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**VARIOUS**

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ORIGINAL PAPERS.

A LOST ART IN SURGERY.\*

BY

A. E. CRUSEY, M. D.,

Professor of Anatomy, Bellevue Hospital Medical College.

It was the celebrated humorist, Charles Lamb, who said, on seeing a very dirty man, "If dirt were trumps, what hands you'd hold."

It must be confessed that man is a dirty animal; and if by reason of water he improves upon his natural state, he deserves commendation therefore. It is true that mere attrition will separate from the surface of the body its effete matter and its worn-out covering—and so man may be in possession of respectable health in spite of his filth. But when we approach the domain of the surgeon, we find that cleanliness is the *sine qua non* of successful surgery.

Filth in wounds means poison, and poison means death. The most extended observation has established the above statement as an aphorism in surgery. I do not hesitate to affirm that, in the great metropolitan hospitals of the world, cleanliness, in the highest and best sense, is almost unknown. I trust that I shall not be deemed impertinent when I assert that perfect cleanliness is a lost art in surgery.

To indicate the way in which this lost art may be restored is the object of the present paper. My method will be historical. I propose to adduce certain clinical facts which have come under my observation at

\*This paper was read before the New York County Medical Society a year since, but its publication has been delayed until another year's experience in Bellevue Hospital might confirm its statements. A more extended observation has only reaffirmed its conclusions.

different times and in different places, and then deduce such inferences as these facts will seem to justify.

In the summer of 1861, being the first of our civil war, I was assigned as Division Surgeon to the staff of General Charles P. Stone, then commanding a corps of observation at Poolesville, Maryland. As we were thirty-six miles from Washington, and as the general hospitals in that city were at the time crude and unsatisfactory, I conceived the idea of establishing a Division Hospital on the ground, and so retain both our sick and wounded.

In August, 1861, I made a communication to Surgeon Charles A. Tripler, who was the Medical Director of the army at Washington, submitting my plan for the construction of a hospital, and asking for the necessary lumber, doors, windows, etc., with which to construct it. The plan was approved, my requisitions were endorsed, and the necessary materials furnished. Some enlisted men belonging to the 15th Massachusetts Volunteers, who were skilled carpenters, were detailed as builders, and on the 21st of October, the day on which the battle of Ball's Bluff took place, we were ready to receive the wounded from that ill-fated engagement.

This hospital was built essentially on what is now known as the pavilion plan, although I was at the time ignorant of the action which the Sanitary Commission was taking in the same direction. I have recently learned that the Sanitary Commission made a communication to the government in July, 1861, advocating the use of pavilion hospitals, and in October following—about the time my hospital was completed and occupied—secured an order for the construction of a hospital on the pavilion plan. I have given these details because from them it appears that my hospital was built and occupied before any of those suggested by the Sanitary Commission, and, so far as I know, was the first hospital of the kind erected during the war.

It consisted of a series of one story buildings, each large enough for a single ward of thirty beds. Each building was made of rough boards, the cracks being battened with strips, and all thoroughly white-washed, inside and out. There was a window at the head of each bed, suitable ventilators, which were always kept open, and a large stove in each ward. The kitchen and offices were in a building by themselves. All these buildings were connected by water sheds, without walls, so that each ward was distinct, and elevated walks were made beneath the sheds. The ground was elevated and dry, and as trenches were dug around each building to receive the droppings from the eaves, the drainage was

perfect. The sinks were at a distance from the hospital, fresh earth being thrown daily over the dejections.

The condition of the wounded brought off from Ball's Bluff was at the outset unfavorable. They were all suffering under the depression of defeat. It was necessary to transport the sufferers from the Virginia shore to Harrison's Island, in the Potomac, on scows, where they received immediate attention. As an attack was apprehended at day-break, the wounded were again moved to the Maryland shore. Some of them were then pushed across the Ohio and Chesapeake Canal, while others were moved by canal boats to Edward's Ferry—but all were obliged to endure several miles of transportation by ambulance over exceptionally rough, rocky roads, the matter being complicated by a heavy rain.

On arriving at the Division Hospital at Poolesville, a uniform plan of treatment was adopted. The sum and substance of the plan was absolute cleanliness. This was enforced by frequent scourings of the wards, and the instant removal of dejections and all effete matter from them. The bedding was changed as often as it was in the slightest degree soiled. A rough wash-house was extemporized, where four men incessantly boiled, washed, and ironed the bedding. The patients' bodies were sponged with warm water—those suffering with surgical fever at short intervals.

At that period of the war the common dressing for gunshot wounds was lint, held in place by adhesive strips, by which the wound was soon hermetically sealed, the retention of sloughing tissue and the burroughing of pus being thereby favored. This "whited sepulchre" method of dressing was absolutely interdicted. Every injury was treated as an open wound. A water dressing was applied, which was changed at short intervals, and burned as soon as soiled. All wounds which were offensive were treated with antiseptic and stimulating applications. No wound was drawn together until its surfaces were covered with bright, healthy granulations.

All our patients were fed for the first few days on the richest soups, fresh milk and bread, supplemented afterwards by a thoroughly nutritious mixed diet. The wards were flooded with sunshine and pure air. All these regulations were rigidly enforced, the nurses soon learning that the guard house and starvation were the penalties for any direktion. Thus absolute cleanliness, nutritious food, and pure air formed the tripod on which our Division Hospital at Poolesville rested, and to which its excellent results were mainly attributable.

Fortunately, I am inclined to think, our requisitions for drugs

remained unanswered, and we were obliged to content ourselves with a few pounds of copperas—a crude sulphate of iron—obtained at a country store, which, pulverized and mixed with molasses, answered admirably in cases where there was excessive suppuration. We had also opium, cinchona, Epsom salts, and whiskey.

Having thus summarized the history of this hospital, I shall as briefly summarize our results. The whole mortality, including those known to be mortally wounded on admission, and all cases in which operations were performed, both primary and secondary, as well as those where no operation was required, amounted to only ten per cent. Similar results have been attained with such a degree of uniformity in pavilion hospitals that many surgeons and sanitarians have been inclined to affirm that the old-time metropolitan hospitals cannot compete with them, and must therefore give place. It remains for us to see whether the position of these gentlemen is well taken.

The Third Surgical Division in Bellevue Hospital has had a remarkable history during the past eighteen months, which cannot fail to prove both suggestive and instructive. Prior to September, 1874, the four wards of this division were occupied by puerperal cases, and had become infected to such a frightful extent that the patients were all finally transferred to Pavilion Hospitals on Blackwell's Island. The records of the division during the last six months of its occupancy for lying-in purposes, show the following facts. My esteemed colleague, Prof. William T. Lusk, stated that from Jan. 1st to June 11th, 1874, inclusive, out of one hundred and sixty-six lying-in patients, there were thirty-one deaths. A large portion of the survivors suffered from chills, an elevated temperature, a frequent pulse, and abdominal tenderness. In June the patients were all transferred to Blackwell's Island. In September the infected wards were occupied by surgical cases. It was obvious that the puerperal epidemic had left the wards in an unsafe condition for the receipt of open wounds. Consequently, at the request of the commissioners, my colleague, Prof. Doremus, took charge of the disinfecting process. As the method of disinfecting large hospitals has generally been faulty, I take great pleasure in presenting the efficient course pursued in this instance. Under a recent date Dr. Doremus is kind enough to write as follows :

"In the Spring of 1875 the Commissioners of Charities and Corrections of this city requested me to disinfect the surgical wards in the North wing of Bellevue Hospital. In deciding what course to pursue I was influenced by the following considerations :

Although our knowledge of the products of human decomposition in various



diseases is exceedingly limited, we have reasons for believing that they are complex substances, and that hydrogen is one of their essential elements, the compounds of carbon with oxygen or with sulphur being excepted. On this theory, by attacking these emanations, with an element possessed of superior affinities for hydrogen, we can break up these compounds and thus rob them of their virulence. Moreover, as many of these poisonous bodies are gaseous, they are readily absorbed by porous substances, and thus, walls, ceilings, as well as the furniture of hospital wards become magazines of pestilence. To attack these evil spirits successfully, gas must meet gas. Chlorine gas seemed to fulfill these conditions, and as it is easily made and comparatively inexpensive, I determined to test the efficacy of large volumes of said element. It is well known that this gas has an intense affinity for hydrogen. When these two gases are mingled in a flask of colorless glass or collodion and exposed to the bright sunlight or to the electric light, they unite with explosive violence,—even in diffused daylight they unite rapidly, forming hydrochloric acid. Water saturated with chlorine will decompose when placed in the sunbeam; its hydrogen, associated with the chlorine, and oxygen gas is set free. When chlorine is presented to sulphuretted hydrogen immediate decomposition of the ill odored gas takes place—the superior affinity of the chlorine for the hydrogen causes the sulphur to be deposited in fine, yellow particles, and the doubtful (egg) flavor disappears. If chlorine and arseniuretted hydrogen are put together, hydrochloric acid is again formed, arsenic is deposited and this most poisonous gas is rendered inert. One of the lecture experiments at the Bellevue Medical College, is to displace a portion of water in a tall glass jar, with sulphuretted hydrogen gas over the pneumatic trough and another portion of the water with arseniuretted hydrogen; on passing up a few bubbles of chlorine, chemical action occurs; the *yellow tersulphide of arsenic* is seen on the sides of the jar and on the surface of the water, owing to the abstraction of the hydrogen by the said chlorine and the releasing of the sulphur and the arsenic in the nascent state. When a paper saturated with oil of turpentine is placed in a jar of chlorine gas, black clouds of carbon appear, accompanied with a dull, red flame, because of the intense affinity of this electro-negative element for the hydrogen of the carbonated hydrogen vapor. The potency of chlorine as a bleaching agent, is doubtless due to its ability to abstract the hydrogen from the coloring principles, either directly or indirectly, by liberating active oxygen from water. In this bleaching process care has to be taken lest the tissue be destroyed; as a rule, bleached goods have less strength than unbleached ones.

Many years since Faraday demonstrated that vaccine virus could be decomposed and thus deprived of its extraordinary powers by the agency of chlorides. These few facts demonstrate that we understand the *modus operandi* of this deodorizing and disinfecting element. I refrain from mentioning others lest I prove tedious. Moisture is requisite in order that chlorine prove effective—although all substances contain more or less of water, I determined to fill each ward of the hospital with steam prior to charging it with chlorine. To check the loss of a portion of the gas, through crevices and other apertures, strips of paper were pasted around the windows and doors.

Some ten years ago, at the request of Prof. Lewis A. Sayre, Health Physician to this city, and of Mayor Gunther, with the co-operation of Dr. Swinburne,

Health Officer of the Port of New York, I undertook the disinfection of certain cholera ships. In employing chlorine as one of the purifying agents, I found sheets of lead were most convenient as receptacles for the chemicals used in generating this gas. I turned up an edge of about six inches, after rolling out several feet of the lead, and in these troughs placed the materials, such as the peroxide of manganese and hydrochloric acid, or common salt, manganese and sulphuric acid, I therefore used similar leaden troughs at Bellevue, in which I placed a mixture of peroxide of manganese, common salt, (chloride of sodium) and water, stirring the mass with wooden shovels.

Vessels of sulphuric acid (pots de chambre) were placed around said long troughs; the floors of the wards were wetted; steam was turned on until the walls and ceilings were thoroughly moistened, and with four or five assistants we groped our way through the cloudy atmosphere, applied the doses of acid and hastened out of the rooms, twenty-four hours later a second application of acid was made, after stirring the mixtures the wards were again closed for twenty-four hours, and in some instances the gas was allowed thirty-six hours of additional treatment. The windows were then thrown open; the floors and walls were scrubbed and dried. This ended the purification.

To disinfect the water closets a mixture of about equal weights of manganate of soda and sulphate of magnesia (Epsom salts) was sprinkled in and around the basins at night. In the reaction of these salts the permanganate of soda is one of the products. The ozone liberated effectively deodorized and disinfected the water closets and the discharge pipes. Between two and three tons of chlorine gas were generated in disinfecting the aforesaid surgical wards. Two hundred pounds of the mixture of manganate of soda and sulphate of magnesia were used in the water closets.

Vive la Chimie!"

After this thorough disinfection by Dr. Doremus, my distinguished colleague, Dr. James R. Wood, took charge of these four wards, which now constitute the "Third Surgical Division." In the absence of Dr. Crane, one of the surgeons of this division, Dr. Wood has rendered the greater portion of the surgical service since September, 1874, and his results have been so exceptionally good that I have deemed it best to quote him directly with reference to the precautions which he instituted on occupying the wards. I am indebted to Dr. Wood, who writes as follows:

"Having chosen the third floor of the North wing of the hospital for my division, I determined, notwithstanding the wards having been used previously for the lying-in service, to prevent if possible the reappearance of any septic diseases. Wishing to begin under the most favorable of hygienic influences, I directed that all the straw in the beds in the wards should be burned, and the ticks should be well washed in carbolic acid. The bedsteads were also sprinkled and washed in the same material, and then painted. The floors were thoroughly saturated with carbolic

acid, and then scrubbed. The walls also were washed repeatedly with acid water and painted, in order to make the disinfection as complete as possible. Prof. Doremus was requested to generate immense quantities of chlorine gas in the wards, which was accomplished thoroughly. I then gave orders to my staff that under no circumstances should any case of erysipelas, cellulitis, gangrene, ulcers, or burns enter any of the wards. Should any of the above diseases enter the wards without the knowledge of the House Surgeon, he should, on becoming acquainted with the facts, immediately transfer the case to the Pavilion, and have the bed and bedding removed from the ward at once, and thoroughly washed and disinfected. I further ordered that no sponges should be used in the wards, and sheet lint and oakum be used in their places. Balsam Peru was ordered to be placed over wounds, and, in order to prevent the spread of disease by this means, it was decided that each patient should have a separate bottle of balsam, and that brushes should not be used more than once.

The House Surgeon and assistants were directed to take precautions to wash their hands and instruments in carbolized water after dressing unhealthy wounds, and the orderlies and nurses were ordered to keep the patients and beds perfectly clean, and to look after the thorough disinfection of the water closets daily. It was further directed that all wounds, especially amputations, should be irrigated several times daily with carbolic acid water and smeared with balsam Peru, the wounded part being placed on a pillow of oakum, in such a position that drainage should be perfect. Since the wards were occupied for surgical purposes, some eighteen months ago, so perfect have been the disinfective and sanitary regulations, that there has not been, during my service, a single case of pyemia, and only two cases of erysipelas, both occurring where cancerous tumors had been removed."

As I have the honor of being associated with Dr. Wood as one of the surgeons of this division, being at present on duty, I have taken great pains to carry out his suggestions. The results continue to be exceedingly satisfactory, not only in surgical cases where operations have been done, but in a class of compound comminuted fractures, with extensive laceration of the soft parts, which are generally regarded by surgeons as imperatively demanding amputation. In this connection I might quote several cases, the records of which I have, but I will not trespass on the patience of the Society at this time.

In view of the puerperal infection and the grave mortality that were present in these wards during the first half of 1874, I propose to bring