

S A C S

I hereby state, that after graduating as an M.B. and C.M. from Edinburgh University in 1858, I proceeded to Vienna, Austria, where I was in constant attendance on the hospitals for a period of six months. After five months of travel in Europe I returned to the United States, locating in Washington, D.C. I was engaged in private practice for six months, when I received the appointment of Assistant Surgeon in Charge of Columbia Hospital for Women and Lying-in Asylum; the Surgeon in Charge going, a' once to Europe after my appointment, I acted as Surgeon in Charge - After this the Hospital was placed under the charge of a Staff of Four Surgeons, and for one year and eleven months I held the position of Resident Physician. Since resigning from the Hospital I have been in private practice for over five months, and have lately received the appointment as Obstetrician to the Hospital. I further state that this Thesis is entirely of my own work and in my own handwriting.

James Foster Scott.

Hydrothionuria, or the Phenomenon of
Sulphuretted Hydrogen Gas in Urine -
Four Cases - A review of the literature -

By

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Sworn & subscribed to before me
this 20th day of April A.D.
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[Signature]
Notary Public



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Within the past three years it has been my good fortune to meet with and demonstrate, chemically, the presence of Sulphuretted Hydrogen Gas in solution in the urine, in no less than four cases. The subject is one which has been almost entirely overlooked, alike by the practitioner and the writer of text books, though undoubtedly the condition of Hydrothionuria occurs, from time to time, in the practice of many others. Since my first case, over two and a half years ago, I have been constantly on the watch for others, with the result of having met with it three times since. In three of my cases, and in most of those recorded by others, the condition was associated with grave conditions, and I believe that such will usually be the case. - When such an untoward

symptom does occur, it behooves the physician to assume "an attitude of watchful expectancy" at least, even though he may be puzzled in his diagnosis and method of treatment. I will first give my own four cases, with the results of the chemical tests. This will be followed by a complete review of the literature bearing on the subject and, finally, the clinical significance of the condition.

Case I.

M. J., a negress, aet. 14 years and ten months; single; primipara - Height, 5 ft; weight, 110 lbs; Admitted to Columbia Hospital Aug. 22nd 1890. - The patient was brought to the Hospital, at midday, in a comatose condition, suffering with a well marked case of Puerperal Eclampsia - Her friends stated that she had had twelve convulsions since 2 a.m. of that morning - Examination on admission showed labour just beginning, the os uteri admitting the tips of two fingers - The position was Occipito - Laeva - Anterior -

The temperature on admission was 101.6°F ;
pulse, 112 per minute; respirations, 26 per
minute. There was extreme anasarca.

The convulsions continuing with awful
severity, and not yielding to chloroform
anaesthesia or morphia hypodermically,
I performed podalic version and delivered
her of a full-time dead child weighing
6 lbs. Soon thereafter the eclamptic
attacks ceased. The urine, which was
drawn by catheter three and a half hours
after delivery, was intensely acid and became
entirely solidified by both the heat and
nitric acid tests.

On the evening of the following day, the
nurses came to me complaining of an
overpowering odour from the patient, which
I at once recognized as that of Sulphuretted
Hydrogen. This odour was so strong that
it nauseated the nurses, and I myself
suffered with intense headaches on several
occasions while making the analyses on
the following days.

It was fortunate that my first case was
so exceedingly well marked as to force
itself upon my attention at once through

the sense of smell. This led me to perform a series of careful chemical tests, all of which proved satisfactorily the presence of Sulphuretted Hydrogen.

The following were the results of my tests, the reagents conforming to the U.S.P.

Test Solutions.

Urine drawn by catheter Aug. 23rd '90 (day following delivery):-

Amount = 12 oz.

Sp. gr. = 1015.

Reaction = acid.

Albumen = present in enormous amount.

Odour = penetrating odour of H_2S .

Microscopical Examination; Heavy deposit of ammonio-magnesian-phosphate; broken down blood corpuscles; vesical epithelium, and an enormous number of active vibriones in the freshly drawn urine.

Tests for Sulphuretted Hydrogen.

I. 2 in. of urine in test tube + $AgNO_3$ solution, (white ppt. of albumen) + HNO_3 = dark grey precipitate at once, becoming rapidly darker and eventually exhibiting a distinct dark zone of silver sulphide, Ag_2S .

II. Urine + excess of lead acetate solution = copious

light grey precipitate. The excess of the reagent precipitates all the albumen in the urine and thus, by admixture of the white albumen with the black sulphide of lead, (PbS), gives a grey colour.

III. 2 in. urine + one drop of lead acetate solution = inky black precipitate of lead sulphide, (PbS), with a dark brown supernatant liquid, no white or greyish precipitate at all being caused -

With this one drop of lead acetate solution there was only an insignificant trace of albumen thrown down, yet it contained enough lead to unite with all the sulphur of the H_2S and convert it into the black sulphide of lead.

This last test, with one drop of lead acetate solution, is one of the most delicate of all.

IV. Filter paper moistened with solution of lead acetate and placed over the mouth of the jar containing the urine gave, in the course of an hour or so, a dull black colour of a leaden lustre -

This is the test I always try primarily as it is exceedingly delicate and easy to carry out.

V. Another characteristic test is made by using a solution of antimony, (tartar emetic), to form the orange-red precipitate of Sulphide of Antimony. 2 in. of urine + solution of Antimony in excess of HCl = white precipitate of albumen in which, after a few hours, a beautiful orange-red zone of Sulphide of Antimony unmistakably differentiates itself.

This is a very beautiful test if the H_2S is present in large amount, but it is apt to be fallacious as it requires a few hours in which to develop, during which time the urine may be undergoing decomposition in the test jar.

X VI. Hellers test: - Urine + solution of Iron Chloride = black precipitate of $FeSO_4$. If very little H_2S be present it only causes a brown discolouration.

In this, my first case, I would draw particular attention to the enormous number of active vibrios in the freshly drawn urine. This point will be considered more fully later on when I take up the clinical significance of the condition.

After the appearance of the H_2S the bladder

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was repeatedly washed out with a solution of Potassium Permanganate. The presence of H_2S ceased soon thereafter.

In this case there is no doubt in my mind that the bacteria liberated the sulphur contained in the albumen which was present in such enormous amount.

Case II.

J. A., female, aet. 21 years; single -

Admitted to Columbia Hospital Oct. 9th 1891, with febrile symptoms and a temperature rising every evening to $104^{\circ} - 105^{\circ} F.$

Laparotomy was done on Oct. 14th 1891.

A left-sided pyosalpinx was found, containing a foetid, blood-stained pus. The ovary and tube of the right side were normal and not removed.

Before and after the operation the patient was in an exceedingly low condition, with a temperature which ranged for many days after the operation between $104^{\circ} - 106^{\circ} F.$

She lived however for a year afterwards, eventually dying in another hospital of Phthisis Pulmonalis.

Her urine was tested repeatedly but no

Trace of albumen was ever found either before or after the operation.

On the fifth day after the operation the examination of the urine resulted as follows:-

- Sp. gr. = 1017
- Reaction = faintly acid.
- Albumen = none.
- Odour = H_2S .

Microscopically there were no organized deposits nor bacteria.

Now this case is exceedingly interesting - H_2S appears in the urine without a trace of albumen. Probably the hypothesis that H_2S was liberated by the action of bacteria in albuminous urine rests upon a solid foundation in my first case, but that there may be other causes for the presence of this gas in urine is rendered evident by this, my second case, in which there was no trace of albumen in the urine at any time for several weeks previous to or after the presence of H_2S , nor were there any bacteria in the freshly voided urine seen.

In this case the abdominal wound did not heal for several months, pieces of ligature

silk from the pedicle being discharged on several occasions. There was always an offensive, faeculent odour to the pus, but no H₂S appeared in the urine after there was an opening established for the discharge of pus.

In this case the appearance of H₂S in the urine may be accounted for in two ways;

A. By a resorption of the H₂S from the pus-containing cavity into the blood, and its subsequent elimination through the kidneys.

B. By an exsmosis of the gas, developed in the pelvic abscess, directly through the living animal membrane, — the bladder wall —

Case III.

M. J., the same patient who furnished me with my first case, returns in labour twenty months later with another attack of Puerperal Eclampsia! In passing, I may say that this case was one of those rare examples where Puerperal Eclampsia occurs for a second time without the patient carrying twins.

This time labour was artificially induced and forceps applied. She was again delivered of a still-born child.

Examination of her urine showed it to contain albumen in enormous amount, and on the sixth day H_2S was present in large volume, all of the tests giving satisfactory reactions.

The urine during the first few days was scanty and very highly albuminous, but after a free flow was established the H_2S disappeared spontaneously. Utriones were present on this occasion also.

Case IV.

E. P., a negress, aet. 22 years. IV fara. She was admitted to Columbia Hospital, May 25th 1892, far advanced in labour, and delivered normally of a $6\frac{3}{4}$ lb. child in L. O. A. position.

Examination of her urine revealed albumen present in large amount.

On the second day I detected the odour of H_2S in the urine, which was also demonstrated by the previous chemical tests.

Examination of urine on day following delivery:-

Sp. gr. = 1029

Reaction = strongly acid.

Colour = fawn red.

Albumen = present in large amount.

Odour = H_2S .

Microscopical Examination = red blood discs; a few leucocytes; detached vesical epithelium; no vibriones.

Sulphuretted Hydrogen was Chemically demonstrated.

The bladder was washed out with a weak solution of Potassium Permanganate, but I doubt if the rapid convalescence in this case was dependent on the treatment.

The patient had an excellent puerperium, the highest temperature being recorded on the second day and only registering $101.8^{\circ}F$.

This case is of interest, in contra-distinction to the others, on account of the mildness of the symptoms and the complete and rapid recovery.

Review of the Literature.

After looking over the references in the Index Medicus of the Army Medical Library with the greatest care, I have only been able to find these comparatively few cases which I here present.

The presence of Sulphuretted Hydrogen Gas in urine was recognized as far back as 1829 by Chevallier, (*Journal de chim. Méd.* 1829-I - p. 179) - He mentions a case which occurred in a syphilitic woman undergoing mercurial treatment, and regards it as a phenomenon of fermentation.

Höfle, (*Med. Annalen* - Bd. XI - 1845 - p. 415), found H_2S in the urine in a case which occurred during a small-pox epidemic in 1843-44.

Friedrich Betz was one of the first to devote much attention to the cause of Hydrothionuria. Betz, (*Memorabilien*, XIX - 1869 - p. I, Ueber den Nachweis und die klinische Bedeutung des Schwefelwasserstoffhaltigen Urins-) mentions a case in a man 38 years old, of a strong constitution, who, after a night spent in

heartily eating and wine drinking,
 suffered with symptoms of acute
 gastro-intestinal catarrh - H_2S was present
 in his eructations and urine - After free
 evacuation of the bowels the H_2S disappeared.
 Betz also records another instance,
 (Ueber die Quellen und diagnostisch-therapeutische
 Bedeutung des H_2S im Urin - Memorabilien,
 1874 - XIX - pp. 66-69);. This was the case of a
 man, aged 79 years, who had H_2S in the
 urine for a protracted time -

The Post-Mortem Examination showed hyper-
 trophy of the Prostate, which interfered with
 the emptying of the bladder and caused
 diverticula of the bladder walls in several
 directions. One of these diverticula,
 which was exceedingly thin, pressed closely
 against the rectum which, bulging out like
 an ampulla, was filled with stagnant-faeces.
 In this case the conditions were peculiarly
 favourable on account of the exceedingly
 thin diverticulum which pressed upon
 the rectum, while the bladder, in its
 normal anatomical relations, only presents
 a small area to the abdominal cavity.
 The fresh urine in this case had a

penetrating, faeculent odour of H_2S ;
weakly acid reaction; sp. gr. of 1003-5;
and contained no albumen.

Microscopical examination showed pus
corpuscles, epithelial cells and vibriones.

The catheter, which was made of silver, was
discoloured black by the H_2S .

Betz found that the faeces in this case
contained more than the usual amount
of H_2S , and that the quantity of H_2S in
the urine and bowel took a parallel course.

It is important to note that the ureters
were as thick as a finger and that there
was suppurative atrophy of the kidneys.

Betz enunciates three theories of causation
as follows:-

I. The H_2S develops in the bladder from a
decomposition of albuminoid bodies, as pus,
blood, etc., - a rare cause.

II. H_2S appears in consequence of the resorption
from the intestine into the blood and its
subsequent elimination through the kidneys.

III. The H_2S appears in the urine on account
of the exosmosis of the gas from the intestine
into the bladder.

H. Emminghaus has fully written up two cases, (Zwei Fälle von mehrfacher Perforation des Verdauungs-canal's, und Schwefelwasserstoff-gehalt im Urin; Berl. klin. Wochenschr. 1872, H. 47⁽²⁹⁾) His first case occurred in a woman, aged 20 years, who was admitted to the hospital at the latter part of February 1871, suffering with symptoms of gastric ulcer - She died in collapse and with slight convulsions after being in the hospital about a week. In Post Mortem there was found a perforation of the stomach between the pyloric and cardiac orifices near the small curvature, the small intestine was perforated twice and the sigmoid flexure once -

Four days after the symptoms of perforation H_2S appeared in the urine -

His second case was that of a man, aet. 20 years, admitted to the hospital March 19th 1871 - He was so ill that no history could be taken.

In Post Mortem examination there were found abscesses in the small intestine, caecum, vermiform appendix and sigmoid flexure.

In both these cases of Emminghaus, and in case II of Bely, it would seem that the H_2S appeared in the urine by exosmosis through the bladder wall and its absorption

into the urine.

Johannes Rankke, (Lehrbuch der Physiologie, 3-Aufl. S. 530), made an experiment of very great importance in the study of this phenomenon. He found that if a few drops of the urine, which contained the H_2S , were added to other normal urine, H_2S would develop in the latter, and again a third specimen of normal urine could be inoculated from the second.

Rankke says, (translation), "there is no doubt that in the formation of H_2S in urine we are dealing with the phenomenon of fermentation, which I call H_2S fermentation. The development of H_2S in urine can only take place in acid and neutral urine and not in alkaline."

His experiment would go to prove that the property of developing H_2S was contained in the organic ferments of the urine which contained the H_2S by reason of certain fungous substances peculiar to it.

Muller, (Ueber Schwefelwasserstoff in Harn, Berl. klin. Wochenschr., 1887 - XXIV - 405 - 8 - 436), verifies the above experiment in every particular, and says that the addition of the very smallest quantity will suffice to cause

the inoculated urine to become turbid - Müller says that not every urine can be so inoculated, especially those urines which are highly concentrated, as in infectious diseases, peritonitis, and ileus, which contain a large quantity of phenol and indigo-forming substances which are toxic to the microorganisms.

Rosenheim and Gutzmann, (*Zur Klinischen Würdigung und Genese der Schwefelwasserstoff Ausscheidung im Urin - Deutsche med. Wochenschr., Leipzig, 1888. XIV, 181-184.*), present three cases -

Their first case was that of a man, aged 55 years, who had a retro-strictural abscess which communicated through a fistulous opening directly with the bladder. The patient died after a very short course of the disease without affording much opportunity for study. The Post Mortem showed a direct communication of the bladder with an abscess cavity which precluded the theory of gas diffusion in this case.

Their second case was a most interesting

one in a woman who entered the hospital suffering with pains in the left side under the arch of the ribs, and an irritable bladder, which led them to diagnose the case as vesical catarrh. On the fourth day after admission to the hospital the urine attracted attention by its penetrating odour of H_2S .

From this case they succeeded in isolating little rods by culture which, transplanted in other urine after the method of Ranke, produced H_2S in the second specimen of urine. The H_2S disappeared spontaneously after eight days, although the bladder catarrh continued. The patient left the hospital, but soon thereafter returned with the same complaint, yet no H_2S could ever be discovered, while under the microscope, there were a number of bacteria identical with those seen before. They do not mention whether the urine was albuminous or not.

Their third case occurred in a woman, act. 17 years, who came into the hospital suffering with parametritis, inflammation of the vaginal mucous membrane and pain on pressure in both inguinal regions. Both tubes and ovaries were thickened

and surrounded by exudates - There was erosion of the Fortio vaginalis uteri - This to me seems most likely to have been a case which was septic and probably gonorrhoeal in origin - In the light of the ^{present} pathology of peri-uterine inflammations they were probably wrong in calling it a case of parametritis - The vast majority of cases, such as the one here described, are cases of pyosalpinx with a plastic exudation round the ostia abdominalia binding together the fimbrial and ovaries - Very probably in the centre of this "mass" or "exudate" there was a degenerating fus-sac which formed the H_2S - Soon after the relief of the vaginitis she developed a cystitis and had to be catheterized. The urine was acid, free of albumen, without any leucocytes, turbid from masses of bacteria in it, and smelled of H_2S . Soon the urine became clear, the bacteria diminishing but the odour of H_2S continuing - Soon thereafter the H_2S reaction disappeared - After eight days the bacteria again appeared in enormous numbers in the urine and the H_2S reaction again became distinct. Gradually the bacteria disappeared

and the H_2S reaction as well.

Here there is a distinct parallel between the presence of H_2S and the quantity of bacteria in the urine. They suggest that the bacilluria might have been caused by masses of bacteria which passed through the bladder walls from the neighbouring inflammatory area.

From this urine they succeeded in isolating a very markedly characteristic species of bacillus which they considered as the cause of the Hydrothionuria.

They convinced themselves by experimentation that this species of bacteria had the power to act reducingly upon the sulphur-containing substances in the urine and, in this above mentioned case, they consider it to have been the sole cause.

Müller, (loc. cit.), making experiments at the same time and independently, showed that other microorganisms were capable of developing H_2S in the same manner. We will refer to these experiments more fully later on.

Rosenheim and Gutzmann further made experiments to show from what substances

present in the urine H_2S was developed.

They placed their bacteria in nutrient liquids, to which they added traces of albumen, but were never able to observe the formation of H_2S , while, on the other hand, the same microorganisms placed in other urine free of albumen developed the H_2S reaction - The question then arose to them, "which of the sulphur-containing substances was the source of the H_2S ?"

According to Neubauer and Vogel, (Anltg. zur Analyse des Harns, II - Auflage - 1856), whom they cite, the source of the H_2S would be in the sulphates which form H_2S in the presence of moist organic substances at a moderate temperature - They quote Pfeffer as saying that, with the presence of sulphates, certain fungi reduce these sulphates to H_2S - They support this by the following experiment:- Normal fresh urine was freed from sulphates and then inoculated from urine which contained H_2S - Not a trace of H_2S was developed in it. Müller, (loc. cit.), however, did succeed in developing H_2S in urine freed from sulphates by transplantation of bacteria.

Rosenheim and Gutzmann believe that the H_2S -producing sulphur belongs to a class of sulphurs normally existing in urine, and they say that very possibly it may be hypo-sulphurous acid, which is particularly apt to develop H_2S with facility.

Friedrich Müller, (Ueber Schwefelwasserstoff im Harn. Berliner Klin. Wochenschr., 1887-XXIV-405-8, and 436), mentions a case of a servant girl, aet. 29 years, suffering with Phthisis Pulmonalis. The urine sediment contained numerous leucocytes, bladder epithelium and crystals of triple phosphate. The urine gave a strong H_2S reaction, and this was more pronounced when it stood in the bladder than when drawn by catheter. On Post-Mortem there was found a very small recto-vaginal fistula which had been there since the birth of her child, ^{more than} five years previously. Faeces passed through this and probably infected the bladder by passing up the urethra, thus causing a cystitis. Müller found no H_2S in the urine of patients who had H_2S in the sputa or vomited matters, nor in patients who took

sulphur baths and inhaled large quantities of H_2S , nor did he find it in cases of gastric ulcer and typhoid fever with perforation. He has never found it where there has been a pus-sac adjacent to the bladder, not even if that pus-sac contained H_2S in large amount. In his experiments on animals he found that only by injecting lethal quantities of H_2S , or of sodium sulphate in solution into the abdominal cavity, could he cause H_2S to appear in the urine. He does not believe that diffusion through the bladder walls often occurs, but that in every case in which the urine contains H_2S it has undergone decomposition, yet not every decomposed urine contains H_2S .

He further says that Hydrothionuria is a very common phenomenon in all possible forms of cystitis, not only in the slight degree so often found in females as a sequela of leucorrhoea, but also in the more serious diphtheritic diseases of the mucous membrane of the bladder. He says, some specimens of normal urine left exposed to the air,

especially at a warm temperature, will develop H_2S , and from these specimens which do develop H_2S other urines can be inoculated.

He found, out of many kinds of microorganisms which develop in urine, two kinds which especially develop H_2S .

One kind was an oval-shaped coccus, 8μ . in diameter, which often forms diplococcus and liquefies gelatin quickly.

The other organism was larger, round, did not liquefy gelatin, and formed H_2S very slowly.

He believes that other microorganisms can form H_2S , but he only wants to prove that they do form it and not what kinds form it.

Albumen is not the cause, because urine free of albumen and peptones can be inoculated and develop H_2S .

Müller concludes that Hydrothiouria is in most cases a result of decomposition in urine caused by certain microorganisms.

The appearance of H_2S which has been absorbed from other parts of the body, e.g. intestines, kidneys, or from neighbouring pus or gas collections is only very rare, he thinks, and ^{occurs} only then if the quantity of H_2S

be so great that general toxic phenomena resulted - This latter theory, he says, could only be accepted if the urine were examined immediately and no trace of decomposition found -

Sertoli, (Sull' esistenza di uno speciale corpo solforato nell' urina - Gazzett. med. ital. lomb. 1869 - Ser. VI - II. p. 197), found that with the addition of any mineral acid and heating to 100°C . any urine would give off H_2S .

Senator, (Berl. klin. Wochenschr. 1868 - p. 254), mentions a case of Hydrothionuria where an error in diet caused a catarrh of the stomach and a general intoxication of the whole system by H_2S poisoning, with the evolution of large quantities of H_2S from the mouth, and it also appeared in the urine in such great quantities that it coloured a visiting card, containing lead, black -

J. Vogel, (Neubauer und Vogel, Anleitung zur qualitativen und quantitativen Analyse des Harns etc - bearbeitet von Huppert - 8 Auflage - S. 197 u. 100), says that - He had

Had an opportunity for a long time to observe Hydrothionuria in a man who had paralysis and who had to be catheterized. The urine was faintly acid, pale yellow, with some sediment, and gave a strong reaction of H_2S with lead acetate.

Löbisch, (Harnaalyse, II Auflage, S. 354), observed H_2S in the urine in a case convalescing from typhoid fever. It had no trace of albumen.

C. A. Cameron, (Notes on Pathology of Urine, 1880), had a case of Hydrothionuria in a middle aged man who suffered for two years with H_2S in his urine. I add also another peculiar case, which he mentions, of a young girl who, though in good health, had H_2S eliminated through the perspiration after exercise. The urine examination was not mentioned.

Härtling, (Ueber das Vorkommen von Schwefelwasserstoff im Harn - 8° Berlin, 1886), presents a case which had gangrene of the right lung and faeculent cystitis.

The sputa contained H_2S - The urine was acid, with a specific gravity of 1011-1024. Albumen was present, as well as leucocytes, but no tube casts - Eventually H_2S appeared also in the urine, but after an observation of a month and a half the patient was discharged cured -

Eichardt, (Pathologie u. Therapie, vol. II. p. 647), says that in certain diseased conditions H_2S appears in the urine and that it can be known by its colouring a silver catheter black - He mentions no cases -

Heller, (Arch. f. Phys. u. path. Chem. u. mikrosk., 1844 - p. 24), found H_2S in the urine of a tuberculous case suffering from pneumonia. He said that it was decomposed urine.

L. Kolipinski, (Med. News, Phil., Feb. 6th 1892, Vol. IX. no. 6 - p. 154), had a case of Hydrothimuria in a man, aet. 67 years, who was an inebriate and suffered with chronic gastritis - He had profuse incontinence of urine and an enlarged prostatic gland. June 5th 1891 the urine examination showed

a red colour, acid reaction; slight turbidity; no sediment; sp. gr., 1018; no albumen, bile, or sugar - Lead acetate paper gave the H_2S reaction.

The urine continued of this same composition for one month, and H_2S was always present. "At the end of the month the patient's condition grew worse.----- There now appeared a new light to clear up the mystery of the H_2S . The patient began to complain of pains about the anus at the site of a former ischio-rectal abscess - There was found on the right side, around a small, circular cicatrix, a moderate degree of induration, extending forward to the sacral fold, slightly tender and fluctuating - A free incision gave exit to about an ounce of pus having a strong odour of H_2S - The abscess was thoroughly washed out and left clean and dry." The night of this day, July 4th '91, the urine was drawn by catheter twelve hours after the abscess had been opened, and presented the following characteristics: - "colour, red; acid reaction; sp. gr. 1019; slightly turbid; opaque sediment; a trace of albumen; indican in excess; granular epithelium, and blood corpuscles, H_2S was present."

H_2S was not again found in the urine, though on the following day or so he had a severe diarrhoea, with offensive stools and undigested material which showed the existence of gastro-intestinal indigestion. He died July 13th 1891.

The autopsy, which was confined to the abdominal cavity, showed a dilated stomach, cirrhotic kidneys, the right one containing several small cysts and calcareous infarctions - The liver was in a condition of fatty degeneration; the spleen was dark and friable but not enlarged; there was no fluid in the abdominal cavity. "The ischio-rectal abscess was thoroughly explored and found empty and granulating. The bladder was contracted, and there was no induration or inflammation in its neighbourhood. Here was an old ischio-rectal abscess, (the residual variety of Paget), for a long time manifesting itself only by the presence of a decomposition-product in a natural secretion." This case bears some similarity to my second case, (page 9), in which there was a pelvic abscess with an offensive, faeculent odour to the pus. In that case, as in

the one mentioned by Kolipinski, no H_2S appeared in the urine after there was an opening established for the discharge of pus.

The bacterial origin of the H_2S , in such cases as these, seems doubtful.

Austin Flint, (On the elimination of H_2S artificially introduced into the body - Med. News - Phil., 1887 - vol. 51 - pp. 670 - 73), made experiments to ascertain the value of the Bergeon treatment of pulmonary phthisis by H_2S gaseous enemata, the object being to have H_2S eliminated by the lungs and destroy the tubercle bacilli. He tried gaseous enemata of H_2S to see if it could be eliminated by the lungs. He never succeeded, after the injections, in detecting it in the breath of a human being, but did find it in the breath of a dog on one occasion. A piece of white filter paper moistened with lead acetate solution was held before the mouth for the detection of the gas. In the case of the dog the elimination only lasted for three minutes. He has repeatedly injected H_2S into the veins of dogs, and has always

noted a prompt elimination by the lungs, but this lasted only for a few seconds after the injection was discontinued.

He did not find H_2S in the urine of these dogs. Flint says, "it would appear from these observations, that a certain quantity of H_2S introduced, even in saturated aqueous solution, may be destroyed in some way in the system without being eliminated as H_2S ."

Out of all the literature on the subject I have only been able to find these comparatively few cases. It is difficult to actually demonstrate the cause or causes, but we can arrive at pretty certain conclusions from the material presented.

I believe that the condition of Hydrothionuria exists much more frequently than it is recognized, especially in cases of faeculent cystitis. Its diagnosis is of the utmost importance, when it does occur, in leading us to the therapeutic measures to be adopted.

The condition, from whatever cause it

originates, demands that the diagnosis be accurate; - whether there are neighbouring pus-sacs, stagnant and decomposed faeces, intestinal Catarrh, perforations, or bacilluria.

The possibility of the diffusion of gases through animal membranes is recognized by all physiologists.

Müller, (loc. cit.), does not happen to have found H_2S in the urine when there was rupture of the viscera with escape of H_2S into the abdominal cavity, nor where there were pus sacs adjacent to the bladder, nor could he cause it to appear in the urine of animals except by injecting lethal quantities of H_2S or of sodium sulphate into the abdominal cavity. But the observations of others antagonize this; for instance, Sinator's case, where there was a general intoxication by H_2S poisoning resulting from an error in diet; my own case no. II, (page 7), where there was a pelvic abscess adjacent to the bladder; the case of Betz, where a very thin diverticulum of the bladder pressed closely against the rectum which was filled with stagnant faeces and contained an unusual amount of H_2S ;

the two cases of Emminghaus, (page 15), in the former of which there were numerous perforations of the alimentary canal, and in the latter, abscesses in the small intestine, vermiform appendix, caecum and sigmoid flexure; and Kolipinski's case, in which there was an ischio-rectal abscess containing H_2S .

Chas. B. Kelsey, in an article on abscesses round the rectum, (Therapeutic Gazette, Phil., vol. XVII - no. I - Jan. 16th 1893), says that the pus in abscesses round the rectum often has a faecal odour from proximity, without actual perforation - This is known to all surgeons.

I therefore consider that the diffusion of the gas from a neighbouring pus-sac, or from an intestine containing an unusual amount of H_2S , directly through the bladder walls, is one of the causes of Hydrothionuria.

I place little credence in Betz' second theory, "that H_2S appears in consequence of the absorption from the intestine into the blood and its subsequent elimination through the kidneys. Müller and

Austin Flint, (loc. cit.), have both shown that H_2S can be made to appear in the urine only by injecting lethal quantities either into the abdominal cavity or veins.

Husband, (Forensic Medicine, 4th ed. p. 379), says, "when the gas is but slightly diluted, the person becomes suddenly weak and insensible and rapidly dies. The Post Mortem appearances are, flaccidity and blackness of the blood, loss of muscular contractility, and a tendency to rapid putrefaction. The bronchial tubes are reddened, and the internal vascular organs appear almost black."

In order to be absorbed into the blood and later eliminated by the kidney, the H_2S would have to be present in such enormous amount as to cause speedy collapse and death; - a condition which was present in none of the cases.

The experiments of Ranke, made also by Müller, and Rosenheim and Gutzmann, prove conclusively the bacterial origin of a large class of cases of Hydrothionuria. Ranke proved that a few drops of urine, containing H_2S , on being added to other

normal urine, caused H_2S to develop in the latter by a process of fermentation -

Rosenheim and Gutzmann, (loc. cit.), discovered a bacillus in the urine which developed H_2S in other urine, and Müller, (loc. cit.), discovered two forms, one an oval-shaped coccus, 8μ . in diameter, and another larger organism.

In cases I and III of my own series, the urine swarmed with vibriones and, when these were killed by irrigating the bladder with a solution of Potassium Permanganate, the H_2S soon disappeared.

Müller found that some specimens of normal urine left exposed to the air, especially at a warm temperature, developed H_2S , and from these specimens which did develop H_2S other urines could be inoculated.

Just what substances the bacteria split up to form H_2S it is difficult to say. Extreme albuminuria in eclamptic cases was present in two of my cases, and albumen was present in some of the other cases also.

When we consider the large proportion of sulphur contained in albumen it

is not hard to understand how it may be one of the substances present in wine out of which H_2S may be developed.

In the two cases referred to above out of my own series, where there was a dense precipitate of albumen on testing it, and an enormous number of active vibriones, I conceived the idea that the process was analogous to the formation of H_2S during the putrefaction of an egg.

But Rosenheim and Gutzmann have positively shown that the presence of albumen is not necessary, and that other substances present in the wine can produce it. These are probably the sulphates, but even this supposition is rendered difficult, since Rosenheim and Gutzmann succeeded in developing H_2S in wine which was previously freed from sulphates; Müller, however, could not cause it to develop in wine freed from sulphates.

I believe that any of the sulphur-containing substances present in the wine may at times be the source of the H_2S .

The clinical significance of Hydrothionuria varies according to the circumstances under which its development occurs.

In some cases we must reduce the clinical significance of H_2S in the urine to a bacilluria; in others to a diffusion of the gas from a neighbouring fus-sac or towel containing a large amount of H_2S .

The decomposition of the urine occurs after its secretion, either in the bladder, ureters, or pelvis of the kidneys, on account of the action of bacteria. It is not essential to find any particular kind of microorganism to explain it, but simply to accept as proved that various kinds have been found to split up the sulphur-containing substances in acid urine.

Härtling, (loc. cit.), says that every urine remaining exposed to the air eventually develops H_2S , so this precludes the idea of assigning the cause to any particular kind of microorganism.

The therapeutic measures to be adopted will depend upon the cause—

If the intestinal canal is filled with stagnating gases and faeces, we will

freely purge the patient and administer intestinal antiseptic drugs.

If there are neighbouring pus-sacs, for instance, pyo-salpinx, pelvic abscesses, ischio-rectal abscesses, or tubercular ulcerations of the bowel, bladder, or internal organs of generation, we will evacuate the pus and drain according to surgical methods.

If the condition is associated with a cystitis and bacilluria, as will in most instances be the case, we will wash out the bladder with antiseptic solutions of Potassium Permanganate, Hydrogen Dioxide, or other substances suitable for bladder irrigation.

The End -