NAUPATHIA OR SEA-SICKNESS. SYMPTOMATOLOGY, PATHOGENESIS, AND EFFICACIOUS TREATMENT.

Read by Title at the Thirty-ninth Annual Meeting of the American Medical Association, May 11, 1888.

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It is not without much reflection that I venture to bring before the Association a paper upon such an old subject as sea-sickness. This subject, however, which I have the honor to develop anew before this assembly, has recently become enriched both by new theories regarding the nature and pathogenesis of sea-sickness and, what is still more practical, by new methods of treatment which bring into action medicinal agents not hitherto exhibited in this affection, and which are recognized to have beneficial and even curative effects. There is much in this matter that is new and important; the Academy of Medicine of Paris recently discussed it in one of their séances; and it may be profitable to briefly review it here, in order that we and our patients may be spared that atrocious suffering to which those who venture upon old Neptune's domain are exposed.

The author of this paper does not come before you without having had some experience in the treatment of naupathia. He has, in fact, made it the object of special research during the last two years, and the voyages he has made amount to nearly 60,000 miles of ocean, made upon French steamers plying between France and South America, between Belgium and the United States, and between France and the United States. He was the medical officer on board these ships, and in that capacity he has come into direct relation with more than 2,500 passengers.

With the object of discovering, if possible, the nature of sea-sickness, I have carefully examined all observable symptoms in this affection, and have found many which had not before been observed. Let us, then, enumerate these symptoms, which, when intelligently interpreted, will, I am convinced, lead to the true understanding of this hitherto mysterious affection.

We will suppose an otherwise perfectly healthy person suffering from a complete attack of sea-sickness. The nervous system yields the following symptoms: Great prostration, indisposition to make the least effort, vertigo, intense frontal or temporal cephalalgia, insupportable sensation of uneasiness, weakness and discomfort, sometimes causing the patient to groan continually; and finally, insomnia which may extend over a period of several days. All the modalities of reflex action are preserved intact. One important symptom remains, myosis, which is often observed in these cases. This symptom is of great importance in the study of the pathogenesis of naupathia, as will be seen a little later. The digestive apparatus

furnishes the most striking and best known phenomena: anorexia, adipsia, paleness and coldness of the lips, salivation, nausea, emesis, gastralgia (which is frequent after three or four days of sickness), and especially constipation. The tongue, liver and spleen are normal in uncomplicated cases. From the circulatory apparatus we have: Diminished force of the cardiac pulsations with consequent abnormal depressibility of the pulse; decrease or increase in the number of cardiac revolutions per minute (constant decrease in men, descending so low as 57, 51, and in one case 45 beats per minute, and decrease in one-half the cases in women; with the latter there is often increase [114 without fever has been observed]; while in children of both sexes there is almost always increase—the maximum I have observed is 120 beats per minutes without fever); the capillary circulation appears diminished, as may be inferred from the coldness of the extremities, ears, lips and nose, and from the extreme paleness of the skin. The muscles composed of unstriated fibres which receive their motor nerves from the great sympathetic system are evidently parietic, as is denoted by the inertia of the intestine and by the myosis. The urine, as is well known, is excreted in exceedingly small quantity. It preserves its normal color, precipitates no sediment, is acid, clear, and free from albumen and glucose. Finally, sea-sickness is an apyretic affection; it has no period of incubation, properly speaking. Its period of invasion is exceedingly variable, being from a few seconds to several hours according to the predisposition of the person concerned.

For all these varied phenomena there is, I think, a simple explanation to be advanced; one which clears away much of the mystery which has hitherto enveloped this peculiar affection, and which points the way to its rational treatment, as the results of the new method show. Sea-sickness ought to be regarded as the expression and result of certain purely functional or dynamic perturbations of the organism, for organic lesions there are none known. *These perturbations can all be referred directly or indirectly to the sympathetic nervous system. Every symptom named above can be explained by invoking a paralysis, or at least a paresis, of this system, and sea-sickness can be cured by those alkaloids which stimulate the great sympathetic and the unstriated muscular fibres to which it is distributed.*

It is really remarkable how this theory harmonizes with the phenomena observed and with the results obtained. The constipation, for instance, must be due to the defective action of the great sympathetic upon the muscular coat of the intestines; the myosis, as is well known, to its defective action upon the radiated fibres of the iris; the slowness and weakness of the heart's action to defective action of the cervical portion upon the intracardiac motor ganglia (as Brücke, of Vi-

enna, and others have shown).¹ Finally, general paresis of the great sympathetic admirably explains the lowering of the blood-pressure which is undoubtedly present in this affection, for Cl. Bernard, Vulpian and Brücke have proved that this nerve regulates the tonus of the arterial system through its action on the muscular tunic of the arteries.

This diminution of the pressure of the blood is, to my mind, the key to the enigma of sea-sickness. But upon what grounds may we admit the existence of this condition? The following considerations will help elucidate the question: The lowering of the blood-pressure is indicated by the scantiness of the urine, by the abnormal depressibility of the pulse, by the coldness of the extremities, by the extraordinary pallor of the skin, and by the indubitable signs of acute cerebral anæmia (prostration, apathy, vertigo, cephalalgia and insomnia). The symptoms of nausea and vomiting are generally attributed to anæmia of the medulla oblongata which is due, most probably, to the general lowering of the arterial tension. There is, moreover, an additional evidence of the verity of this hypothesis. I have demonstrated by actual manometric experiments upon the lower animals that the alkaloids employed in the new method of treatment which I propose, and which cures sea-sickness, really possess the property of raising the blood-pressure. The results of these experiments were published in the *Bulletin général de Thérapeutique*, July 15, 1886. It would seem, therefore, that one was fully authorized to admit that the pressure of the blood is lowered in this affection. If this conception of the nature and immediate cause of sea-sickness be correct, you may already perceive which important class of agents ought theoretically to cure it. It is that great class called cardio-vascular tonics and some of the substances of the class of neuro-muscular agents that ought, *à priori*, to act as specifics in naupathia. We will see in a few moments later how admirably these agents operate.

The question now arises, "But what is the cause of the paresis of the great sympathetic that produces the lowering of the blood-pressure?" The cause of the paresis of the sympathetic is, doubtless, what Bidder has named *reflex inhibition*, which may have its origin either in the sensorium (the centre for vision and olfaction) or in the terminal nerves of the abdominal organs. It is undeniable that these organs are slightly displaced and contused by the movements (sometimes violent) of the pitching and rolling ship, and thus the terminal ramifications of the sympathetic nerve distributed to these organs excited, thereby constituting the origin of the reflex action in question. In fact, in a recent communication to the Société de Biologie of Paris, M. Dastre, the

successor of Paul Bert to the chair of physiology of the Sorbonne, demonstrated the displacements of these organs by citing experiments made in his laboratory upon the lower animals.

In sum, this is the chain of influences that produce sea-sickness according to this theory: Excitation of the nervous extremities in the abdominal viscera produced by the movements of the ship, or excitation of the senses of vision and olfaction, or of both, causing by reflex action a suspension of the motor functions of the great sympathetic which in turn results in this general lowering of the blood-pressure with all its attendant symptoms. (Chapter on Diagnosis omitted.)

The theory thus passed, let us turn to the practical fact of the prompt cure of naupathia in the vast majority of uncomplicated cases, and to the details of the new method of treatment here proposed. This method is based upon 87 written observations, taken mostly upon transatlantic steamers, and it would seem, from my experience, that the sicker the patient was the more surely he would be cured.

The medicinal substances employed are atropin, strychnine, caffeine, sparteine and hyoscyamine; atropin and hyoscyamine are administered in conjunction with strychnine, the others alone. All these substances are not given to the same patient, but constitute as many varieties of treatment. Sea-sickness is cured either by atropin associated with strychnine or by caffeine held in concentrated solution by salicylate or benzoate of sodium, or by sparteine.

These substances are all administered by hypodermic injection. This mode of administration was chosen for the following reasons: The frequent vomiting in sea-sickness, by which the agents employed would be thrown out and lost; the difficulty of their absorption from the stomach in this affection, and also the retaining and destructive action of the liver upon these alkaloids when absorbed from the gastro-intestinal tract, as Hegar, Schiff, Lautenbach and others have amply shown.

First, as regards atropin and strychnine, I would remark that the dose for adults of these two agents, given subcutaneously in well-marked cases of sea-sickness, is 1 milligram (.001 grm.) of each (about $\frac{1}{4}$ of a grain). The following is the formula I have employed thus far:

R.	Atropin sulph.	
	Strychnin sulph. aa.	.04 grams.
	Aq. menth. pip.	40 "

A gram of this solution contains a milligram of each of the alkaloid salts. Although these eminently active substances have been administered in sea-sickness a great number of times during the last two years, no injurious effect therefrom has been observed. If, after the space of two hours from the time of the first injection, the patient is not cured, a second injection of 1 gram of the

¹ When there is increase in the number of pulsations it ought to be attributed to a coexisting paresis of the pneumogastric.

solution must be injected, but it would be imprudent to repeat this dose of atropin too frequently.

Children and adolescents are very susceptible to this medication. A little girl of $2\frac{1}{2}$ years, sick during fourteen hours, was promptly and definitely cured by the injection of one-sixth of a full dose, *i. e.*, by about .00016 gm. of atropin and as much of strychnine (about $\frac{1}{40}$ grain of these substances). A boy of 6 was cured by $\frac{1}{4}$ of a gram of the mixture.

The effects of this medication are often surprising. In the majority of cases of simple naupathia *the patients entirely cease vomiting immediately after receiving a single injection of 1 gram of this solution.* A little later they feel no more nausea, headache, or vertigo. More than this could hardly be demanded of any remedy. Sometimes two injections are necessary to produce complete exemption from all unpleasant sensations. The sufferer ceases groaning, color comes back to his cheeks, he affirms that he feels "much better," or that he suffers no more at all. Almost always he falls asleep shortly after receiving the injection and remains sleeping one-half or three-quarters of an hour. If given late in the evening the injection insures a refreshing night's sleep for which the patient is very grateful.

One of the best evidences of the efficacy and innocuity of this method is the fact that the patients often ask for a repetition of the treatment, and mothers who have been treated desire it applied to their children.

As regards caffeine I have experimented with it thus far in adults only. The following is the formula for the solution employed:

R. Caffeine pur.	4 grams.
Sodii salicyl.	3 "
Aq. destill. q. s. ad.	10 cc.

Dissolve by gently heating.

Each cubic centimeter contains .40 gm. of caffeine. A single dose of .30 gm. injected under the cutis completely cured in seven hours a patient who had been suffering intensely from sea-sickness during three days. Another patient in the same condition was cured in five hours. Both had remained in bed and had eaten nothing during the whole period of their sickness, but on the evening of the day of the injection they both went to dinner and remained well.

Certain *disadvantages* of the method exist, but are not of great importance. Dryness of the throat is sometimes caused by the atropin; young children may present an intense redness of the skin which alarms their parents and which is also due to the atropin, and the amblyopia caused by the alkaloid is occasionally observed in adults. Exceptionally the seat of the injection is slightly painful, especially in nervous individuals, and once troublesome inflammatory symptoms were caused by one injection under the skin of the outer border of the forearm, which subsided spon-

taneously, however, in the course of two days. I have never observed either abscess or phlegmon as a result of this mode of treatment. None of these phenomena have more than a few hours duration and I have never noticed any injurious effects therefrom.

If this method, conscientiously employed, produces no favorable effect upon a person affected with naupathia, who has not exceeded the age of adult life, it is almost certain that the failure is due to an organic lesion in some part of the circulatory apparatus, especially in the valves of the heart. A patient having well-marked mitral insufficiency received three injections in the space of six hours, each containing 1 millig. of atropin and 1 millig. of strychnine, without the slightest favorable result, the only change in the symptoms being an increase in the number (but not in the force) of the cardiac pulsations. It is well to remark, that if these injections produced no amelioration in this case they did not, on the other hand, occasion any aggravation.

This method has not yet been employed as a means of prophylaxis in sea-sickness. The two alkaloids exhibited in the form of pills, however, have successfully warded off this affection when taken immediately upon feeling the first approach of the nausea, and caffeine and atropin have also produced marked amelioration when administered together in the pill form.

Still other substances of the great classes mentioned above have cured sea-sickness in my hands. The sulphate of sparteine, which Professor Germain Sée has introduced into pharmacology as a cardiac agent, also produces speedy recovery. The formula I employ is as follows: Spartein. sulph. .40 gm., aq. menth. pip. 20 grms. Each cc. contains .02 gr., which is a common dose. The benefit after administration has been constant.

Another alkaloid—hyoscyamine, so nearly related to atropin, also cures sea-sickness when combined with strychnine. Formula: Hyocyanin. pur. cryst. .02 gm., strychnin. sulph. .02 gm., aq. menth. pip. 20 grms. Each cc. contains 1 millig. of each alkaloid.

Having thus exposed to your indulgent attention my own personal researches in this direction, allow me to briefly sum up the useful methods of treatment that others have imagined.

The means of prophylaxis are of two kinds, mechanical and pharmaceutical. Of the mechanical means the most useful is the abdominal supporter, a large bandage-like appliance covering nearly the totality of the surface of the abdomen and drawn up tightly enough to prevent much displacement of the abdominal viscera by the movements of the boat.

The choice of the steamer one sails upon is not indifferent. The larger the ship the less movement it has. In all cases one should seek a position as near as possible to the center of gravity of

the ship, for there the rolling and pitching is felt at its minimum. Further, it is well known that complete decubitus is the best of all positions, both to prevent sea-sickness from coming on and to aid its cure. One should lie in a horizontal position with the head on the same level as the body.

The *pharmaceutical means* for prophylaxis which are of real efficacy are few. Alcohol, liquors and wines are sometimes beneficial, but they are uncertain. Certain aromatic substances have been recommended, especially peppermint and its preparations. More potent, however, are the three following: chloral, cocaine, and antipyrin, the two latter being also used to cure the affection when once developed. These substances, like morphine, which has also been used, all act by diminishing the reflex power of the nervous centers, and we have seen above that the reflex action induced by the irritation of the extremities of the nerves of the abdominal organs is the starting point of sea-sickness.

As regards the *curative treatment* of naupathia little satisfaction has been obtained from the *materia medica* until quite recently. Some years ago, M. LeConiat, of the French Transatlantique Line, treated his patients by faradization of the epigastric and hypochondriac regions, aided by an external application to the gastric region of a solution of atropin (0.05 to 30 grm.). He affirmed having obtained good results from this treatment. More recently cocaine has been given and, I believe, with a certain success. Doses as high as 0.30 grm. have been given by Regnault, of Paris, but I esteem that quantity eminently dangerous. The latest remedy that has come to my knowledge is antipyrin. It is certainly very useful in those cases in which the patient *has not yet vomited*, but like all medicines given by the mouth in sea-sickness, it is little or no use after vomiting has once begun. The hypodermic method is then the only one that is sure, safe, easy and efficacious.

I also have tried these other remedies but I find none so effective as those used in my own researches. Allow me to cite two or three short observations by which the working of these agents may be judged.

OBSERVATIONS.

Caffeine.—Mrs. L., æt. 21, embarked at Bordeaux for New Orleans, Aug. 14, 1886. Aug. 17: The patient has been sea-sick ever since the departure from Bordeaux, three days ago. She has not left her bed during that time, and has eaten nothing. At 9.30 A.M. the following symptoms were observed: great prostration, intense frontal headache, gastralgia. Pulse 114 per minute, small and feeble. Rectal temperature 37.6° C. (about 99.5° F.).

Treatment. Subcutaneous injection of three-fourths of a cubic centimeter of the following

solution: caffeine 4 grams, salicylate of sodium 3 grams, water q. s. to make 10 cubic cm.; *i. e.*, a dose of .30 gram only of caffeine was employed. At 10 o'clock the pulse was down to 78 per minute, and was fuller. Patient feels better. At 11.40 pulse 75, and stronger; patient feels still better; suffers no more from cephalalgia nor from gastralgia. Rectal temperature 37.3° C. 4.30 P.M., pulse 90, and strong. Patient feels herself entirely well, although somewhat weak from abstinence. At the hour of the evening meal she ate with the other passengers and was not sick any more during the voyage.

Atropin and Strychnine.—1. Mrs. W., æt. 30, left Montevideo for Havre April 28, 1886. She had travelled by water and was always very sick. The next morning after the departure she was very sick while still in bed before attempting to get up. She presented abundant mucus vomiting at very frequent intervals, constipation, frontal cephalalgia, and moderate prostration; pulse 65, feeble. At 8.35 a subcutaneous injection of 1 gram of the following solution was given: atropin sulph. .04 grm., strychnine sulph. .04 grm., aq. menth. pip. 40 grms., *i. e.*, a dose of one milligram of each of the two alkaloids was injected. At 9 o'clock, *i. e.*, 25 minutes later, *she got up and felt no more nausea*. She felt herself well; the face was no longer pale as before, and there was no more headache nor prostration. 6.30 P.M., the amelioration has continued. She has dined very well and manifests no more symptoms of sea-sickness.

2. Paula X., a young negress, æt. 8, native of the Island of St. Vincent, one of the Cape Verde Islands, was one of our passengers to Buenos Ayres. She commenced to be sick as soon as she came aboard, and was terribly sick every day, so that she could keep absolutely no aliments upon her stomach. She lay down almost the whole time, vomiting at frequent intervals. This state of things continued during *six days* without her receiving any treatment, and by that time she had become so thin and feeble that the captain, to whom she was given in charge, became alarmed about her and asked me to apply my method of treatment. At 10 o'clock on the sixth day I gave her a hypodermic injection of one-third of a cubic centimeter of the solution of atropin and strychnine, *i. e.*, about .0003 grm. (or about $\frac{1}{2000}$ gr.) of each of these alkaloids. Three-quarters of an hour afterwards she ate and drank with great appetite. She kept everything upon her stomach, and from that moment she felt no longer sea-sick, but on the contrary she ate well and soon began to play. This is one of the most striking examples of cure that I have seen.

In conclusion, be our theory of the nature of naupathia as it may, the practical empirical fact remains, that this affection, once developed, is rapidly curable in the majority of cases; that the

judicious employment of the new method never produces serious accidents; that the method sometimes fails on account of some lesion of the heart vessels or nerves; but that *in simple sea-sickness it always produces amelioration, and generally a prompt cure of this affection.*

REPORT OF A CASE OF CEREBRAL CYST. RECOVERY.

Read in the Section on Surgery and Anatomy, at the Thirty-ninth Annual Meeting of the American Medical Association, May, 1888.

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Common experience, as well as the literature of surgery, teaches that wounds involving the brain heal readily when secondary inflammation does not take place, and because of the risk in this direction a prognosis must always be unfavorable, though many cases are on record after wound of this organ in which there was full recovery.

From punctured fractures of the skull involving the dura mater there is equal danger, because the dura is very sensitive and the projecting spiculæ irritate the brain at its every pulsation, and from this source there is inflammation of the meninges and death as a consequence. The surgeon usually makes as early efforts as possible for the removal of this foreign body, knowing the longer it remains the greater is the danger from the inflammation spreading along the cellular tissue which surrounds the branches of the meningeal arteries, and by this means reaching the base of the skull.

When meningitis ensues from a traumatism, with suppuration as a result, the hope of the patient is by letting out the imprisoned matter; and where those rare pathological entities, cysts, communicate with the cranial cavity, the operation of trephining is imperatively demanded, as in the case operated on by myself, and which, with your permission, I will briefly report.

John Proctor, of Mt. Vernon, Ky., æt. 22, received a blow upon the left side of the head in 1880, which produced a punctured fracture of the parietal bone—unconsciousness quickly ensued. Elevation of the depressed bone, by Drs. Brown and McKee, of that place, was next undertaken, for prudential reasons, till the end of the third day. This event was not followed by anything unusual, and after the lapse of eight more days the mind became clear and he progressed to apparent recovery without an untoward symptom. Three years passed, when he was seized with an epileptic convulsion, the seizures alternating as to frequency and severity. His attending physician desiring a consultation, I was called about the middle of October, 1884. We agreed as to depressed bone, the depression being one inch posterior to the coronal suture and the same distance from the mesial line in the temporal bone on the

left side. Trephining was at once done. The button removed was three-fourths of an inch in diameter, and from the center of this there projected a spicula one-fourth of an inch in length, and sharp, from the inner table. The brain tissues were firmly attached around the base and the anterior portion of this spicula, and with difficulty it was detached by the handle of the scalpel.

The appearance of the underlying tissues was granular, or cell-like, and highly vascular. The wound was dressed in the usual way, there was no recurring inflammatory symptoms and in a few days it was healed. He had no convulsion for six weeks, but at the beginning of the seventh he played a game of base-ball, the fit occurring on the grounds.

The convulsions having got a start, took place with regularity up to the time of the last operation (of which I will now speak), Feb. 11, 1888. Right well nourished and his functions generally in good shape, in consultation with Dr. A. W. Johnstone, of Danville, Ky., we concluded to do another trephining, and the second button was removed. An incision was made through the dura and the pia mater, when there was revealed a cyst as large as a guinea egg, and whose walls were almost transparent, with a congerie of small vessels traversing it in divers directions. By hooking the cyst with a tenaculum and making an incision through the cyst wall, a half-ounce of clear fluid escaped, the last to come being tinged with blood. The skin flap was in the shape of a horse-shoe, in consequence of the scars or cicatrices made by previous operations. Three drainage tubes were placed in the wound, an opening made in the center, immediately over the incision of cyst, and one tube included in the button-hole, but not extending through the membranes, nor into the cyst, by which device direct drainage was made. The other two tubes were passed through the same opening and were brought out at the upper and lower angles of the flap wound. There were no antiseptic solutions or precautions employed in the treatment of the case. Cleanliness and pure water were our weapons, and he got along beautifully till the close of the third day, at which time he had a fever of 105° F., his pulse was 140, respiration 45, the right arm paralyzed, and a stupor amounting almost to coma, which made the prognosis doubtful. The flap was at once reopened, the wound thoroughly douched in cold water, the drainage tubes well washed and replaced, and without further medication, in six hours the temperature fell to 100° F., the breathing became normal, the pulse 90 per minute, the mind clear, a desire for food, and the danger was passed. From the angles of the wound the tubes were removed on the fourth day, but the direct tube remained in its place till the evening of the eighth, at which time it was removed, though the discharge continued, more or less profuse, for