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PAIN AND ANÆSTHETICS:

AN ESSAY,

INTRODUCTORY TO

A SERIES OF SURGICAL AND MEDICAL MONOGRAPHS,

BY VALENTINE MOTT, M. D.

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PREPARED BY REQUEST OF THE SANITARY COMMISSION.

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PHYSICS DEPARTMENT

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OFFICE SANITARY COMMISSION,

*Washington, April 15, 1862.*

The attention of the Sanitary Commission has been called to the fact that most of our Army Surgeons now in the field are unavoidably deprived of many facilities they have heretofore enjoyed for the consultation of standard medical authorities. It is obviously impossible to place within their reach anything that can be termed a medical library. The only remedy seems to be the preparation and distribution, among the medical officers of the army, of a series of brief essays, or hand-books, embodying, in a condensed form, the conclusions of the highest medical authorities in regard to those medical and surgical questions which are likely to present themselves to surgeons in the field, on the largest scale, and which are, therefore, of chief practical importance.

The commission has assigned the duty of preparing papers on several subjects of this nature to certain of its associate members, in our principal cities, belonging to the medical profession.

The following paper on "Pain and Anæsthetics" is contributed as an introductory essay to the series, by the veteran chief of American surgery, Valentine Mott.

FRED. LAW OLMSTED,

*Gen'l Secretary.*



## ESSAY.

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AMONG the many improvements which characterize modern surgery, one of the most invaluable is the introduction of Anæsthetics. That we should be enabled safely and conveniently to place the human system in such a state, that the most painful operations may be performed without consciousness, is to have secured to man immunity from what he most dreads; for most men fear pain even more than death. When seeking death by suicide, the instinctive aversion to pain is apt to govern in the choice of means, and the person generally selects the method which he imagines will inflict upon him the least suffering.

Pain humbles the proudest and subdues the strongest. It was the great agent of the Spanish inquisition, because it was more effective to extort confession than death itself. It was pain that made Cæsar weep, and I have seen the most heroic and stout-hearted men shed tears like a child, when enduring the anguish of neuralgia. As in a powerful engine when the director turns some little key, and the monster is at once aroused, and plunges along the pathway, screaming and breathing forth flames in the majesty of his power, so the hero of a hundred battles, if perchance a filament of nerve is compressed, is seized with spasms, and struggles to escape the unendurable agony. We have then this the first reason for the use of anæsthetics.

*To prevent pain is humane.* No gentleman, not to say Christian, would needlessly inflict pain on any creature. It was, indeed, a certain kind of humanity which led the Athenians to execute Socrates by means of a narcotic draught, and which also made the Romans give their male-

factors, during crucifixion, drugged wine. Even the guillotine had its conception in a kind of humane sentiment. Only savages inflict upon their victims the horrors of torture. And I do not believe that there is a surgeon of the nineteenth century who would willingly inflict any unnecessary pain in his operations if once practically acquainted with the means of prevention, and once confident and facile in their use.

But, secondly : *Pain is useless to the pained.* So Galen said centuries ago, and so the late discussions of the question of anæsthesia have abundantly proved; and if any members of the medical profession still entertain the idea that pain may have some occult, mysterious use, with which it would be dangerous to dispense, we must remember that the general sentiment of our profession, together with the common sense of mankind, is now unquestionably far in the advance.

The torment of tooth-ache and the griping of colic confer no benefit on the sufferers; and all experience proves that the step proper to be taken first in the cure of these diseases is to relieve the pain.

When the pain produced by a surgical operation, or any other injury, is excessive, the exhaustion is greater, reaction comes on more slowly, the subsequent process of restoration is delayed, and the tendency to depression is increased. The practice of applying irritating applications and stimulating plasters to phlegmons has long been confined to the ignorant—the educated surgeon preferring soothing poultices and sedative lotions. But this reason may be made stronger; since

*Pain is positively injurious to the pained.* If sufficiently acute and long-continued, it will of itself produce death.

The collapse which follows severe injuries, where there is little loss of blood, is to be attributed entirely to pain. When death occurs in such cases without reaction, it is the direct effect of pain.

Ambrose Parè, the father of modern surgery, in speaking of pain, says, "nothing so much dejects the powers of the patient." Gooch says, "mere pain can destroy the powers of life." My friend, Mr. Travers, observes, "pain, when amounting to a certain degree of intensity and duration, is of itself destructive." And I myself, like every other surgeon in active practice, am continually witnessing injuries where death results solely from the nervous shock.

In corroboration of this fact, we may notice, *en passant*, the Statistics of Amputations, collected by Professor Simpson, of Edinburgh. It is not necessary to quote them at length, but they come, by numeric process, to this conclusion—that in all serious surgical operations the prevention of pain, by the use of anæsthetics, gives to the patient not only present relief, but also a better prospect of subsequent recovery—the mortality in such cases being clearly lessened by the use of anæsthetics. We see, then, that pain has the effect, primarily and directly, to depress the powers of life.

If we inquire into the cause of this, we shall find it in the physiological law, that the *nervous system controls the vascular*, and the collapse which attends severe injuries has its origin in the nervous system. Collapse is a provision for defending the nervous centres from an intolerable assault, and in this way does nature herself in a manner dictate the use of anæsthetics. It was probably in supposed obedience to this indication that John Hunter, great and ingenious even in his errors, advocated amputation before reaction had occurred. He meant to avoid the nervous shock.



In collapse the return of nervous energy precedes the restoration of the circulation; and, admitting all that is claimed for the chemical origin of the forces which produce the circulation of the blood, we must still allow that the current is controlled and directed by nervous influence. The most severe operation during anæsthesia produces little or no effect upon the pulse, because the nervous centres receive little or no impression.

Whatever, then, may be the physiological necessity for pain, though its uses in the animal economy may be to prevent lesion and deter from danger, we are here to view the question merely in a therapeutic light, and to conclude that pain is only evil, and that continually. And now, how shall it be prevented? Obviously by any means which will produce a less injurious effect. We are not required to possess an absolutely innocuous agent; if the injurious effect of the means used be less than that of the pain prevented, we are justified in employing them.

If we examine these doctrines carefully, we shall find that they are in fact not essentially new. The principles on which they are founded have been long recognised *in the use of narcotics*. I was in the habit of giving opiates freely before the introduction of anæsthetics, both before and after operations; and now, after over fifty years of experience, I still retain them in my confidence, for their power to relieve pain after operations, thus improving the condition of the patient, and favorably modifying the subsequent inflammation. In the treatment of certain painful affections, such as puerperal fever or peritonitis, opium is well known not only to be palliative, but directly curative. Richter called it "the grand antiphlogistic remedy."

It has always been used more freely by surgeons in this

country than in Europe, and to this cause I attribute, in great measure, our lesser subsequent mortality. And opium and its preparations are the only anodynes well adapted to surgical use. No substitutes are worthy of confidence.

When chloroform or æther is to be used, it is not advisable to give an opiate previous to the operation, as to do so would increase the tendency to subsequent vomiting, which every experienced surgeon is anxious to avoid. When the system is laboring under the shock of any newly-received and severe injury, the powers of life are in abeyance, and the act of retching tends to an unfortunate issue. In collapse, if the patient vomit, he is apt to die.

In cases of hare lip, however, and in operations about the mouth and jaws and nose, we are frequently compelled to depend, as formerly, upon narcotics for preventing or mitigating the pain, as the locality renders inhalation impracticable.

After operations, opiates are to be used, without much reference to quantity, in proportion to the severity of the pain. The only injurious effect of their too free exhibition would be after some hours a little irritability of the stomach. Their constipating tendency in such cases is of no therapeutic importance, and would in no degree increase the subsequent local inflammation.

*Alcoholic stimulants* are also well known to exercise a limited anæsthetic power. Men in a condition of complete intoxication are sometimes unconscious of the injuries they receive, and formerly some surgeons were in the habit of benumbing the sensibility of the patient, and sometimes I fear their own, by copious draughts of spirituous liquors. But this practice can, at best, produce but very imperfect anæsthesia, and intoxicating drinks are than opium still more apt to

disturb the stomach. I well remember a case of amputation of the thigh which occurred a few years since in my own practice, where the attending physician, notwithstanding repeated cautions, administered brandy to the patient so freely as to induce vomiting, thus interfering with the continuance of the reaction, and inducing a fatal result. It was an extensive cannon shot of the knee joint, and on the third day from the injury, before the collapse had sufficiently passed off.

But opium and alcohol have been referred to, rather as illustrations of the truth of the principles of anæsthesia than as practicable anæsthetic agents. To produce any considerable insensibility with them would require their use in quantities and for a length of time that could not fail to be seriously injurious to the nervous system. Days would be required to recover from their narcotic effect. Hence it is, that such agents are of little account when compared with inhalations.

The great extent of the pulmonary surface, and the facility with which æriform agents may be introduced through it into the circulation—their complete efficiency and their ready evacuation by respiration—conclusively indicate that the lungs, instead of the stomach, is the best route through which to introduce the proper agents for inducing insensibility. Now, the question arises, can these advantages be secured without danger to the patient? And sufficient time has already elapsed to enable us to reply: *Anæsthetics, when properly used, are perfectly safe.*

At the period of my last visit to Europe, some ten years since, Professor Simpson had then given chloroform to over 8,000 persons without a single fatal result from its use, and by this time he has, no doubt, more than duplicated that

experience. In the Crimean war, it was used commonly and freely. Baudens speaks of several thousand cases in which it had been used without accident, and McLeod reports over 20,000 cases, with only a single fatality. Even when ignorantly and carelessly employed, there is less danger than is commonly apprehended. When last in Paris, I saw it used continually, and freely, and carelessly, with little precaution to dilute the vapor, and by rude means—a sort of bag tied over the mouth and nose of the patient,—yet heard of no case of asphyxia from its use. Both chloroform and æther are continually employed in this city, in the hospitals and public institutions, as well as in private practice, with little or no regard to either the quantity or intensity of the vapor, and yet but very few accidents have occurred. In my own practice, I have never seen a death from their use.

But there is another reason for employing anæsthetics which must not be forgotten. *The insensibility of the patient is a great convenience to the surgeon.*

How often, when operating in some deep, dark wound, along the course of some great vein, with thin walls, alternately distended and flaccid with the vital current—how often have I dreaded that some unfortunate struggle of the patient would deviate the knife a little from its proper course, and that I, who fain would be the deliverer, should involuntarily become the executioner, seeing my patient perish in my hands by the most appalling form of death! Had he been insensible, I should have felt no alarm.

By the use of anæsthetics, also, the shrieks and cries of the patient are prevented; so that the surgeon's powers are not additionally taxed, either to nerve himself to a very unpleasant task, or to control and encourage the attendants.

This discovery, then, has not only taken from surgery its greatest horrors, but it has also very much increased the facility and safety of operations; and in this way, *the domain of surgery is extended.*

In the removal of tumors with intricate surgical relations, the operator now feels at liberty to take the amount of time required for careful and slow dissection. He performs painful operations on children with little or no fear of subsequent convulsions, and the nervous and timid are so protected from the shock that he is free to assert the dominion of the knife wherever science has decreed and the powers of the human constitution will allow.

But it is the object of this paper not only to show the propriety of inducing insensibility to pain, but also to give some plain and practical

*Directions for the use of Anæsthetics.*

Of these agents, only two—æther and chloroform—are as yet worthy of consideration; and of these I have always preferred chloroform, for the reason that it is more effective. Æther has been supposed to be safer in the hands of the inexperienced, but this is clearly no reason why the practiced surgeon should confine himself to the weaker and more inconvenient agent. Æther is longer in producing anæsthesia, is more bulky, and in some cases fails to produce the desired effect. I am in the habit, however, of employing both, commonly commencing with æther, and resorting to chloroform if insensibility is not readily induced.

*It is better to employ no special apparatus for inhalation.* All that is needed is a common linen handkerchief, on which the liquid is poured. This should be held loosely in the hands of the operator, as in the folded condition it might

interfere too much with respiration. If æther is used, little attention is paid to quantity—from two to four ounces being commonly required for an adult; and all the caution necessary is not to exhibit it so rapidly as to excite a cough. If chloroform is employed, less quantity will be required—from one to four drachms being generally sufficient. But care must be taken to dilute the vapor sufficiently with atmospheric air.

*During the inhalation the patient should always be in a recumbent position.* We must remember that the vapor of chloroform is exceedingly heavy, having a specific gravity more than four times that of common air, with little disposition to diffuse itself. Carbonic acid, which weighs only one and a half times more than common air, may be poured from one vessel into another like water. By reason, then, of its great gravity, the vapor of chloroform passes into the lungs more readily when inhaled in the recumbent posture; and if for any reason we should desire to free the lungs speedily from its presence, we can do so with most facility when the patient is in the same position.

The circulation of the blood through the lungs is now known to depend on the reaction of its carbonized constituents with the oxygen of the air; and in those cases where death has occurred during inhalation, this result is to be attributed rather to the absence of oxygen in the lungs than to the presence of chloroform in the blood.

We may presume that anæsthetic vapors are not poisonous of themselves, but when ignorantly or carelessly used they arrest the circulation in the capillaries of the lungs, as nitrogen or hydrogen would do by exclusion of the necessary oxygen. Hence, in case of asphyxia from their use, where the natural process of respiration is interrupted, we endea-

vor to substitute it by artificial means. We open the windows to procure fresh air, dash cold water in the face to excite convulsive respiratory movements, turn the patient on his side to lessen the gravitative tendency of the vapor, and make artificial respiration by compressing the ribs after the manner of Dr. Marshall Hall. And when the vapor is sufficiently displaced from the lungs by admixture with atmospheric air, circulation and respiration will both be restored. For these reasons, it was, that Mr. McLeod, in the Crimea, always preferred to use chloroform in the open air.

We see, then, that to *exhibit anæsthetic vapors too rapidly is to incur the danger of asphyxia*; but, on the other hand, to exhibit them too slowly incommodes the surgeon and prolongs inconveniently the stage of excitement; and a greater quantity of the anæsthetic will also be required, and spasmodic action of the glottis is more likely to occur.

Professor Simpson speaks of one or two minutes as being the proper time to allow for the induction of insensibility, but in this country it is customary to take a longer time, perhaps from three to five minutes.

The full effect of the anæsthetic is indicated by sonorous or even stertorous breathing, which, though apparently serious, is of no importance. The pulse is generally but little affected, though it is often diminished somewhat in frequency and force, and yet I have seen it, when the vapor was being administered too rapidly, suddenly stop, to resume its ordinary motion when the effect of the vapor passed off.

There is another practical fact in regard to the use of inhalations which I do not remember to have noticed. *If the patient vomit, the effect immediately passes off*, and, as he is

much more likely to vomit when the stomach is full, he should not be allowed food for some hours previous to inhalation.

In operations where the mouth becomes filled with blood I was formerly apprehensive of strangling, but subsequent observation shows that during anæsthesia deglutition takes place by means of reflex nervous action, in the same manner that uterine contractions occur, notwithstanding the use of these agents.

Within the last year Professor Simpson, of Edinburgh, has recommended a new plan for securing the admixture of the proper quantity of air. It consists in spreading a handkerchief single-fold over the face of the patient, and allowing the liquid to fall drop by drop upon it near the mouth and nose. The quantity of the liquid required by this method is said to be less than what is ordinarily used, but from my experience I should apprehend irritation of the skin, as this is apt to occur in using chloroform and æther by the ordinary method. To prevent this irritation I am in the habit of applying previous to inhalation a little olive oil about the mouth and nostrils. Care should also be taken to prevent the vapor from acting on the eyes.

In my own practice I have been in the habit of using the Scotch chloroform of Duncan, Flockhart, & Co., of Edinburgh, but have also employed that of Dr. Squibb, of Brooklyn, and with pleasure commend the latter for its purity and reliability.

For such reasons then as have been recounted, I desire to direct the attention of the Surgeons of the Army and Navy to the advantages which would accrue from a more extended use of anæsthetics in naval and military practice. I am satisfied that if, in their operations, the pain were



more generally prevented many lives would be saved which are now lost from the shock to the nervous system, and that, in all severe cases, the prospect of recovery is better and the subsequent inflammation is milder when an anæsthetic has been used.

To this conclusion I have not come hastily. Of so much import have I always regarded the prevention of the pain of operations, and so desirable, if it could be practically effected, that ten years before the introduction of anæsthetic vapor I listened patiently and attentively to the claims of animal magnetism to this power to produce insensibility; but found, and I may say with unalloyed regret, that when fairly brought to the test, its most ardent friends were compelled to admit its utter inefficiency, and even since the invention of anæsthetic inhalation, I have carefully tested the power of other agents, such as nitrous oxyde, to produce insensibility to pain, but still consider none of them deserving of mention when compared with chloroform or æther.

In conclusion, perhaps I may say, that these observations and reflections have been made during the intervals taken from a business still pressing, at a time of life when most men desire repose. They are given to the cause of American nationality, and may claim to be at least an old surgeon's offering on the altar of his country. The flag of our Union, the glorious Stars and Stripes, has repeatedly protected me in foreign lands beneath its broad folds, and if what I have written here shall be in any measure successful in preventing the sufferings and prolonging the lives of that noble army who are now serving under my country's banner, I shall receive my reward.