between an appendicular calculus on the one hand and a renal or ureteric calculus on the other. A shadow thought to be in the kidney should move on respiration and be shown in quite different positions in two photographs taken at the height of inspiration and of expiration, whilst if doubt should still exist a pyelogram should be sufficient to clear it up. A shadow thought to be a stone in the ureter should again present very little difficulty in the majority of cases. Such stones are almost constantly fusiform in shape, except when of very small size, and again, except when very small, throw a uniform or a uniformly laminated dense shadow. An opaque bougie passed up the ureter will demonstrate the relationship of the shadow to that structure. It is perhaps permissible at this point to urge the use of a stereoscopic x ray if recourse be had to opaque catheterization. The one-dimensional picture is of use if the two shadows lie well apart, but may be misleading if they should be superimposed. Douglas and Lewald¹² in their paper say that in one of their cases the stone, after removal, had an x -ray density equivalent to that of a ureteric calculus, whilst instructive errors of diagnosis are reported among others by Hunner,¹² Seelig,¹⁶ and Eastmond.¹⁷ The last two writers each describe independently a case of ureteric obstruction caused by an adherent appendix containing a concretion resembling a ureteric calculus. In one of these cases an opaque catheter was passed and the error was confirmed by its being arrested at the point of adherence. It is quite rightly emphasized that a single x ray in such a case gives insufficient information. Radiograms must be made either stereoscopically or by lateral photography. Another writer¹⁸ describes a similar instance of careful investigation leading to a faulty conclusion. He draws attention to the frequent mistake of removing the appendix for a pain of renal or ureteric origin, and describes an instance of the reverse error. Two fairly uniform shadows, well illustrated in the article, were observed in the line of the ureter; an opaque bougie was passed, and, whilst the stones were not actually touching it, they were seen to lie at only a short distance from it and to move when the bougie was moved. Opaque fluid was then injected into the ureter, which was found to be dilated, and this larger shadow overlay the stone shadows. The diagnosis of ureteric calculi was considered complete and operation embarked upon, resulting in the discovery of the appendix lying on the posterior parietal peritoneum adherent to the ureter and containing two stones. In commenting on this particular instance of mistake in diagnosis there would appear to be two points which might be criticized. First, the excretory function of the kidney does not seem to have been compared with that of its fellow, and secondly, it seems probable that a stereoscopic x ray following injection of the ureter would have obviated the mistake which, however, it must be conceded, was a very natural one in the circumstances.

Differential Diagnosis from Gall-stones.—This problem does not appear to have arisen very frequently, no doubt because it presupposes an abnormal situation for either the gall-bladder or the appendix. One most instructive case may be quoted.¹⁹ Two large concretions were seen throwing good shadows below and to the right of the tip of the twelfth rib. The case was primarily believed to be one of gall-stones, and was finally operated upon as such, but not before a full urological investigation had been undertaken. An x ray showed an opaque catheter lying with its tip in contact with the shadows, and the urologists were satisfied that these were of kidney origin. It is worthy of note, again, that the photographs were not stereoscopic. However, the bulk of opinion was in favour of gall-stones, and a laparotomy was performed. The appendix was removed, having been found fixed high up behind the colon and containing in its tip the two stones.

The position of stones in the biliary apparatus is far from constant, so that this error is one apt to recur, but at the present day it should be avoidable with the aid of cholecystography. Further, whilst most gall-stones throw no shadow, such shadows as are thrown are most usually annular. None the less it is true that a group formed of a large number of very small opaque gall-stones does throw a mottled shadow, which is not characteristic of gall-stones in general.

Differential Diagnosis from Mesenteric Glands.—Curiously enough, this does not seem to have been very seriously entertained by the majority of writers consulted. In one's own case one thought the most probable explanation of the shadow was that the appendix abscess had led to the exposure of a mass of calcified mesenteric glands, and these were acting as a foreign body preventing the cessation of the discharge. It is possible that had a bismuth meal been given, one might have been able to demonstrate that the stone was lying in the appendix, but it seems more likely that such an attempt would have failed. Considering the question broadly, it would appear that the differential diagnosis must depend upon (a) the characteristics of the shadow, (b) its degree of motility, and (c) its possible relation to a bismuth meal, following preliminary measures, if indicated, to exclude urinary and biliary origin. Ordinarily, of course, the less opaque concretions commonly found in the appendix cause a filling defect in the appendix shadow. Kleeblatt²⁰ suggests air inflation of the colon in doubtful cases, and Hurter²¹ a barium enema.

SUMMARY.

A case is described of a large stone in the appendix opaque to x rays.

The origin and surgical significance of such bodies is discussed.

The diagnosis is discussed and the differential diagnosis from urinary stones, gall-stones, and calcified glands is considered in some detail.

Such cases as could be traced in the literature and which bear on the subject are described.

For his help and permission to publish this account I am much indebted to Mr. John T. Morrison, in whose absence this case came under my care.

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W. ARNOTT DICKSON: PLEURAL EFFUSIONS IN GENERAL PRACTICE.

Empyema cured by absorption in boy aged 6.

Fig. 1.—May, 1929.

Empyema cured by absorption in boy aged 6.

Fig. 2.—After recovery.

C. ALEX WELLS: APPENDIX CONCRETIONS
OPAQUE TO X-RAYS.

X-ray photograph, showing shadow of stone at site of the appendix,
(from behind).

J. F. D. SHREWSBURY: A CASE OF HUMAN
INTESTINAL MYIASIS.

Microphotograph of the head and anterior segments of the larva of
Anisopus (Rhyphus) fenestralis, Scopoli ($\times 40$).