subject. It was easy to disprove that many of the reputed cases gave no satisfactory explanation of the disease. Many of these affect only the infantile population, and affect these more or less throughout the whole town, whereas the prevalence of the disease was confined to certain well defined low-lying districts of the town and affected all ages and occupations, etc., within those districts. The cause must be something common to every resident within those districts, which something was apparently absent in other parts of the borough. The only things or conditions common to all were food supplies, water and air. The two former were the same throughout the whole town; there remained, therefore, only the air. During the past three years Dr. Tomkins had undertaken a large series of observations on the air, with special reference to the microbic forms of life contained therein. The general result showed that the air of the diarrhoea district of the town contained three to six times as many microorganisms and their germs as the air of the non-affected districts. These microbes (or certain of them) grew in a distinctive manner when artificially cultivated, and were capable of producing diarrhoea; or, perhaps more correctly speaking, the products of their artificial cultivation were capable of producing diarrhoea in the human subject. At present Dr. Tomkins was endeavoring to isolate and single out the particular form or forms which were most concerned in this. The organisms and growths obtained from various tissues, organs and intestines in fatal cases of diarrhoea give like results. A very probable explanation of the undue prevalence of diarrhoea in Leicester, or rather in certain parts of the town, was found in this excess of aerial microbes and germs, and this excess might be satisfactorily accounted for in the following way: Since 1850 (from which date the prevalence of diarrhoea appeared to have commenced and increased) the whole of the area of the "diarrhoea district" of the town had been subjected to a pollution with organic filth, more or less of an excremental character. This, acted upon by the heat of the summer sun, amply sufficed for an enormous production of bacteria. Imperfect and filthy sewers, containing much deposit, in the same way contributed to like results. Meteorological observations during the summer months of 1885, 1886 and 1887 showed that as soon as the earth, at a depth of one foot, reached about 62° F., the disease broke out. At the time of writing (July 23, 1888) this subsoil temperature had not yet been reached, and the outbreak had not yet commenced for this year. In addition to the need for more exact isolation and identification of the "diarrhoea microbe," it was of equal importance to study how this and other bacteria acted in producing disease; whether it was probable by the production of some poisonous material of an alkali-

loid character, such as ptomaines or leucomaines. These inquiries were of supreme importance to the physician and clinical observer, as well as hygienist, but could hardly be expected to be carried on by an ordinary health officer, with multifarious routine duties to attend to. Such questions as these required the whole time and attention of specialists."

IS SENN'S GAS TEST INFALLIBLE AND ALWAYS DEVOID OF DANGER? TWO CASES OF SHOT WOUNDS.

CONCLUSIONS.

Read before the Mississippi Valley Medical Association, at its meeting at Evansville, Ind., September 11, 1889.

BY H. C. DALTON, M.D.,

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I report to-day one case of laparotomy for shot wound, and another in which an operation ought to have been performed, and would have been, had I not been deterred on account of the failure of the Senn method, being led thereby to believe that the intestines were intact. It is not always pleasant to report our failures, but believing it a duty we owe the profession, in order that our statistics may be reliable, I have made it a rule to report all my failures as well as successes in abdominal surgery.

It is true this course may subject me to criticism owing to some sins of omission or commission, but as criticism will teach me wherein I have erred, I shall still be the gainer. Should the criticism be unjust, I trust it will proceed from him only who has never made a mistake in surgery. This apologetic prelude is written to induce you to "be to my faults a little blind," when you listen to the "o'er true tale" of the two following cases:

Case 1.—B. J., colored, æt. 35, laborer; admitted to the hospital October 25, 1888; was shot at a distance of twelve or fifteen yards three hours before admission, after which he was unable to walk, and soon felt a numb, dead sensation in the right leg, followed by pain in the abdomen.

Examination showed a shot wound an inch and a half above and a little to the right of the anus, the probe passing upwards and inwards through the great sciatic notch into the pelvic cavity. The urine was drawn and found to be clear. There was absence of liver dulness to the extent of two inches above the border of the ribs. The patient was suffering from shock and intense pain in the abdomen, referred to the umbilicus. The extremities were cold, pulse 72 and respiration 39, rectal temperature 96.6° F.

Assisted by Drs. Meisenbach and N. B. Carson, and the hospital staff, I proceeded to make median laparotomy, using Senn's hydrogen gas test

before making the incision. A small hole was made about two inches below the umbilicus, a glass tube was put in and an ineffectual attempt was made to ignite the gas. When the tube was removed the gas escaped through the hole and ignited readily. Upon enlarging the wound the gas escaped with an audible sound. The bullet was found to have entered to the right of, and almost grazing, the iliac vessels. It then entered the cæcum a little to the inner side of the appendix, and passed out an inch and a half above. Twelve holes were closed by the interrupted Lembert suture, iron-dyed silk being used, two in the cæcum (as described above), six in the small intestine, three in the mesentery, and one—the hole of entrance—near the iliac vessels. The bullet was not found, nor were we able to find it post mortem.

After a thorough peritoneal toilet we attempted to return the enormously gaseous, distended intestines, but found, like Banquo's ghost, that they would not down. It seemed our task was like that of Sisyphus, for as fast as we would replace one coil another would "bob up serenely from below," until our patience, as well as our patient, was well nigh exhausted. To make confusion worse confounded, about this time, when we thought our task almost completed, the intestines being nearly all reduced, two or three sutures gave way and the cavity was again flooded with faecal matter. In the attempt to reduce them the intestines were necessarily subjected to rather rough handling and considerable pressure; hence the rupture. The sutures which gave way were those closing two holes which were very close together, and we found it difficult to locate the exact spot from which the faeces escaped. We accomplished it, however, by a very simple, but, I think, important method suggested by Dr. Carson, *i. e.*, allowing water from the irrigator to play upon the part while making pressure upon either side of the holes. The escape of the gas elevated the water to perhaps a half inch, indicating the exact site of rupture. An attempt was made to get rid of the gas by washing out the stomach and putting a cylindrical speculum into the rectum to facilitate the escape of the gas, but this much vaunted method failed utterly.

Here was a case where the Senn method not only did no good, but absolutely did a great deal of harm; but more anon. The case also teaches a valuable lesson in that it should caution us, no matter how far away the wound of entrance may be, to look out for abdominal injury if the range of the bullet be in that direction. In a conversation with Dr. Senn, some weeks ago, I informed him of the above facts. He stated that he had also been annoyed by the same thing, but it could be overcome by elevating the hips and using a large funnel-shaped towel to produce compression upon the intestines during their reduction.

I do not believe that it would have worked in this case.

Case 2.—Wong Gau, Chinaman, æt. 25, laundryman, entered the hospital at 7:25 P.M., October 11, 1888. One hour before admission he was shot by a negro at a distance of ten feet, the bullet entering between the fourth and fifth ribs in the left axillary line.

The assistant who examined him (I was absent at the time) probed the wound and concluded that it did not penetrate the abdominal cavity, a very natural mistake, as there were no symptoms pointing in that direction, except that he had vomited several times, the ejecta, however, containing no blood. When I returned to the hospital, three hours after the injury, the pulse had gone up to 100, temperature 100° F., but there was still entire absence of abdominal symptoms. Suspecting, however, from the direction of the bullet, that it had penetrated the cavity, I resected two inches of the seventh rib in order to inspect the diaphragm. A hole was found in the same about three inches from the thoracic wall. Through this hole I placed a glass tube and applied the hydrogen gas test, which gave negative results, although the tube was moved in various directions and removed several times to see if it was unobstructed. The urine was drawn and found to be clear. Having great faith in the gas test I was satisfied that the alimentary canal was intact. My faith has received several rude shocks, and I am no longer an enthusiastic advocate of the measure, except in certain cases. The diaphragmatic and thoracic wounds were closed with heavy chromotized catgut. Patient died twenty-eight hours after the injury.

The above cut shows the relation of the food and bullet holes to the stomach as revealed by the autopsy in Case 2. The arrows show the course the gas would naturally take in passing up the alimentary canal rather than to displace the food sufficiently to gain exit through the bullet holes.

The autopsy revealed two holes in the stomach and a large lacerated wound of the left kidney. The holes were on the greater curvature, three or four inches below the cardia. They were quite close together (half an inch of septum), each

hole being about half an inch in diameter. The stomach was one-third full of semi-solid food, mostly rice, the consistence of which was so firm that it failed to run out when the stomach was elevated, nor did any escape ante-mortem. The food plugging up the holes and overlying them, accounts for the failure of the gas to escape. It naturally sought the higher and unobstructed portion of the stomach, and by its pressure plugged up the holes still more securely.

During anæsthesia the patient came near dying from interference with respiration, due to the great gaseous pressure upon the diaphragm. Had there not been large gaseous eructations, partially relieving the pressure, I believe he would have died upon the table. The case teaches that extreme care should be taken in giving the anæsthetic during the gas test. It also teaches that the test is liable to deceive us at a very important juncture, and that we cannot positively depend upon it in gunshot wounds.

In the above case I might have turned the patient on the right side allowing the food to gravitate to the right, leaving the holes free for the exit of the gas. But who would have suspected such a condition as we found in the case, or would have thought of the necessity of placing the patient in such various positions? It is certainly unusual to have a patient with both stomach and kidney so badly injured without some blood being vomited, or being found in the urine, and this assisted the Senn test to deceive us in the case. I object to the use of the gas test in shot wounds for the following reasons:

1. Because it is misleading, not being *always* reliable.

2. Because even if it give negative results, we should operate anyway, as we are not sure that the intestines are not perforated, and statistics give but poor encouragement to those who adopt the do-nothing plan, the recoveries in such cases being less than 8 per cent.

3. Because even were we positive the intestines were uninjured, there are other organs which are almost equally important, such as the liver, spleen, mesentery, etc., which might require prompt attention.

4. Because I believe there is danger of the gas forcing fæces through the wounds into the peritoneal cavity, thereby adding to the gravity of the case. It is said this does not take place, but I am loath to believe it.

5. Because of the additional danger during anæsthesia from interference with respiration.

6. Because of the liability of the sutured holes to be torn open while handling the intestines, especially during the effort to return them to the peritoneal cavity, as in case 1.

7. Because after their return to the cavity, owing to their distended condition, and the consequent pressure upon the diaphragm, it em-

barrasses respiration, and hence adds to the shock. I believe this to be a valid and most serious objection to its use. He who can put his patient to bed with the least shock, *ceteris paribus*, has the best chance of seeing him recover, for shock is the cause of death in the vast majority of cases; and certainly the liability to death during anæsthesia, while not probable is more likely to occur with the use of the gas than without it, and hence should be taken into account.

Those who have attempted to close the abdomen over intestines distended by gas can fully appreciate my statement. I imagine that a well person with intestines so distended would suffer from colic, and a feeling of oppression consequent upon the great gaseous distention. Why should we add such additional danger to our patient, already in such a perilous condition, when a feather's weight may turn the scale against him? It may be claimed, and I grant it, that the gas soon becomes absorbed, but why subject a patient to an additional risk, even for a short time, at such a critical period? Then too, the preparation and administration of the gas takes up valuable time, it is true not a great deal of time, but when one remembers that the saving of every moment in these cases is vitally important, he naturally is anxious to get through at the earliest moment consistent with the proper management of the case.

Senn reports a case of shot wound of the intestines in which, after sewing up all the holes he could discover, he was enabled by the use of the gas to find another, low down in the rectum, which he could not have found without it. I imagine such cases are very rare, and do not counterbalance the harm which the gas may do in other directions. I would not leave the inference that I have discarded the gas test. I would use it in shot wounds of the back, and low down on the sides of the abdomen, where I could not positively determine whether or not the peritoneal cavity had been penetrated. In other words, where we are in doubt as to the penetration use it, and if we get affirmative results, operate. I think the test is more appropriate to stab wounds, for there we are often very much in doubt as to whether or not the intestines are wounded. When we are so uncertain we should use the gas test; if it give negative results we need not operate, especially as we know that many penetrating stab wounds do not wound the intestines, whereas it is quite the exception—in fact a *very rare* occurrence for a penetrating shot wound to fail to do so.

So I conclude that the fact that a shot wound of the abdomen is penetrating, justifies laparotomy, for, unless the ball be a spent one (a very unlikely occurrence), we can be almost certain that there is serious injury to the viscera. This is a rule to which the exceptions are too few to have any weight.

The gas test then in this class of cases is unnecessary. In penetrating incised wounds, however, the character of the injury is such that the viscera may, and in fact often do, escape.

I believe that this question should be thoroughly discussed, and the truth evolved, not only for the good of our patient, but also for the medico-legal aspect of the case. Self-protection demands that the status of the test be definitely settled. I have not been able to find that any one has controverted Dr. Senn's claim that "rectal insufflation of hydrogen gas is an infallible test in the diagnosis of visceral injury of the gastrointestinal canal in penetrating wounds of the abdomen." My experience will not allow me to subscribe to the statement.

I propound the query "Is the question settled? and answer in the negative, believing it to be still *sub judice*. What say you after thoroughly weighing the facts in the above cases?"

THE CLINIC.

THE CLINICAL HISTORY OF A CASE OF CYSTITIS FOLLOWING TUBERCULAR KIDNEY, THE CHIEF SYMPTOM OF WHICH WAS CONTRACTED BLADDER; TREATED BY HOT WATER DILATATION.

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Miss M., white, æt. 22 years, came under my care in April, 1885. She had for two years had cystitis, for which she had been treated in Washington, D. C. She was somewhat anæmic, although but slightly reduced in flesh. Her family history was exceptionally free from suspicion of tubercular disease, although her father had recently died of supposed carcinoma of the liver and stomach. The patient complained of pain extending along the ureter to the bladder from the right kidney. The pain was not constant, but was increased by pressure over the kidney or by severe exercise, as in riding or jumping, etc. The urine had sp. gr. 1020, reaction neutral, vol. 24 ozs. per diem; was heavily charged with pus to nearly one-third of its vol. Microscopical examination revealed abundant epithelium apparently from the bladder, besides pus corpuscles and abundant amorphous urates. No casts, very slight amount of albumen.

The usual treatment for cystitis gave so little relief that I sought for the cause in the urethra

and found two small papillomata, the removal of which gave some relief. She was passing urine every hour or two and was obliged to continue this through the night, causing loss of sleep and consequently loss of strength. The patient, in September, 1886, passed from my care and entered Columbia Hospital for Women, D. C., where she steadily grew worse and was discharged as incurable in December, after nearly two months' residence therein.

I was again called to see the patient and found her quite wretched and anxious to end her miserable existence. There was constant dribbling of urine, great pain in region of the bladder, extending to both kidneys, although worse on the right side. Her temperature was 102°-103°, pulse 110 to 120, attended by rigors and other septic symptoms. Her kidneys were not supposed to have to do with her condition; no tumor or other disease having been discovered by those recently in charge of her. Again hoping to benefit the patient by wise counsel, and to satisfy the demands of urgent friends in Philadelphia, she was taken to Jefferson Medical College Hospital and placed under the care of Dr. S. W. Gross, January 15, 1887. His diagnosis was "contracted bladder from cystitis with some pyelitis," which latter he thought needed no special treatment. Accordingly he prescribed hot water irrigation of the bladder, dilatation of the urethra, and argent nitr. sol., xx ad 3j every five days. During the seven weeks' residence of the patient at the hospital, her bladder increased its capacity for urine from zero to 3ij. The general condition of the patient had greatly improved, and she was greatly encouraged with the prospect of recovery. Dr. Gross failed to detect any tumor or other disease of the kidney—save the pyelitis—and doubted the expediency of any surgical examination.

The patient was again brought under my care in March, 1887, and the treatment instituted by Dr. Gross continued. By increased pressure the bladder reached a capacity of 8 ozs. forced distension, with hot water. At this point, Dr. Gross suggested the stretching cease, but it soon became apparent that contraction would again take place, and the stretching was continued until a capacity of 19 ozs. was reached. This treatment was continued for many weeks and gave the patient great relief from the bladder symptoms. She could retain her urine for eight hours, although generally was called up twice during the night. The quantity of pus in the urine constantly diminished until about $\frac{1}{5}$ by volume remained. Sulphate of morphia gr. $\frac{1}{4}$ with sulph. atropia gr. $\frac{2}{100}$, hypodermatically, were always required to afford relief from pain during the distension. The anodyne was given only once in five days and a gain of from 3j to 3j secured at each sitting. This increase in capacity with morphia was sustained by daily irrigation and distension by means of hot