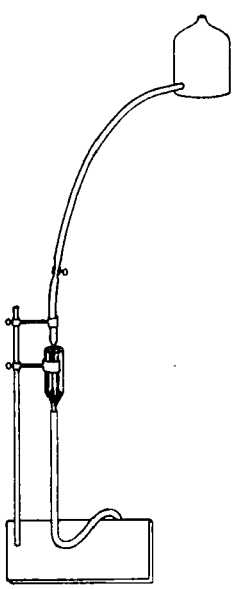
THE SOLUBILITY OF PHOSPHATIC KIDNEY STONES.

BY J. F. GEISINGER, M.D., W. F. RUDD AND E. V. GREEVER.

It is unnecessary to explain that any measure contributing to the non-operative removal of urinary calculi is a desideratum of some moment. So common is the condition and so imperative is its demand for attention that a new method of attack need only demonstrate its safety and efficiency to be immediately adopted with enthusiasm.

Operation alone will remove large calculi in the kidney or renal pelvis. About 50 percent of the small stones, however, are according to some statistics, spontaneously expelled if the patent is not hurried into the hands of an over-zealous surgeon. For the remaining 50 percent the cystoscope has done much. We are now cutting the ureteral orifices, dilating the ureters, changing the axis of ureteral stones by catheter manipulations, and injecting around the stones various substances, including lubricants (glycerin) and ureteral relaxants (papaverin). By this means many stones are being teased out or actually picked out with forceps when low enough in the ureter. There always remains, however, a certain number of small stones which will respond to none of these methods and others which will finally yield only after prolonged cystoscopic coaxing, more or less torturing to the patient. It was in consideration of this class that the writers attempted to evolve some additional method short of operation. No consultation of the literature has been made and the method may or may not have been proposed or used before.

It is, of course, well known that certain urinary concretions appear to depend on the acid-alkaline content of the urine. This fact has led to the oral administration of numerous "solvents" which were intended to alter the reaction of the urine and cause dissolution of the calculus. Dismal failure has met this line of treatment. On the same principle that we now irrigate infected renal pelves with formaldehyde and no longer blindly (and uselessly) give urotropin by mouth and trust to Providence to deposit it in the pelvis in the shape of formaldehyde in sufficient quantity, it occurred to us to make a direct introduction of the solvent. Briefly, it is proposed, in a given case, to introduce through a cystoscope a catheter up to the point of lodgment of a stone in the ureter. Through this catheter the solvent will then be allowed to pass drop by drop on the stone until the mineral contents have been dissolved and the concretion has been reduced to the pulp described hereafter. Two courses are then open: (1) The catheter may be withdrawn and ureteral peristalsis allowed to expel the concretion which can now be easily moulded to any shape. (2) A fish-mouth catheter (now under construction) may be passed up to the concretion and the soft pulp aspirated into the mouth of the catheter by means of a suction apparatus, such as a hypodermic syringe. Details of the technique are clear in the mind of the writer but need not be entered into here.



It is, of course, important to be certain in advance that the acid will do no damage to the kidney. We had planned extensive animal experimentation in

connection with this point and several other points associated with the problem. We had also proposed an attempt to extend the applicability of the method to stones other than phosphatic. Unfortunately, circumstances have interrupted this programme and the prospect of an early transference of Dr. Geisinger to France or some other portion of the war zone, makes it unlikely that the subject can be further studied for many months. Hence, it may be that we are premature in introducing the discussion; our results thus far, however, have been of such a character as to lead us on with great enthusiasm, and perhaps this publication will at least induce others to carry the work out to definite conclusions on one side or the other.

The following tables indicate results of experimental work on the stones *in vitro*,

The solution to be used was placed in the one-gallon bottle and the flow regulated by means of the screw clamp so that from 12 to 27 drops would drop on the stone per minute. This was allowed to run until the stone became soft.

An interesting feature about this was that the stones contained some organic matter which, while saturated with the solution, remained as large as the original stone and of the same color but of such a consistency that they could hardly be handled without breaking, and could easily be moulded into any shape. On drying, this residue would contract to about one-tenth of its original size and become dark brown to black in color.

At frequent intervals (except in Stones C and D, Experiment 1), the stone was taken out and examined to determine whether or not the inorganic constituents had been dissolved.

After the stone had become soft, which showed the inorganic constituents had been removed, the residue was dried and weighed.

TABLE 1.

An analysis of these stones indicated the presence of the following radicals: Calcium, traces of magnesium, phosphate and traces of carbonate.

Stone.	Weight.	Solution used.	No. of drops per minute.	No. Cc. used.	No. Cc. used per mg.	Weight of residue.
A	0.1778	2% aluminium acetate	25	500	2.81	0.1694
B	0.3352	5% ammonium chloride	27	2000	5.98	0.3302
C	0.1316	1% hydrochloric acid	19	2500	19	0.011
D	0.1694	1% hydrochloric acid	20	720	4.25	0.0132
E	0.1818	1% hydrochloric acid	15	80	0.44	0.0118

The large amount of solution used in C and D was due to the fact that we could see no change in size or color of the stone and, therefore, could not tell when all the mineral constituents were dissolved.

Stone E was observed very carefully to determine the minimum amount that was necessary.

TABLE 2.

An analysis of these stones indicated the presence of the following radicals: Calcium, magnesium, phosphate and traces of carbonate.

Stone.	Weight	Solution used.	No. of drops per minute.	No. Cc. used.	No. Cc. used per mg.	Wt. of residue.
A	0.0727	0.26 hydrochloric acid	15	390	5.38	0.006
B	0.1202	0.13 hydrochloric acid	5 to 7 Cc. were allowed to run on the stone and remain for 1 to 2 minutes	860	7.15	0.007
C	0.1414	0.13% hydrochloric acid	18	500	3.56	0.006
D	0.2864	0.13% hydrochloric acid	20	2090	7.37	...

In an attempt to duplicate the natural condition in the body, stone D was placed in the large tube. An equal number of drops of the hydrochloric acid solution and urine obtained from the patient, were then allowed to flow through a tube and drop on the stone. This made approximately a 0.06 percent solution of hydrochloric acid acting on the stone till it was dissolved, which took about 48 hours.

From the experiments which we have reported, we feel justified in making the following statements:

First, that a 0.06 percent solution of hydrochloric acid will dissolve phosphatic stones.

Second, that the length of time the solution is in contact with the stone is a more important factor than the rate of flow.

In a limited way we have already demonstrated that acid eight times the strength of that to be employed clinically has no deleterious effect in the pelvis of a dog's kidney. Furthermore, we have used the acid in 0.5 percent solution in one patient with phosphatic diathesis and not only did no harm but accomplished excellent temporary results. Finally, in the treatment of renal infections, we have in scores of cases irrigated the pelves with silver nitrate varying in strength from 1 : 1000 to 5 percent and with formaldehyde solution varying in strength from 1 : 5000 to 1 : 1000. This is an accepted and highly effective treatment for this condition. Certainly the mild hydrochloric acid solution—less than ($^1/_8$ of 1 percent) will prove no more irritating than these pungent solutions. If it be objected that the process required a continuous hydrochloric acid drip lasting perhaps through several hours, we will reply (with a citation of cases if necessary) that we have conducted a continuous formaldehyde irrigation of the renal pelvis lasting from 3 to 24 hours and the patients have not only survived the treatment but recovered as a result of it.

Summed up in a word, we are satisfied that in expert hands the method will prove harmless, and if time permits we propose to put it to immediate clinical use. Only the results of its application in a series of actual cases will determine unequivocally whether it deserves the consideration it now appears to demand or whether it will eventually find its way to the therapeutic scrap-pile.

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A NEW METHOD OF EXTRACTING DRUGS FOR ALKALOIDAL ASSAYING.*

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In brief, the U. S. P. method for extraction of most drugs for alkaloidal assaying consists of macerating a weighed portion of the drug in an alkaline solution of ether, chloroform, or a mixture of the two for a certain length of time; then pouring off an aliquot part of this extractive.

There are some things in this method of extraction which all chemists will admit are undesirable, if a satisfactory method of improving them can be obtained.

* Read before Scientific Section, A. Ph. A., Indianapolis meeting, 1917.