[From a photograph by Mr. W. Reid, 100, Holburn Street, Aberdeen.]

terior surfaces of the femora, innominate bones, and ribs exposed to view. This was doubtless in a measure caused by the falling of the slates on the body, and a more perfect cinder would have been found had we arrived earlier on the scene. Part of the trousers on the anterior aspect of the legs that had escaped the impact of the slates was still represented in cinder.

Regarding the condition of the internal organs, I regretted much having been denied the opportunity of investigating their condition, as wishing to have a photograph taken of the remains prevented me at the time, and on my return from other work later on I found that the whole had been removed. The bearers told me that the whole body had collapsed when they tried to remove it *en masse*. From the comfortably recumbent attitude of the body it was evident that there had been no death struggle, and that, obfuscated by the whisky within and the smoke without, the man had expired without suffering, the body burning away quietly all the time.

So much for the condition of the corpse. The strange fact remains that while round about in close proximity were dry woodwork and hay, loose and in bundles, these had escaped, and the body of the man was thoroughly incinerated. The exceeding stillness of the night (for it was remarked by the policeman on the beat that there was not a breath of wind) would only in part account for the facts.

To return to Dr. Ogston's paper. That increased combustibility exists cannot be denied, though at first sight it is not so clear to what it owes its existence. The question has given rise, as has been already seen, to numerous hypotheses, all of which, with one exception, are manifestly untenable, and it is owing to the wildness and illogicality of these hypotheses and deductions surrounding the subject that the whole question has come to be treated as a half-forgotten fable. In the doctrine that increased combustibility in bodies is due to excess of fat, Dupuytren has advanced the only explanation capable of setting the subject at rest, and on a true basis explaining rationally and philosophically the cases of so-called "spontaneous combustion."

When we consider the amount of fat some bodies contain, the subject grows even clearer, and a review of the cases demonstrates that the incineration was always most extensive in the skin and subcutaneous adipose tissue, and other places where fat is abun-

dant, and least marked in organs and regions with less fat. The fatty degeneration of various organs and structures, the intermuscular and subcutaneous adipose tissue, along with the masses deposited on other parts of the body, all present a body of oleaginous matter amply sufficient to account for the combustion, and which, once ignited, would tend rather to burn *in situ* than to flow out, thus explaining the greater destruction of the corpse than of objects in the vicinity.

Regarding the influence of alcoholic indulgence in these cases, it has been conclusively proved that tissues soaked in alcohol do not burn more readily than others not so treated, and that it is only as a stupefying agent and in its tending to the deposition of fat in the body that alcohol aids in increasing its combustibility.

THE DETECTION OF PROTEID BODIES IN URINE.

By SIDNEY MARTIN, M.D., M.R.C.P.,

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THE test ordinarily applied for the detection of albumin in the urine is, as is well known, that of boiling and acidulation. This test is taken as indicative of albumin alone; it does not distinguish between albumin and paraglobulin, and, moreover, does not indicate the presence of those proteids which occur more rarely in urine, as for example, the albumoses and peptones. Of late years the methods for distinguishing and separating proteid bodies have greatly improved as our knowledge of their properties has advanced.

The object of the present paper is to discuss these more modern methods of the separation and detection of the proteids in the urine—methods which are not universally applicable in bedside clinical examination, but which are necessary for the elucidation of doubtful cases. The bodies which I shall consider are:

1. Albumin: serum-albumin, egg-albumin. 2. Globulin: paraglobulin (serum, fibrino-plastin). 3. Albumoses (globulin, hemi-albumose, propepton). 4. Peptones.

As was stated above, the heat test does not distinguish between these bodies. This test may be applied in two ways as follows: a small quantity of dilute acetic acid may be added to the urine

in a test tube, and the upper stratum of liquid boiled; or the liquid may be boiled first and rendered strongly acid with nitric acid. The first method is more delicate, provided too much acid is not added so as to convert albumin into acid-albumin; it also prevents the precipitation of phosphates. In the second method, phosphates, if present in excess, are precipitated by heat and redissolved by the acid. The picric acid test has no advantage over the heat test carefully applied.

In ordinary cases these tests are quite sufficient, but when it is a question of the presence of globulin or albumoses or peptones, other tests are necessary.

In the first place, if the proteid is present in only small quantity, it ought to be obtained in a concentrated solution before tests are applied to it; and even if present in large quantities in the urine, it ought to be separated and redissolved if its nature is of a doubtful character.

Precipitation of Proteids in an Unchanged Form from the Urine.—This is readily done for most proteids by saturating the urine with neutral ammonium sulphate $[(NH_4)_2SO_4]$. After powdering the crystals in a mortar the salt must be added to the urine in a flask, and shaken well with the hand until no more is taken up by the liquid. This operation takes only a few minutes. By this means albumin (serum and egg), paraglobulin, and albumoses are completely precipitated, whether the liquid be acid, neutral, or alkaline; while peptones remain in solution.

The precipitate obtained is amorphous, and rises to the surface of the liquid; it is readily removed by filtration. When on the filter it may be redissolved by adding a small quantity of distilled water, or, if it is requisite to obtain the proteid in a state of great purity, it may be washed twice with a saturated solution of ammonium sulphate before adding the distilled water. The proteid or proteids are now in concentrated solution containing ammonium sulphate, the presence of which does not interfere with the ordinary test for proteids. The filtrate, after saturation with ammonium sulphate, may contain peptones, and these are to be tested for in the manner presently to be described. We shall now consider the tests for the individual proteids.

Albumin.—In the great majority of cases the precipitate obtained by boiling urine after acidulation is due to serum-albumin. But in a smaller number of cases it may be due to egg-albumin, paraglobulin, or to hemi-albumose. It is, therefore, not possible by this test to distinguish between serum-, egg-albumin, or paraglobulin, even if the temperature of heat-coagulation be carefully taken, inasmuch as they are all precipitated at about $75^\circ C$. The behaviour of heat to the kind of hemi-albumose which has been found in urine is peculiar, and is suggestive of its presence. If urine be not acidulated, the albumose is precipitated on gently heating, but redissolves on further heating, being reprecipitated on cooling. If the liquid be acidulated with acetic acid, it is not precipitated by heat. Further details of this reaction will be given further on.

Egg-albumin is distinguished from serum-albumin by the addition of ether, which coagulates it. Before this test is applied, however, the proteids ought to be separated by saturation with ammonium sulphate in the manner described. If it is a question of the presence of serum-albumin or paraglobulin, or both together, the tests for paraglobulin must be applied.

Paraglobulin.—This may be found in urine by itself (globulin-uria) or in association with albumin when there is pus or blood present. It is indicated by the following tests:

1. Urine containing it gives a precipitate on acidulating and boiling, which precipitate is not soluble in an excess of acid; that is, it is coagulated proteid.

2. Saturation of the liquid with magnesium sulphate precipitates the paraglobulin. Before doing this test the urine must be perfectly clear. If there is a deposit of mucus, urates, or phosphates, the clear superstratum of liquid must be poured off, and if the urine is turbid it must be filtered till clear. Two or three drops of dilute acetic acid are then added to the urine in a test tube, and magnesium sulphate added to the liquid, which is to be well shaken with the thumb placed over the mouth of the tube. The amount of salt that it is necessary to add is about equal to half the bulk of the liquid. Complete saturation at the ordinary temperature does not occur unless the liquid be shaken three or four hours, but for ordinary purposes simple hand-shaking for a few minutes is sufficient to cause the precipitation of most of the globulin. The precipitate is readily removed by filtration, and after dissolving it by adding distilled water the ordinary tests for proteids can be applied to the solution. This test distinguishes

paraglobulin from serum-albumin, which is not precipitated by magnesium sulphate; but it does not distinguish it from hemi-albumose or any of the albumoses presently to be described. There is only one albumose which is precipitated by heating; this is called hetero-albumose, and this is the albumose found by Kühne and others in the urine. As has been stated, this body is precipitated at a low temperature, and is dissolved on further heating. Moreover, the precipitate by heat is readily dissolved by adding a drop of dilute acetic acid—an important point of distinction from paraglobulin, which when precipitated by heating is rendered insoluble in acid.

If this heat test is doubtful the clear urine must be saturated with magnesium sulphate, and the precipitate with the liquid poured off from the sediment of salt into a clean dry test tube. This precipitate and liquid must now be boiled and several drops of acetic or nitric acid afterwards added. If the precipitate dissolves it is albumose; if it does not dissolve it is paraglobulin. These tests may be confirmed by the following: To a small quantity of the original urine, or, better still, to the magnesium sulphate precipitate dissolved in water, a drop of one per cent. solution of copper sulphate is added, and then an excess of liquor potassae; the albumose gives a pink colour (biuret reaction), while the paraglobulin gives a violet colour (ordinary proteid reaction). These reactions taken together distinguish paraglobulin from serum- and egg-albumen and albumose. Sodium chloride also precipitates paraglobulin and most of the albumoses, and it has been stated that saturation of the liquid with ammonium sulphate precipitates globulin, leaving albumin in solution. But besides the doubtful character of this reaction, some albumoses, if present, would be precipitated with the globulin. It is only necessary to perform these distinctive tests between paraglobulin and albumoses when there is an indication of the latter being present. To the detection of these we shall now pass.

Albumoses.—These are bodies which are formed during peptic digestion, and are considered as intermediate between globulin and albumin on the one hand and peptone on the other. To those derived from albumin the term "albumose" has been applied, and to those from globulin the term "globulose." These two classes, however, bear so close a resemblance to each other in their reactions and properties that, in the present state of our knowledge, it is more practical to use the term "albumose" for both. The reactions to be described apply to both albumoses and globuloses.

Albumoses are of three kinds, and they may be considered as a row of bodies linked at one end by their properties to globulins or albumins (undigested proteids), and at the other end to peptones (digested proteids). They are named hetero-, proto-, and deuto-albumose. They differ in the following manner. Hetero-albumose is soluble only in saline solutions (1 to 15 per cent. sodium chloride), and not in distilled water. It is precipitated from solution by heat, and by saturation with sodium chloride or magnesium sulphate, but only partially; it is thrown down also by dialysis.

Proto- and deuto-albumose are soluble in distilled water, are not affected by heat, and are not thrown down by dialysis. Proto-albumose is, like hetero-albumose, partially precipitated by saturation with sodium chloride, but deuto-albumose only if 20 per cent. of acetic acid be added. All the albumoses are precipitated by saturation with neutral ammonium sulphate in the manner which has been previously described, and they all give a characteristic reaction with strong nitric acid. Nitric acid added to a solution of hetero- or proto-albumose causes a precipitate, which dissolves on heating, is reprecipitated on cooling, redissolves on again heating, and so on. Deuto-albumose only gives this reaction when a few crystals of sodium chloride are added to its solution in a test-tube. All the albumoses are precipitated by adding acetic acid and the ferrocyanide of potassium to their solution. The precipitation by ammonium sulphate, and by acetic acid and ferrocyanide of potassium, and the peculiar behaviour of the nitric acid precipitate, serve to distinguish albumoses from all other proteids. Like peptones, they all give a pink colour with copper sulphate and potash.

All these albumoses have not been described as occurring in urine, very probably because their distinctive tests have not been applied.

The albumose first described by Bence-Jones, and later by Kühne and others, as occurring in the urine, was probably hetero-albumose. The specimen of urine examined by Kühne ("Hemi-albumose im Harn," *Zeits. für Biologie*, Bd. xix) gave a proteid precipitate between 43° and $50^\circ C$. (109.4° and $120^\circ F.$), the pre-

precipitate dissolving on further heating. If a small quantity of acetic acid were added to the urine, no precipitate was obtained by heating. Sodium chloride to saturation gave a precipitate, and the precipitate with nitric acid behaved in the manner peculiar to albumoses. The sediment in the urine partly consisted of albumose. These reactions are similar to those given by hetero-albumose in urine, as I have ascertained by applying them after dissolving some of the proteid in normal urine. Further researches will show whether the other albumoses occur as abnormal urinary constituents. At present it will be sufficient to state that an albumose is indicated in urine by the following reactions.

1. The precipitate by heat comes down at a lower temperature than that of paraglobulin and albumin. The temperature of coagulation may be accurately taken by means of a very simple apparatus. A portion of clear urine is placed in a test tube, in which an accurate thermometer is also put, and the test tube allowed to rest in the neck of a small flask containing distilled water. The water must be above the line of the urine. The flask is then gradually heated, while the urine in the tube is stirred by means of the thermometer. The temperature at which the urine becomes cloudy is the lower limit of coagulation; the liquid is then heated further until a precipitate occurs; this is the higher limit of coagulation. For paraglobulin and albumin the lower limit is about 73° C. and the higher 75° C.; for hetero-albumose the lower limit is 43° and the higher 50° C. If hetero-albumose be suspected, the urine must not be acidified previous to heating; but in the case of paraglobulin or serum-albumin, one or two drops of dilute acetic acid must be added.

It is important to emphasise the fact that a specimen of urine containing hetero-albumose (without paraglobulin or serum albumin) will give a precipitate with heat only when no acetic or other free acid is added.

2. Nitric acid added drop by drop to the urine causes a precipitate if albumoses are present, which behave in the characteristic manner already described. This reaction is distinctive of albumoses. It is not given, it must be remembered, by deuto-albumose, unless solid sodium chloride be added to the urine.

Peptones are closely allied to albumoses, especially to deuto-albumose. A urine containing them alone would give no precipitate on boiling, and none with nitric acid, even if sodium chloride be added. Such a urine would, however, give a pink colour with copper sulphate and potash. This test (biuret reaction) would indicate the presence of peptones if the heat and nitric acid tests proved negative. A small quantity of proto- and deuto-albumose would, however give the biuret reaction, and be in such small quantity as to give a doubtful reaction with nitric acid. The biuret reaction cannot then be taken as absolutely demonstrating the presence of peptones, even when applied after the heat and nitric acid tests. It is best to apply the following: saturate the urine with neutral ammonium sulphate in the manner described above, and filter off the precipitate, if any, which occurs. The precipitate will consist of globulin, albumin, or albumose, if they be present, and the filtrate will contain the peptones, for these are not precipitated by saturation with ammonium sulphate. To the filtrate then add a drop of 10 per cent. copper sulphate solution and a large excess of potash; if a pink colour is produced peptones are present. Or add two or three drops of nitric acid, boil and add liquor ammoniæ after cooling; if the liquid turns brown peptones are present. This method of saturation with ammonium sulphate is the only certain one of testing for peptones in urine.

A method which has been commonly applied is to filter the urine after concentration into a large excess of alcohol; the peptones are thrown down, and may be collected on a filter and dissolved in water. If such a solution gives no precipitate on heating, or with nitric acid, or with acetic acid and ferrocyanide of potassium, or on saturation with ammonium sulphate, and yet gives a brownish colour on heating with nitric acid and adding ammonia, and a pink colour with copper sulphate and potash, the urine contains no proteid but peptones, and the case is one of simple peptonuria. But in every case it is best to saturate the urine first with ammonium sulphate, as by this means all proteids are readily separated from peptones.

PROFESSOR CACCIOPIOLI recently performed extirpation of the larynx and six rings of the trachea for sarcoma on a woman, aged 50, in the Hospital for Incurables at Naples. This is the thirteenth case of laryngectomy in Italy.

ON THE TREATMENT OF STERILITY IN WOMEN.¹

By THOMAS MORE MADDEN, M.D., F.R.C.S. Ed.,

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THERE are few gynecological questions of greater practical interest, and none which have been more frequently brought under my notice in the course of a somewhat extensive clinical experience in hospital and consultation practice, than those connected with the subject of sterility in women. I therefore now venture to submit the following observations on this topic, not merely for the purpose of expressing my own views, which I believe to be well-founded, but also in the hope of eliciting the opinions of other practitioners on a matter of much importance, and one involving not only the physical health of our patients, but, moreover, in many instances also intimately affecting their social interests and the happiness of conjugal life.

Etiology of Barrenness.—As in every other morbid condition, so with regard to sterility, our first aim must be to ascertain its cause in each instance. Of the various factors in the causation of infecundity, some—such as the absence or arrested development of any of the organs essential for conception, namely, the uterus, Fallopian tubes, or ovaries—being beyond remedy need not here occupy consideration. In the great majority of instances, however, sterility, when occurring in women within the period of ovarian functional activity, admits of effectual treatment, provided that treatment be rationally directed to the special exigencies of each case.

For convenience of description, in the following observations I have followed the example of the majority of writers on female sterility, by whom, under this term, is also included the subject of impotency or sexual incapacity. Strictly speaking, however, the latter term should be restricted to those cases in which marital intercourse is prevented by some physical impediment, such as vaginal or vulvar occlusion, imperforate hymen, vaginismus, etc., whilst sterility, or reproductive inability, is commonly the result of some structural lesion, malformation, displacement, or deficiency of either the uterus or its appendages, although it may also be due to certain morbid constitutional conditions, as well as be occasioned by other causes, such as sexual incongruity or irresponsibility of a moral rather than of a physical kind.

Stenosis of the Cervical Canal.—This is not only the most common of all the causes of sterility just alluded to, but is, moreover, according to my experience, the one which proves most amenable to appropriate treatment. Until a comparatively modern period, however, atresia of the cervical canal was generally regarded as irremediable, and this opinion continued to prevail very generally for years after the period when Dr. Mackintosh, of Edinburgh, by his revival of the ancient but long-disused method of dilating the cervical canal when occluded, proved the curability of that condition. Practically, the modern treatment of cervical stenosis was initiated a quarter of a century later, when Simpson brought the subject prominently before the profession, and proved the feasibility of treating stenosis by incision with the metrotome, as well as by dilatation with sponge and laminaria tents. This, however, is not the place to trace the progressive history of the improved procedures by which the crude operations resorted to half a century ago in the treatment of obstructive dysmenorrhœa and sterility have been now replaced. My present object is a more practical one. Believing as I do that, though both dilatation and incision of the cervix may be successfully employed in many cases, I also know that both these plans very often fail in permanently overcoming the natural contractility of the cervical structures, and that after each operation the canal too commonly rapidly resumes its former condition, and frequently from cicatricial contraction becomes still less permeable than before the operation. Hence I now desire to direct attention to the advantage I have observed in the treatment of such cases from a method of procedure and the use of instruments by which the parts are so forcibly separated and torn

¹ Read in the Section of Obstetric Medicine at the Annual Meeting of the British Medical Association, held in Dublin, August, 1887.